[This question paper contains 8 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 1584 **G**

Unique Paper Code : 2342011102

Name of the Paper : Computer System Architecture

Name of the Course : **B.Sc. (H) COMPUTER SCIENCE (NEP-UGCF-2022)**

Semester : I

Duration : 3 Hours Maximum Marks : 90

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Question No. **1** is compulsory.
3. Attempt **any 4** questions from Question **2** to Question **7**.
4. Parts of a question must be answered together.

1. (a) Perform the following conversions to the indicated bases : (6)

P.T.O.

(i) $(973)_{10} = (?)_5$

(ii) $(F23A)_{16} = (?)_8$

(iii) $(10110.11)_2 = (?)_{10}$

(b) Give microinstructions for the following register reference instructions of the basic computer

(i) CMA

(ii) SPA (3)

(c) Simplify the following expression using Boolean algebra (3)

$$Y = (A+B)\ (A+C')\ (B'+C')$$

(d) Differentiate between microprogrammed and hardwired control unit. (3)

(e) Give Characteristic table and excitation table of SR flip-flop. (3)

(f) Construct a 16-to-1 line multiplexer with two 8-to-1 line multiplexers and one 2-to-1 line multiplexer. Give block diagram for the same. (3)

(g) Perform the arithmetic operation (–153) + (–250) using 10's complement. (3)

(h) Why is Input Output Interface required between peripheral devices and CPU? (3)

(i) How many 256 × 8 ROM chips are needed to construct a memory of size 2048 × 8. Specify the number of address lines required for the newly constructed memory. (3)

2. (a) Given the Boolean function $F(A, B, C, D) = \Sigma(0, 5, 6, 7, 10, 13)$ and don't-care conditions $d(A, B, C, D) = \Sigma(1, 2, 3, 15)$ (6)

(i) Simplify Boolean expression F in SOP form using Karnaugh map.

(ii) Find complement of the simplified expression Fusing De-Morgan's Law.

(iii) Draw the logic diagram of the simplified expression F.

(b) Perform the arithmetic operation (−17) + (−27) in binary using signed 2's complement representation for negative numbers (Use 6-bit registers). Specify, if the operation results in overflow or not? (5)

(c) Describe the working of 4-bit binary adder subtractor circuit with the help of an example. (4)

P.T.O.

3. (a) Draw a space-time diagram for a six-segment pipeline to process eight tasks. A non-pipelined system takes 50ns to process a task. The same task processed in six segment pipeline with a clock cycle of 20ns. Determine the speed up ratio of pipeline for 200 tasks. (6)

(b) What is the microprogrammed control unit? Write the microoperations that will be executed when the following 14-bit control word are applied :

(i) 010 001 110 00101

(ii) 101 001 111 01010

Given the binary code for ADD is 00101 and SUB is 01010 and three-bit binary code for selecting the register corresponds to the register number. (5)

(c) What is the difference between a direct and an indirect address instruction? How many references to memory are needed for such type of instruction to bring an operand into a processor register? (4)

4. (a) The content of PC in the basic computer is 2AC. The content of AC is 2EC3. The instruction format has three parts: mode (1-bit), opcode (3-bits), and

address part (12-bits). The content of memory at address 2AC is 832E. The content of memory at address 32E is 0821. The content of memory at address 821 is 8B9F (all numbers are in hexadecimal and 3- bit opcode 000 represents AND operation).

(i) Draw a block diagram of memory unit to give snapshot of the above representation and specify the instruction that will be executed.

(ii) Perform the binary operation in AC when the instruction is executed. Also, specify the values of PC, AR, DR, AC and IR in hexadecimal at the end of the instruction cycle. (6)

(b) A computer uses a memory unit with 65536 words of 32 bits each. A binary instruction code is stored in one word of memory. The instruction has four parts: an indirect bit, an operation code, address mode part to specify one of the four addressing modes, register code part to specify one of the 50 registers and an address part?

(i) How many bits are there in the operation code, addressing mode part, register code part, and address part?

(ii) Draw the instruction word format.

(c) Write down the difference between isolated I/O and memory mapped I/O.

5. (a) Give the microinstructions of BSA instruction for the basic computer. Explain its working with the help of an example. How does it retrieve the return address.

(b) Explain interrupt cycle with the help of flowchart.

(c) What is GPU? How is it different from CPU?

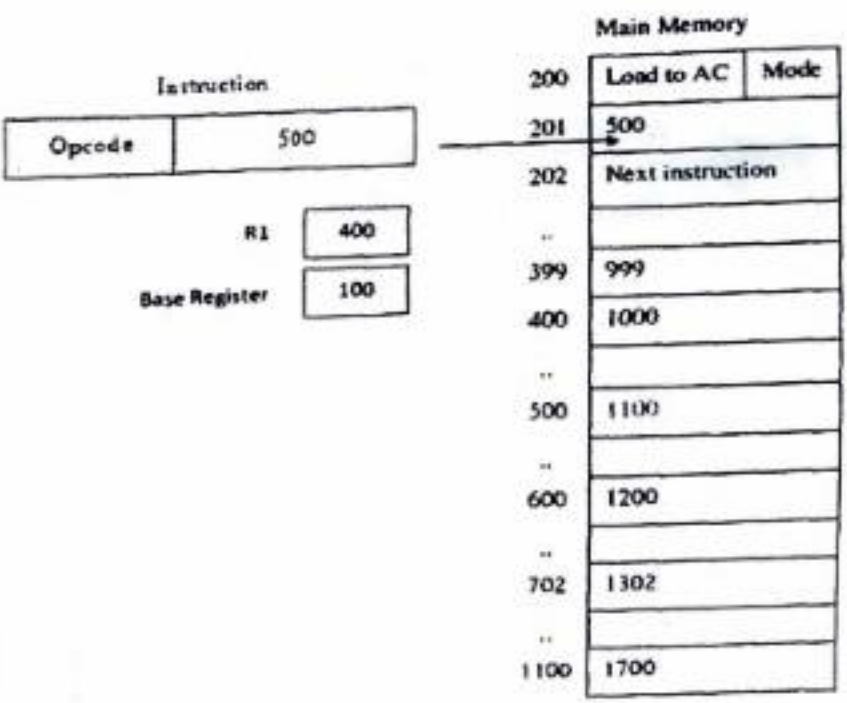
6. (a) Design a combinational circuit that will indicate whether 4-bit number is either "odd and greater than 8" OR "even and less than 5". Assume 0 to be an even number.

(b) (i) Construct a 6-to-64-line decoder using four 4-to-16-line decoders with enable input and one 2-to-4-line decoder.

(ii) Differentiate between RAM and ROM.

(c) Prove that X-OR is complement of X-NOR with the help of a truth table. (4)

7. (a) A two-word instruction to perform the load operation is stored in memory at an address 200 as represented in the memory map given below. The address field of the instruction is stored at address 201. The mode field specifies an addressing mode. R1 is the general-purpose register, which has the value of 400. Base register contains the value 100.



P.T.O.

Determine the effective address and the operand to be loaded for the following address modes:

(i) Direct

(ii) Immediate

(iii) Indirect

(iv) Relative

(v) Base register Addressing

(vi) Register indirect addressing (6)

(b) What is DMA? Briefly explain following terms with respect to DMA :

(i) Bus request

(ii) Bus Grant

(iii) Burst transfer

(iv) Cycle Stealing (5)

(c) What is cache memory? Mention its advantages and disadvantages. (4)

(2)

[This question paper contains 8 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 1622 **G**

Unique Paper Code : 2342011103

Name of the Paper : Mathematics for Computing

Name of the Course : **B.Sc. (H) Computer Science**

Semester : I

Duration : 3 Hours Maximum Marks : 90

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. The paper has **two** sections. **Section A** is compulsory. Each question is of **5** marks.
3. Attempt any **four** questions from **Section B**. Each question is of **15** marks.

P.T.O.

Section – A

1. (a) State the conditions under which a system of linear equations will be consistent? Check consistency for the following system of equations : (5)

$$x_1 + x_2 + x_3 = 7$$

$$3x_1 - 2x_2 - x3 = 4$$

$$x_1 + 6x_2 + 5x_3 = 24$$

(b) Show that V_1 as $\begin{bmatrix}1\\0\\0\end{bmatrix}$ V_2 as $\begin{bmatrix}0\\1\\0\end{bmatrix}$ V_3 as $\begin{bmatrix}0\\0\\1\end{bmatrix}$ forms a basis for R^3. (5)

(c) Let Y be the set of vectors in R^4 of the form [a,0,b,0]. Prove that Y is a subspace in R^4. (5)

(d) Find the rank of the following matrix. (5)

$$\begin{bmatrix} 1 & 1 & 1 \\ 2 & -3 & 4 \\ 3 & -2 & 3 \end{bmatrix}$$

(e) Prove that div(curl v)=0, where v is a twice continuously differentiable vector function. (5)

(f) What do you mean by normalizing a vector? Normalize the vector [2, 3. 1, 1]. (5)

Section B

2. (a) What is a positive definite matrix? Is the following matrix positive definite? (7)

$$A = \begin{bmatrix} 2 & -1 & 0 \\ -1 & 2 & -1 \\ 0 & -1 & 2 \end{bmatrix}$$

(b) Solve the following system of linear equations using Gauss Elimination Method. (8)

$$5x_1 - 5x_2 - 15x_3 = 40$$

$$4x_1 - 2x_2 - 6x_3 = 19$$

$$3x_1 - 6x_2 - 17x_3 = 41$$

3. (a) Define orthogonality of vectors? Determine whether the vectors a and b are orthogonal or not where $a = 2\hat{i} + 6\hat{j} + \hat{k}$ and $b = 3\hat{i} - 2\hat{j} + 3\hat{k}$. (7)

(b) Diagonalize the following matrix (8)

$$\begin{bmatrix} 5 & 2 & 0 \\ 2 & 5 & 0 \\ -3 & 4 & 6 \end{bmatrix}$$

4. (a) Suppose L: $R^3 \to R^3$ is a linear operator and $L([1, 0, 0]) = [-2, 1, 0]$, $L([0, 1, 0]) = [3, -2, 1]$ and $L([0, 0, 1]) = [0, -1, 3]$, Find $L([-3, 2, 4])$. Also, give formula for $L([x, y, z])$ for $[x, y, z] \in R^3$. (7)

(b) Apply Gram Schmidt orthonormalization process to obtain an orthonormal basis for the subspace of R^4 generated by the vectors : (8)

$$V_1 = \begin{bmatrix} 1 \\ 1 \\ 1 \\ 1 \end{bmatrix} \quad V_2 = \begin{bmatrix} 1 \\ 1 \\ -1 \\ -1 \end{bmatrix} \quad V_3 = \begin{bmatrix} 0 \\ -1 \\ 2 \\ 1 \end{bmatrix}.$$

5. (a) Find gradient and curl of V for

$$V = (x^2 + y^2 + z^2)^{-3/2}\left(x\hat{i} + y\hat{j} - z\hat{k}\right). \quad (7)$$

P.T.O.

(b) State Cayley-Hamilton theorem and verify it for the following matrix A. (8)

$$A = \begin{bmatrix} -2 & -4 & 2 \\ -2 & 1 & 2 \\ 4 & 2 & 5 \end{bmatrix}$$

6. (a) Find the inverse of the following matrix using elementary row operations (7)

$$\begin{bmatrix} 1 & -4 & 1 \\ 1 & 1 & -2 \\ -1 & 1 & 1 \end{bmatrix}$$

(b) Solve the following system of homogeneous equations by matrix method. (8)

$$5x_1 - 2x_3 = 0$$

$$-15x_1 - 16x_2 - 9x_3 = 0$$

$$10x_1 + 12x_2 + 7x_3 = 0$$

7. (a) Find the directional derivative of

$F(x,y,z) = 2x^2 + 3y^2 + z^2$ at $P(2, 1, 3)$ in the direction $3\hat{i} + 4\hat{k}$. (7)

(b) Suppose that 3 banks in certain town are competing for investors. Currently bank A has 40% of the investors, Bank B has 10% and Bank C has remaining 50%. Suppose the townsfolk are tempted by various promotional campaigns to switch banks. Records show that each year Bank A keeps half of its investors, with the remainder switching equally to Bank B and C. However, Bank B keeps 2/3 of its investors, with the remainder switching equally to Bank A and C. Finally, Bank C keeps

half of its investors, with the remainder switching equally to Bank A and B. Find the distribution of investors after two years. (8)

(3)

[This question paper contains 8 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 4307 **G**

Unique Paper Code : 32341102

Name of the Paper : Computer System Architecture

Name of the Course : **B.Sc. (H) Computer Science**

Semester : I

Duration : 3 Hours Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. **Section A is compulsory.**
3. Attempt any **four** questions from **Section B**. Parts of a question must be answered together.

Section A

1. (a) Derive an algebraic expression for the complement **F'** of the given Boolean expression:

F=xy'z'+xy'. (2)

P.T.O.

(b) Give any two differences between combinational and sequential circuit. (2)

(c) Determine the number of clock cycles that it takes to process 90 tasks in five segment pipeline. (2)

(d) What is flip flop? Give the truth table of SR flip flop. What is the drawback of SR flip flop? (3)

(e) Perform the following arithmetic operation:
(-19) + (-38)

(Use signed 2's complement representation for negative numbers and 8 bits to accommodate each number together with its sign.) (4)

(f) What is hardwired control unit? Give one advantage and one disadvantage of the same. (3)

(g) Draw instruction format for a 16-bit instruction that has 2048 words memory, 3 bits for opcode, and four addressing modes. (3)

(h) Write two instructions needed in the basic computer to set the extended bit **E to 1.** (2)

(i) Give one advantage and one disadvantage of isolated I/O. (2)

(j) Simplify the following Boolean function using a three variable Karnaugh map:

$$F(x, y, z) = \Sigma(0, 2, 4, 5, 6).$$

Further, draw its simplified logic diagram. (4)

(k) Write the sequence of micro-operations for implementing **BSA** and **ISZ** instructions. (4)

(l) Draw the logic diagram and truth table of a **2x4** decoder using only **NAND** gates with enable input. (4)

Section B

2. (a) A computer uses a memory unit with 4096 words of 16 bits each. An instruction at address 03B in the basic computer has I=1, an operation code of the **ADD** (opcode 001) instruction, and an

address part equal to 075. The memory word at address 075 contains the value 032A. The memory word at address 32A contains the value 9C37 and the content of AC is 54AC. (all numbers are in hexadecimal)

(i) Give block diagram of memory unit to give snapshot of the above representation.

(ii) Go over the instruction cycle and determine the contents in hexadecimal of following registers: PC, AR, DR, AC, and IR when an instruction at address 03B is executed. Give the answer in a table with a column for each register and a row for each timing signal.

(6)

(b) The following memory units are specified by the number of words times the number of bits per word. How many address lines and input-output data lines are needed in each case?

(i) 53K x 16

(ii) 24M x 32 (4)

3. (a) Perform the following conversions:

(i) $(237456)_{10} = (\ ?\ )_6$

(ii) $(2112110)_3 = (\ ?\ )_{10}$

(iii) $(EF345)_{16} = (\ ?\ )$

(iv) $(14.0625)_{10} = (\ ?\ )_2$

(v) $(280)_9 = (\ ?\ )_{10}$ (5)

(b) A non-pipeline system takes 30 ns to process a task. The same task can be processed in a four-segment pipeline with a clock cycle of 10 ns.

(i) Determine the speedup ratio of the pipeline for 100 tasks.

(ii) What is the maximum speed that can be achieved?

P.T.O.

(iii) Draw a space time diagram of the abo pipeline system for 8 tasks.

4. (a) Write a program using one address and thre address instructions to evaluate the arithmeti expression:

$$X = (A-B) * (C + D)$$

Assume that memory operands are in memory addresses A, B, C and D and the result must be stored in memory at address X. (6)

(b) Construct a 4-to-16-line decoder using two 3 X 8 decoders with enable input. Give block diagram and function table of the same. (4)

5. (a) **Given F (A, B, C, D) = Σ (0, 2, 8, 9, 10, 11, 14, 15)**

(i) Simplify the function in product-of-sums form by means of a four-variable map.

(ii) Draw the logic diagram using OR-AND gates.

(iii) Specify the Boolean expression of the function without circuit simplification.

(iv) Compare the number of gates that would be required without circuit simplification against number of gates required with circuit simplification. (6)

(b) Represent the number $(+52.25)_{10}$ as a floating-point binary number with 24 bits. The normalized fraction mantissa has 16 bits, and the exponent has 8 bits. (4)

6. (a) Give block diagram of a Direct Memory Access (DMA) controller. How does CPU initialize the DMA transfer? (6)

(b) Write short notes on any two of the following:

(i) CPU Registers

(ii) Direct and Indirect Addressing Mode

(iii) Interrupt Cycle (4)

(9)

[This question paper contains 12 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 1565 **G**

Unique Paper Code : 2342012302

Name of the Paper : Operating Systems

Name of the Course : **B.Sc. (H) (Computer Science)**

Semester : III

Duration : 3 Hours Maximum Marks : 90

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Question No. **1 (Section-A)** is compulsory.
3. Attempt any **four** questions from **Section-B**.
4. Parts of a question should be attempted together.

(Section A)

1. (a) Briefly explain how an operating system provides efficiency to the system and convenience to the end user. (2)

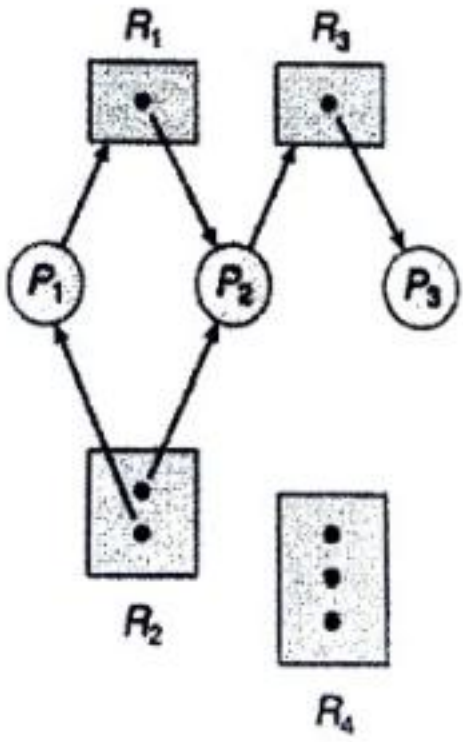
P.T.O.

(b) A bit, called the _____ bit, is added to the hardware of the computer to indicate the current mode: _____ (0) or _____ (1). (2)

(c) For a given set of I/O requests, argue that C-LOOK algorithm will perform more efficiently than LOOK algorithm. (2)

(d) List any two forms of user interface for an operating system? (2)

(e) Consider the following resource allocation graph



Identify the following :

(i) Processes

(ii) Resources

(ii) ssignment and Request edges (3)

(f) Give any three differences between paging and segmentation schemes of memory management. (3)

(g) Consider following statements executing processes P1 and P2:

P1 : counter++

P2 : counter– –

(Assume that Initial value of counter=10.)

Discuss the problem that can occur due to race condition in concurrent execution of these processes? (3)

(h) What is the Belady's anomaly in context of FIFO page replacement algorithm? (3)

(i) Consider a file "f1.txt" in Unix system with permission bits 072 (in 3 octal system). For this file, find the access permissions allowed for owner, group and others. (3)

(j) What will be the output of the given code segment? Briefly give reasons for your answer. (3)

```
int q = fork();
if (q == 0)
    cout<< "\n Inside the child";
else
 {
    wait (NULL);
    cout<< "\n Inside the parent";
}
```

(k) Differentiate between the following : (2+2)

(i) Data Parallelism and Task Parallelism

(ii) Turnaround Time and Waiting Time

(Section B)

2. (a) Under what condition will a child process become an orphan process? What is the role of init() process in the life cycle of an orphan process? (2+2)

(b) Give any two reasons due to which a parent process may terminate the execution of one of its child processes? Explain the phenomenon of cascading termination with respect to parent and child processes. Under what condition(s) will a terminated child process be known as a zombie process. (2+2+1)

(c) Consider the following page reference string

3 0 1 7 5 7 6 4 7 2 2 7 0

Assume that three frames are available. All frames are initially empty. How many page faults would occur for the following algorithms? Show the steps.

(i) FCFS page replacement algorithm

(ii) Optimal page replacement algorithm

(3+3)

3. (a) Mention any one limitation each of Monolithic and Microkernel approaches of Operating System design? How can the modular approach overcome each of these limitations? (2+2)

(b) Consider the following segment table :

Segment	Base	Length
0	250	100
1	350	40
2	1345	350
3	1673	600

What are the physical addresses corresponding to the following logical addresses?

(i) 0, 120

(ii) 1, 25

(iii) 2, 140

(iv) 3, 329 (4)

(c) Suppose there is a system with 128KB of memory with no memory initially allocated. Given the following sequence of requests by the processes, show the memory layout at intermediate stages that is, after allocation/deallocation of memory for each process. Assume that the system uses a best-fit allocation algorithm. (7)

Process Number	Nature of Request	Amount of memo requested (in KB)
P0	Allocation	20
P1	Allocation	30
P2	Allocation	22
P0	Deallocation	
P1	Deallocation	
P3	Allocation	50
P4	Allocation	20

4. (a) For a given queue of I/O requests 98, 183, 122, 14, 124, 65, 67 find total number of h movements using

(i) SCAN algorithm

(ii) C-SCAN algorithm

Assume that the head starts at 57 and st moving towards left end.

(b) Under what conditions the SCAN and C-SCAN algorithms perform better than other disk scheduling algorithms. (3)

(c) Mention any three challenges that may be faced by a software developer in a multicore system. (3)

(d) In a file system, path names for a file can be of two types: absolute and relative. Differentiate giving an appropriate example. (3)

5. (a) Consider a 40-bit logical address. Find the number of bits required to represent the page number and page offset fields. It is given that the page size is 4 KB. (4)

(b) Modern operating systems are interrupt driven. Briefly explain how interrupts are signalled by the operating system. (2)

(c) Identify any two advantages of a multiprogramm system over a single programming system?

(d) What is external fragmentation? Does contigu memory organization scheme suffer from exte fragmentation? Give arguments to support y answer. (3

6. (a) Consider the following set of processes, with length of CPU burst time given in millisecon

Process	Arrival Time	Burst Time	Priority
P1	0	3	2
P2	2	5	1 (Highest
P3	3	3	3
P4	5	1	4

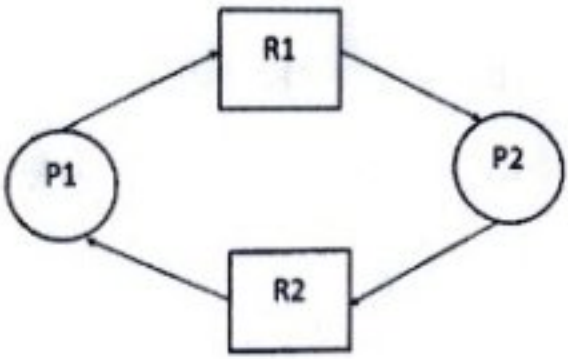
(i) Draw Gantt chart for Shortest Job algorithm and calculate turnaround time every process.

(ii) Draw Gantt chart for Priority based (preemptive) algorithm and calculate waiting time for every process. (4+4)

(b) Consider a demand paging system with the page table stored in memory. What should be the maximum page fault rate to achieve an effective access time of 200 nanoseconds if the time taken for a memory reference is 100 nanoseconds. Assume that a page fault is serviced in 10 ms. (2+3)

(c) Which scheduler controls the degree of multiprogramming? How? (2)

7. (a) What are the four necessary conditions for deadlock to occur? For the following resource allocation graph, find if the system is in a deadlock state. Justify your answer. (4+4)



(b) Consider two processes p1 and p2. Write the structure of process p1 to solve the critical section problem using Peterson's solution? Justify that progress requirement is satisfied in this solution. (4+3)

(5)

[This question paper contains 8 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 1603 **G**

Unique Paper Code : 2342012303

Name of the Paper : Numerical Optimization

Name of the Course : **B.Sc. (H) Computer Science**

Semester : III

Duration : 3 Hours Maximum Marks : 90

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. The paper has **two** sections **A** and **B**. **Section A** is compulsory.
3. Attempt any **four** questions from **Section B**. Each question is of **15** marks.
4. Answer all parts of a question together.

P.T.O.

Section A

1. (a) How does an individual determine if a lin programming problem (LPP) solved usi graphical method has the unique/multiple/infeasi solution? Write appropriate reason for each.

(b) Define convex function. Check whether t following function is convex or not.

$$f(x,y) = \{x^2 + y^2 \geq 6\}$$

(c) A company has 3 production facilities S_1, S_2, S with capacity of 7, 9, and 18 units (in 100s) pe week of a product, respectively. These units ar to be shipped to 4 warehouses D_1, D_2, D_3, D_4 wit requirement of 5, 8, 7, and 14 units (in 100s) pe

week, respectively. Formulate the transportation problem to minimize the total cost, considering the following unit transportation cost from warehouses to facilities : (5)

	D_1	D_2	D_3	D_4	Supply
S_1	19	30	50	10	7
S_2	70	30	40	60	9
S_3	40	8	70	20	18
Demand	5	8	7	14	34

(d) Show that the function $f(x) = 8x_1 + 12x_2 + x_1^2 - 2x_2^2$ has only one stationary point. Also, check that it is neither a maximum or minimum, but a saddle point. (5)

(e) Find out the optimum value of following function

$$f(x_1, x_2) = -\log(1 - x_1 - x_2) - \log x_1 - \log x_2$$

using Newton's method till four iterations assum

initial value $\left(\frac{1}{3},\frac{1}{3}\right)$.

(f) Solve the following optimization problem us

Lagrangian augmented method $Z=\frac{x^2}{2}+\frac{y}{}$

subject to given constraint $x = 1$.

Section B

2. Consider two different types of foodstuffs say F_1 a

F_2. Assume these foodstuffs contain vitamin V_1 a

V_2. Minimum daily requirement of V_1 is 40 units a

V_2 is 50 units. Food F_1 contains 2 units of vitamin V

and 3 units of vitamin V_2. Further, F_2 contains 4 uni

of V_1 and 2 units of V_2. The cost of 1 unit of F_1 is Rs. 3 and 1 unit of F_2 is Rs. 2.5.

(a) Formulate the above problem as a Linear Programming Problem (LPP).

(b) Find the minimum cost diet that would supply the body minimum requirements of each vitamin using graphical method. (7+8)

3. (a) Find out the optimum value of the function $f(x) = (x-5)^2$ using line search optimization algorithm $x \in [-10, 20]$. (7)

(b) Find the points on a circle $x^2 + y^2 = 16$, which are the closest and the farthest from (1,2) using Lagrangian method. (8)

4. (a) Compute the gradient $\nabla f(x)$ and Hessian ∇^2 of the Rosenbrock function $f(x) = 100(x_2 - x^2$ $(1 - x_1)^2$. Show that $x^* = (1,1)^T$ is the only l minimizer of the given function, and the Hes matrix at this point is positive definite.

(b) Use the conjugate gradient method to minim the following function :

$f(x_1,x_2) = 2x_1^2 - 2x_1x_2 + 2x_2^2$, where $b = [1,0]^T$ $(x_1, x_2) \in \mathbb{R}^2$.

5. Solve the following Linear Programming Probl (LPP) using Simplex Method : (

$\min Z = 4x_1 + x_2$

Subject to the following constraints

$3x_1 + x_2 = 3$

$4x_1 + 3x_2 \geq 6$

$x_1 + 2x_2 \leq 4$

$x_1, x_2 \geq 0$

6. (a) Find the rate of change of the function $f(x, y) = x^3y$ at $x_0 = (1, -2)$ in the direction $u = \left(1/2, \sqrt{3}/2\right)$. (7)

(b) Find out the error of function $f(x) = 3x^3 + 2$ using approximating gradient method. (8)

7. (a) Use Lagrangian method to solve the following optimization problem : (7)

max $z = 4x^2 + 10y^2$, subject to the constraint $x^2 + y^2 \leq 4$.

(b) Find minimum x^2 over $[-5,15]$ by the Golden Section rule using tolerance factor, $\in = 1.5$. (8)

(6)

[This question paper contains 8 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 4343 **G**

Unique Paper Code : 32341301

Name of the Paper : Data Structures

Name of the Course : **B.Sc. (Hons.) Computer Science**

Semester : III

Duration : 3 Hours Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Question No. **1** of **35** marks is compulsory.
3. Attempt any **Four** questions from Q. No. **2** to Q. No. **7**.

1. (a) An application requires frequent insertions and deletions to store and maintain its data items. Which data structure is appropriate: a linked list or an array? Justify the answer.

P.T.O.

However, the application's database become stable after some time and no further insertion and deletions are required. At this point, th application can change its choice of data structure Which data structure is appropriate now: a linke list or an array? Justify the answer.

(b) Convert the following function into its equivale recursive code :

```
int f (int a [], int p, int q)
{
   int x = a[p];
   for (int i = p+1; i<q; i++)
       if(x>a [i])
           x=a[i];
   return x;
}
```

(c) Consider a stack S implemented using a singl Linked List. Stack S implements Push() an Pop() operations using add_to_Tail() an remove_from_tail() methods.

(i) Give the running time of Push() and Pop operations for the above stack S.

(ii) Can the efficiency of these operations be improved using any alternate implementation strategy using a singly Linked List? Justify your answer by comparing running times.

(d) Create a Multiway Search Tree of order two and show all the steps involved :

50, 35, 40, 24, 65, 56

Write a function to find the inorder successor of the root node of the above tree. (5)

(e) Consider a scenario where every node of a doubly linked list stores a character with given head and tail pointers. Write a function that visits each node of the list exactly once to check whether the contents of the doubly linked list form a palindrome or not. The function should also report the number of characters in the list without using any further traversal.

A palindrome is a string that reads the same backward as forwards. For example, 'madam and 'ABBA' are palindromes. (5)

(f) Consider a circular queue created using an array of size 4. Perform the following operations in the given order and show the status of the queue after every operation :

Enqueue(4), dequeue(), dequeue(), enqueue(5)
enqueue(6), enqueue(8), enqueue(10), enqueue(9)
dequeue (), enqueue(11)

If the above queue was linear, show the fina
contents of the queue after performing all th
above operations.

(g) A lottery game generates 10-digit ticket number
These tickets are to be stored in a square matri
(5X5) based on the ticket number. The summatio
of the first five digits of a ticket number (modul
the number of rows in the square matrix) is use
to identify the row number and the summation
the last five digits of the ticket number (modul
the number of columns in the square matrix)
used to identify the column number of the squa
matrix to store that ticket. Two tickets may has
to the same location in the square matrix, in whi
case, the location becomes a bucket that can ho
multiple tickets. Demonstrate the working of th
above game on the following ticket numbers:

1234567890, 0123456789, 0234516789, 013452678
0124536789, 0123546789, 0123465789, 901234567

2. (a) Consider a scenario where the students are submitting their answer scripts one by one to a teacher. The teacher is maintaining the collected answer sheets in order always. Suggest the algorithm that can be used by the teacher. Use this algorithm to arrange the following 5 answer scripts that are numbered as follows and show all the steps :

23, 14, 56, 2, 10

Compute the number of comparisons that the teacher must have performed. (5)

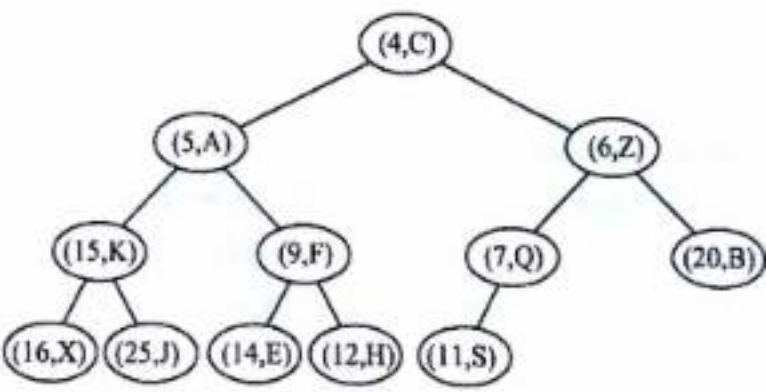
(b) Find the preorder traversal of a Binary Search Tree (BST) if its postorder traversal is given below. Show all the steps performed.

2 20 17 25 15 48 45 50 40 (5)

3. (a) An upper triangular integer matrix A with nXn dimension is to be stored as a one-dimensional array B in column-major order. If the base address of the array B is 200 and each integer takes 4 bytes of memory, find the address of A[1][2]. Also, give the formula to map the A[i][j] element of array A into array B. Assume that the indexing for array A starts with 1 and that of B from 0. (6)

(b) Assuming a class is already defined for a singly linked list, write a member function to display the middle node of the list by traversing the list exactly once. (4)

4. (a) For the given Priority Queue implemented using Heap, illustrate the following operations one after the other : (6)



(i) insert new element (3, T)

(ii) removeMin()

(b) Insert the given keys one by one in a multiway search tree of order 5 such that the search time is always logarithmic. Show all the steps involved. Thereafter, delete the key 16 and show the resulting tree.

24, 30, 16, 43, 51, 65, 48, 75, 34 (4

5. (a) Give a class definition for an ordered singly linked list. Write a member function to insert a node in this linked list such that the list remains in order. (6)

(b) Write a recursive function to find the maximum key value in a Binary Search Tree. (4)

6. (a) Consider an array with the following elements:

102, 280, 405, 513, 632, 746, 910, 958, 1000

Which searching technique (linear/binary) is better suited and why? Will this technique be appropriate if the given data is stored using a linked list? Why/ Why not? (5)

(b) Discuss the minimum and maximum height of a Binary Search Tree having n nodes. State the advantage of using a height-balanced tree like an AVL Tree over a Binary Search Tree. (5)

7. Consider an electronic calculating device named FastCal. On receiving a mathematical expression, A, as input, FastCal converts that expression into a parenthesis-free notation and evaluates it using some suitable data structures. Answer the following :

(i) Which data structures FastCal must use for the conversion and evaluation of the expression?

(ii) Give the complete algorithm for the above-mentioned functioning of FastCal. (10)

(7)

[This question paper contains 8 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 4397 **G**

Unique Paper Code : 32341302

Name of the Paper : Operating Systems

Name of the Course : **B.Sc. (H) CS**

Semester : III

Duration : 3 Hours Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. **Section A** is compulsory.
3. Attempt any **4** questions from **Section B**.
4. Parts of a question must be answered together.

SECTION A

1. (a) Which of the CPU scheduler affects the degree of multiprogramming? (1)

P.T.O.

(b) In which of the access methods, the file is viewe as a numbered sequence of block or record that, one may read block 14 then block 59, an then can write block 13?

(c) In a general graph directory structure write possibl solutions to avoid infinite search loop. (2

(d) Write the bit vector representation for free space list for a disk (10 blocks) where blocks 2, 3 and 6 are free and rest of the block are allocated. (1)

(e) Briefly explain any two main advantages of multiprocessor systems. (2)

(f) A non-preemptive kernel is free from race conditions on kernel data structures. Then why would anyone favor a preemptive kernel over a non-preemptive one? (2)

(g) Why usage of an Application Program Interface (API) is preferred over system calls for writing programs? (2)

(h) Consider the following code segment and give output with justification. (Assuming all appropriate header files are included) (2)

```
int main()
{
    fork(); fork();
    fork(); fork();
    printf("hello\n");
    return 0;
}
```

(i) Consider a paging system with the page table stored in memory.

(i) If a memory reference takes 125 nanoseconds, how long does a paged memory reference take? (1)

(ii) If we add Translation Lookaside Buffer (TLBs) and 80% of all page table references are found in the TLBs, what is the effective memory access time? Assume that the time taken to access a TLB is 20 nanoseconds. (2)

(j) Consider the following segment table : (2)

Segment	Base	Length
0	500	600
1	1200	250
2	400	50

What are the physical addresses for the followin logical addresses? Justify your answer.

(i) 0, 300

(ii) 2, 100

(k) What is VoIP? Explain with an example. (2)

(l) Using semaphores, explain how can we achieve the condition of having statement 'x' of process PI to be executed only after statement 'y' of process P2? (2)

(m) Can a cache be made as large as the disk? Justify your answer. (2)

(n) Consider a disk pack with 4 surfaces, 32 tracks per surface and 64 sectors per track. 512 bytes of data are stored in a bit serial manner in a sector. Calculate the capacity of the disk pack and also, the number of bits required to specify a particular sector in the disk. (2)

(o) What is a page fault? (1)

(p) Write any two pieces of process information that changes during context switch? (2)

(q) Out of Peer-to-Peer and client-server networks, which one is more reliable. Justify your answer. (2)

(r) Write any two ways of deadlock handling. (2)

(s) Under what circumstances the process will become

(i) Zombie

(ii) Orphan (2)

SECTION B

2. (a) Consider the following set of processes, with the length of CPU burst time given in milliseconds : (6)

Process	Arrival Time	Burst Time	Priority
P1	0	2	2
P2	1	5	1 (Highest)
P3	4	3	3
P4	5	1	4

(i) Draw Gantt chart for Shortest Job First algorithm and calculate turnaround time for every process.

(ii) Draw Gantt chart for Priority based (preemptive) algorithm and calculate waiting time for every process.

(b) Given is a system with 128KB of memory (assuming no memory initially allocated). Show the memory layout at intermediate stages for best-fit allocation algorithm for the following given sequence of requests by the processes. (4)

Process Number	Nature of Request	Amount of memory requested (in KB)
P0	Allocation	30
P1	Allocation	10
P2	Allocation	15
P3	Allocation	22
P0	Deallocation	-
P2	Deallocation	-
P4	Allocation	8
P5	Allocation	10

3. (a) A system has three processes P1, P2 and P3 and four resources R1, R2, R3 and R4. There are two instances each of R1, R2 and R4, and one instance of R3. Given the edge set E = {R1 → P1, R2 → P2, P1 → R3, R1 → P2, P3 R1, R2 → P3, R3 → P3}.

(i) Draw the resource allocation graph. (3)

(ii) Is the system in a deadlock state? If yes, then which processes are in the deadlock else identify the sequence in which the processes will be executed. (2)

(b) "It is more economical to create and context switch threads in comparison to processes". Justify this statement. Write any three programming challenges in writing multithreaded programs for multicore systems. (2+3)

4. (a) Give the structure of processes in Peterson's solution and explain how mutual exclusion and progress is preserved. (4)

(b) Consider the following page reference string

0 3 1 5 7 6 5 7 2 2 7 0 4 7 3 2 1 2 1

How many page faults would occur with First-in, First-out (FIFO) and optimal page replacement algorithms assuming three frames? All frames are initially empty. (6)

5. (a) Consider a logical address space of 64 pages with 2 KB frame size mapped onto a physical memory of 256 KB. (2+4)

(i) How many bits are there in the logical and physical addresses?

(ii) How many bits will be used by page offset and page number in logical address?

(b) Compare and contrast the following : (4)

(i) Symmetric and Asymmetric multiprocessing

(ii) Microkernel and Monolithic approach of Operating System design

6. (a) Suppose a disk drive has 200 cylinders numbered from 0 to 199. The request for track 46 is being serviced and is moving towards track 199 and the disk request queue contains read/write requests for the sectors on tracks 113, 156, 22, 132 and 196, respectively. Represent the head movements diagrammatically and also calculate the total number of head movements needed to satisfy the requests in the queue, using : (6)

(i) First Come First Serve (FCFS)

(ii) Shortest Seek Time First (SSTF)

(b) Which are the two address space possibilities for the child process after the execution of fork() system call. (2)

(c) What issues will be faced by operating systems if it resides in read only memory (ROM) as in cellular phones and tablets? (2)

[This question paper contains 8 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 4511 **G**

Unique Paper Code : 32341303

Name of the Paper : Computer Networks

Name of the Course : **B.Sc. (Hons) Computer Science**

Semester : III

Duration : 3 Hours Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. **Section A** is compulsory and carries 35 marks.
3. Attempt **any 4** Questions from Section B.

Section A

1. (a) What is telecommunication? Assume six devices are arranged in a mesh topology. How many cables are needed? How many ports are needed for each device? (1+2)

P.T.O.

(b) What is QPSK? Give a constellation diagram for 4-QAM. (1+1)

(c) Give any two services provided by the following layers :

(1) Physical Layer

(2) Application Layer (4)

(d) Given a noiseless channel with a bandwidth of 3000 Hz transmitting a signal with two signal levels, calculate the maximum bit rate. (2)

(e) Consider a synchronous TDM system with n input lines. Given that the duration of input frame is T, explain the working of this system with a diagram. (2+1)

(f) Draw the digital waveforms to represent the following encoding schemes for the data 10101011. Assume that the last signal level is positive.

(1) NRZ-I

(2) Manchester Encoding (4)

(g) Explain the principle behind the working of optical fiber cable? (2)

(h) What is Flow Control? (1)

(i) Differentiate between packet switching and circuit switching. Give one application of each. (2+1)

(j) Briefly describe piggybacking? What happens if the receiver wants to acknowledge a frame without any data to be sent to the original sender? (1+1)

(k) What is the result of applying zero compression on the following IPv6 address FE80:0000: 0000:0000: 0000:BC21:0000:FFFF (1)

(l) Distance vector routing suffers from "count to infinity problem". Briefly discuss the count to infinity problem with an example. (2)

(m) Enumerate the three parts of a Uniform Resource Locator? Give a suitable example. (3)

(n) What is the purpose of MF and DF flag bits with respect to IP header? (2)

(o) What is the significance of using guard bands? (1)

Section B

2. (a) A bit string, 111011110111110111111101 is to be transmitted at Data Link Layer, what is the string actually transmitted after bit stuffing? (2)

(b) What is subnetting? A router in an organization receives a packet with the destination address 190.240.34.95. If the subnet mask is / 19. Find the subnet address. (3)

(c) Give any three differences between virtual circuit and datagram subnet. (3)

(d) State the optimality principle. (2)

3. (a) Differentiate between:

(i) Microwave and Infrared (3)

(ii) FSK and PSK (2)

(iii) Gateway and Router (2)

(b) What are the three address categories to which an IPv6 address may belong? Explain each of them briefly. (3)

4. (a) Generate even parity Hamming Code for data bits 1100100. Show the steps. (3)

(b) Differentiate between Static and Dynamic Routing Algorithms with the help of an example. (3)

(c) Explain the working of the Selective Repeat Protocol with the help of a flow diagram for the following scenarios.

(i) Successful communication

(ii) Lost acknowledgment (2+2)

5. (a) Describe the User Datagram Protocol header with the help of a diagram. (5)

(b) Briefly describe the one persistent, non-persistent and p-persistent CSMA protocols. (3)

(c) Name the protocols associated with the following port numbers:

(i) 80

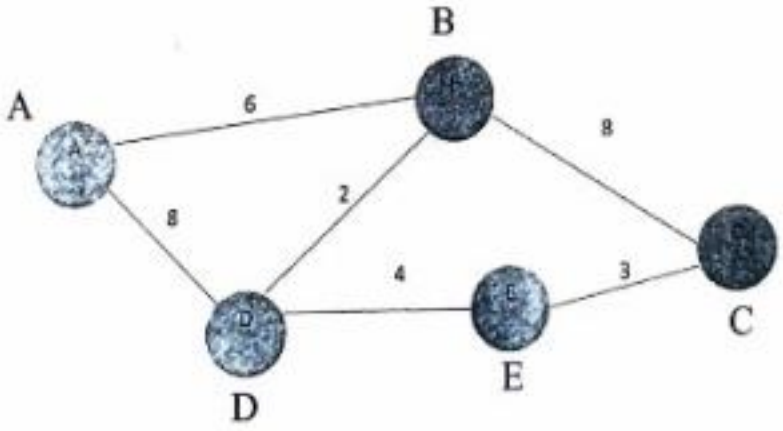
(ii) 23 (2)

6. (a) Differentiate between Bit Rate and Baud Rate with a suitable example. (2)

(b) What is the significance of ARP and RARP protocols? (2)

(c) In reference to digital signals, baseline wandering makes it difficult for the receiver to decode the signal correctly. Justify. (2)

(d) A given network was built with the routers in the network represented as nodes A, B, C, D and E. The edges in the graph represent the communication link between the routers. Each edge is labelled by the cost of traversing the link. Using Dijkshtra's shortest path algorithm, find shortest path from A to C.



(4)

7. (a) Explain the process of connection establishment and connection release process used for Transmission Control Protocol. (3+2)

(b) To detect a d-bit error you need a distance d+1 code. Justify the statement. (3)

(c) What is the use of options field in the Internet Protocol Header? Explain with the help of an example (2)

(9)

[This question paper contains 8 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 4325 **G**

Unique Paper Code : 32341501

Name of the Paper : Internet Technologies

Name of the Course : **B.Sc. (H) Computer Science**

Semester : V

Duration : 3 Hours Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. **Section A** is compulsory.
3. Attempt any **FOUR** questions from **Section B**.

SECTION A

1. (a) Describe port address translation in Network Address Translation with the help of an example. (2)

P.T.O.

(b) Explain stub network with the help of an example. Give a situation where stub networks are beneficial. (2+1)

(c) What is the output of the following code: (3)

```
varregularFunc = function (arg) {
arg = arg || "Hello";
  return arg.toUpperCase();
}
document.write(regularFunc('Hello World'));
document.write(regularFunc());
```

(d) What is the output of the following code: (5)

```
<html>
<head>
<script>
$(document).ready(function() {
$("button").click(function() {
$("h1").before('<h1>This is newheading</h1>');
});
S("button").click(function() {
var $newItem=$("<p>New paragraph added</p>");
$("h1").after($newItem);
 });
});
</script>
```

```
</head>
<body>

<h1>This is a heading</h1>
<p>This is a paragraph.</p>
<button>Click Me</button>
</body>
</html>
```

(e) Write JQuery and HTML code to create a form accepting car name, car model and car manufacture year from the user. When the user clicks on Submit button, the data from the form is sent to Register.php. (5)

(f) Write HTML and Javascript code to create a form that accepts two numbers, num1 and num2. The form also has two buttons, Sum and Maximum. On clicking buttons, Sum should display the sum of num1 and num2, and Maximum should display the maximum of the two numbers, respectively. (5)

(g) Explain the following : (2×6)

(i) ping

(ii) netstat

(iii) Cookies

(iv) VOIP

(v) Proxy server

(vi) Search engine

SECTION B

2. (a) What is the importance of Network Address Translation? Consider the following scenario :

Host A ------ 10.1.1.1—NAT Router—192.168.1.1 ------ Host B
10.1.1.10 192.168.1.5

Give the following addresses for the above scenario :

(i) Inside local

(ii) Inside global

(iii) Outside local

(iv) Outside global (4)

(b) Differentiate between static and dynamic routing. Explain the following with the help of an example :

(i) Default static route

(ii) Floating static route (2+4)

3. Consider you are using the subnet mask of 255.255.255.240 to subnet your class C network with IP address as 192.168.1.0.

Write the following :

(i) Number of subnets

(ii) Number of hosts per subnet

(iii) Network address and broadcast address of first three networks

(iv) First usable IP address and last usable IP address of first three networks (2+2+3+3)

4. (a) Create an HTML file, order.html, to accept choices from the user : (2+1+3+1)

Username: [Textbox]

Order details:

Starters: French fries or Kebabs [List with respective prices]

Beverages: Cola or Juice [List with respective prices]

Main: Burger or Pizza [List with respective prices]

ORDER NOW [Button]

P.T.O.

Your order details are: [div element]

Create Javascript file, getVal.js, to perform the following :

(i) Access the value of user entered data and the div element.

(ii) Using function calc_order, calculate the order value based on the user input.

(iii) Invoke the function calcorder when the user clicks on ORDER NOW button and the order details are displayed on the div element.

(b) Explain Immediately Invoked Function Expression with the help of an example. (3)

5. (a) Design the following form using HTML : (2+4)

Candidate Name: [Textbox]
Candidate Qualification: Undergraduate with id "one"
Postgraduate with id "two" [Unordered list]

Click to view. [Button]

Div element with id "tag"

Using .each() function in JQuery, get access to all the list elements of the unordered list "Candidate Qualification". Insert a new entry to the end of this list with the ids of each list element, that is, the last two entries should be "one" and "two", respectively.

(b) What is the difference between getElementById() and getElementByName() functions? Give an example of each. (2+2)

6. (a) Illustrate the importance of serialize() function in AJAX with the help of any example. (5)

(b) What are the benefits of using BOOTSTRAP in web development? Describe BOOTSTRAP Grid system. (2+3)

7. (a) Explain each line of the following Node .js code: (5)

```
const express = require('express')
const app = express()
app.get('/', (req, res) => {
res.send('Hi!')
})
```

```
const server = app.listen(3000, () => console.log
('Server ready'))

process.on('SIGTERM', () => {

server.close(() => {

   console.log('Process terminated')

  })

})
```

(b) What is the use of following methods in AJAX?

(i) $.get()

(ii) $.post()

(iii) $.getJSON()

(iv) $.getScript()

(v) $.ajax() (5)

[This question paper contains 8 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 4379 **G**

Unique Paper Code : 32341502

Name of the Paper : Theory of Computation

Name of the Course : **B.Sc. (H) Computer Science**

Semester : V (Admissions 2019-2021)

Duration : 3 Hours Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Question No. **1** is compulsory.
3. Attempt any **four** of Question nos. **2** to **7**.
4. Parts of a Question must be answered together.
5. Consider $\Sigma = \{a, b\}$ for all the questions unless specified otherwise.

P.T.O.

1. (a) Let S = {ab, bb} and T = {ab, bb, bbbb}.

- Is $S^* \subset T^*$?
- Is $S^* = T^*$?

Explain.

(b) Write a regular expression for the language, havi
words with exactly one double letter in them.

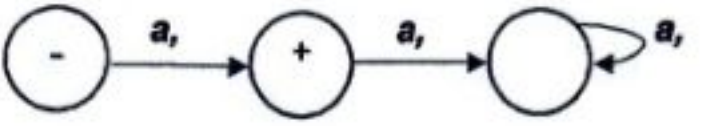
(c) Show that the language PRIME = {a^p, where p
a prime} is non-regular.

(d) Prove that the complement of a context-fr
language may not be context-free.

(e) (i) What are recursive languages?

(ii) State the Church-Turing thesis.

(f) For the following Finite Automata that accepts the language L, draw a deterministic FA that accepts (i) L' (ii) L* (4)



(g) Determine whether the following CFG is ambiguous or not. Justify.

S -> aSX | Λ

X -> aX | a (4)

(h) Convert the following CFG to Chomsky Normal Form :

E -> E + E

E -> E * E

E -> (E)

E -> 7

The terminals are +, *, (,), 7 (4)

P.T.O.

(i) Design a deterministic PDA for the followi
language: $a^n b^{n+1}$, $n >= 1$

(

(j) Design a deterministic finite automata that accep
a string defined over the English alphabet {a-
and ending with 'ied'. For instance, "died" wou
be accepted, but not "dead".

(

2. Consider the following languages

L_{11}: the language of all words that do not contain
double a

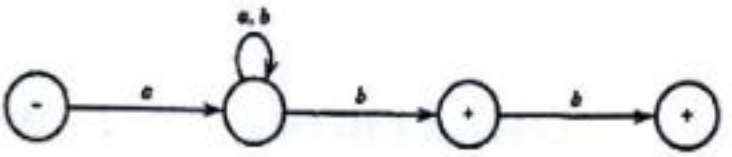
L_{12}: the language of all words that do not contain
double b and end in a

(a) Write a regular expression for each of L
and L_{12}. Hence write a regular expression f
$L_{11} \cup L_{12}$.

(

(b) Draw a finite automata for each of L_{11} and L_{12}. Hence, systematically find a finite automata for $L_{11} \cap L_{12}$. (6)

3. (a) Convert the following non-deterministic finite automata to deterministic finite automata : (4)



(b) Design a Turing Machine that decides the language $L = \{a^n b^n c^{n+2} : n \geq 0\}$. (6)

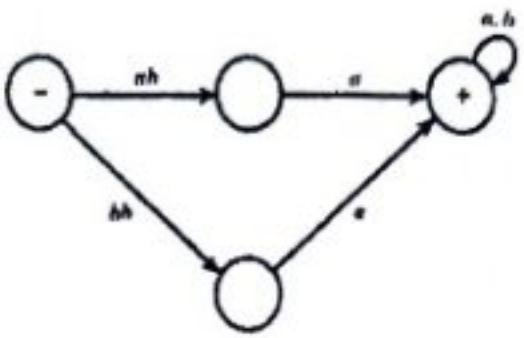
4. (a) Find a CFG for the language $L_4 = a(bb)^*$. Also, find a CFG for $L_4{}^*$. (4)

(b) Construct a deterministic PDA for the language L given below :

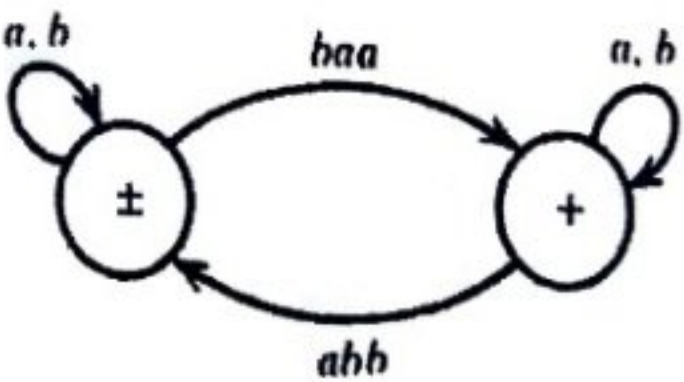
$L = \{a^m b^n \mid n >= 1, m >= 1, m > n+2\}$ (6)

P.T.O.

5. (a) (i) Convert the following Transition graph int regular expression :



(ii) Construct a TG for L* if L is defined by following TG:



(b) Show that the following language defined over alphabet {a, b} is not context free :

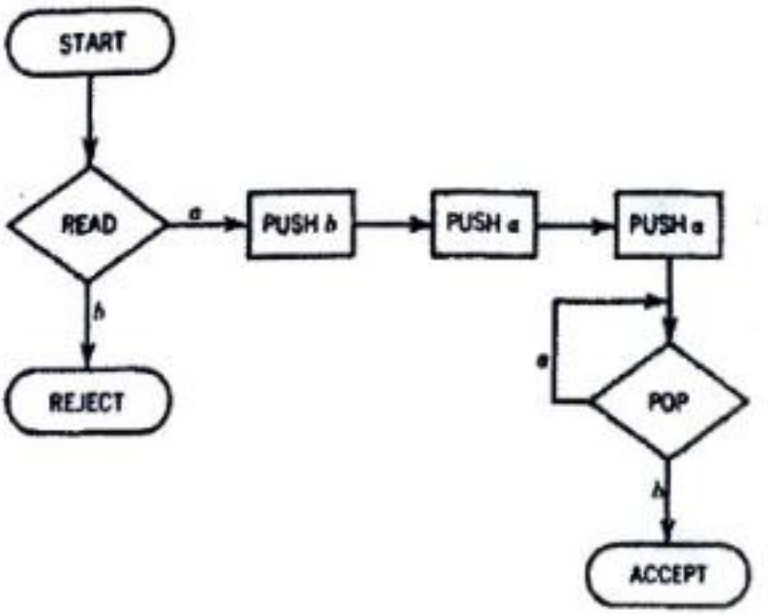
$a^n b^n a^n b^n$

6. (a) Build a finite automata that accepts the language of words having a double letter in them. (4)

(b) Prove that recursively enumerable languages are not closed under complementation. (4)

(c) What would be the length of the shortest string in the language mentioned in part (a) above? List the shortest strings. (2)

7. (a) Describe the language accepted by the following PDA and give its regular expression. (4)



(b) Consider the following CFG :

S -> aAS, S -> a, A -> SbA, A -> SS, A -> ba

For the input string 'aabbaa', find

(i) leftmost derivation

(ii) parse tree (6)

(11)

[This question paper contains 16 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 4432 **G**

Unique Paper Code : 32347507

Name of the Paper : Data Analysis and Visualization

Name of the Course : **B.Sc. (Hons.) Computer Science**

Semester : V

Duration : 3 Hours Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Question No. **1** is compulsory.
3. Attempt any **four** questions out of **Q.2** to **Q.7**.
4. Parts of a question must be answered together.

P.T.O.

1. (a) Provide code to create a time-series with two index labels- 2011/9/01 and 2011/9/02. Assign random values. (2)

(b) What will be the output of the following codes?

(i) (2)

```
import numpy as np
arr = np.array([[1,2,3,4,5],[6,7,8,9,10]])
print(arr[1,-1], arr[-1:])
```

(ii) (2)

```
List = [str[::-1] for str in ('happy','go','lucky')]
print(List)
```

(c) Reshape the following array to dimension (2,6)

[[3,4,5,6], [7,8,9,10], [11,12,13,14]] (2)

(d) Python is a strongly "typed" language. Comment. (2)

(e) Give the output of the following code and identify the role of *is_unique* attribute in the code. (2)

```
import pandas as pd
series = pd.Series([4,5,1,2,3,3,4,5,6])
print(series)
print("Is Unique: ",series.is_unique)
```

(f) Differentiate between mutable and immutable objects. (2)

(g) Write a program to create the given dataframe. (3)

	id	value
0	1	a
1	1	a
2	2	b
3	3	None
4	3	a
5	4	a
6	4	None
7	4	b

Further, split it into groups and count unique values of *'value'* column.

(h) Provide the output of the following code : (3)

```
from datetime import datetime, date, time
dt = datetime(2011, 10, 29, 20, 30, 21)
dt2 = datetime(2011, 11, 15, 22, 30)
delta = dt2 - dt

print(delta)
print(type(delta))
print(dt.replace(minute=0, second=0))
```

(i) Consider the given dataframe *df* containing data of students admitted in the college. (3)

Id	Name	Age	Section	City	Gender	Marks
S0	Anit	10	A	Gurgaon	M	60
S1	Alka	22	B	Delhi	F	80
S2	Sid	13	C	Mumbai	M	60
S3	Ruhi	21	B	Delhi	F	55
S4	Nehu	12	B	Mumbai	F	60
S5	Geet	11	A	Delhi	F	56
S6	Om	17	A	Mumbai	M	45

Set the first column *'Id'* as the row index of the given dataframe *df*. Create a pivot table of df to display the total number of admissions as per *'Section'* and *'Gender'*.

(j) (i) Provide the output of the following code : (4)

```
df = pd.DataFrame({
'a':np.arange(1,7),
'b':np.arange(7,13),
'c':np.arange(12,18),
'd':np.arange(17,23),
'e':np.arange(23,29),
'f':np.arange(29,35)},
columns=['a', 'b', 'c', 'd', 'e','f'],
index=['Svaksh', 'Sarah', 'Svaraj', 'Rivika',
'Rahul','Geet']})
print(df)
df.iloc[2:4,[1,2]]=np.NaN
print(df)

mapping = {'a': 'red', 'b': 'red', 'c': 'blue', 'd':
'blue', 'e': 'red', 'f': 'orange'}
```

(ii) Using the above dataframe, group *df by* mapping and find the sum.

P.T.O.

(k) Consider the following dataset to perform the following operations : (4)

	Age	Section	City	Gender	Favourite_color
0	10	A	Gurgaon	M	red
1	22	B	Delhi	F	NaN
2	13	C	Mumbai	F	yellow
3	21	B	Delhi	M	NaN
4	12	B	Mumbai	M	black
5	11	A	Delhi	M	green
6	17	A	Mumbai	F	red

(i) Find all the raws where Age is greater than or equal to 12 and the *Gender* is male.

(ii) If *Age* is greater than 20, then use the loc function to update *Section* with "S" and *City* with Pune.

(iii) Select rows 1 to 2 with columns 2 to 3

using iloc.

(L) What is the output of the following code : (4)

```
import pandas as pd
fruits=['apple','orange','apple','apple']*2
N=len(fruits)


print(N)
df=pd.DataFrame({'fruit':fruits,'basket_ID':
np.arange(N),'count' :
np.random.randint(3,15,size=N),'weight':
np.random.uniform(0,4, size=N)})
print(df)
Fruit_cat=df['fruit'].astype('category')
print(Fruit_cat)
  print(df.dtypes)
```

2. (a) Differentiate between :

(i) qcut and cut methods

(ii) Pandas.merge and pandas.concat (2)

P.T.O.

(b) Consider the following numeric grades (out of 4). Formulate bins for the given grades as per the following condition : (3)

Below 2.5	Very bad
Between 2.5 to 3	Bad
Between 3 to 3.25	Average
Between 3.25 to 3.5	Good
Between 3.5 to 3.75	Very good
Between 3.75 to 4	Excellent

(c) Given the following dataframe, provide the output for the following commands : (5)

	ord_no	purch_amt	ord_date	customer_id
0	NaN	NaN	NaN	NaN
1	NaN	270.65	2012-09-10	3001.0
2	70002.0	65.26	NaN	3001.0
3	NaN	NaN	NaN	NaN
4	NaN	948.50	2012-09-10	3002.0
5	70005.0	2400.60	2012-07-27	3001.0
6	NaN	5760.00	2012-09-10	3001.0
7	70010.0	1983.43	2012-10-10	3004.0
8	70003.0	2480.40	2012-10-10	3003.0
9	70012.0	250.45	2012-06-27	3002.0
10	NaN	75.29	2012-08-17	3001.0
11	NaN	NaN	NaN	NaN

(i) df.dropna(thresh=2)

(ii) df.dropna(how='all')

(iii) df.dropna(how='all, axis=1)

(iv) df.isnull()

(v) df.isnull().values.any()

3. (a) Write the code to read each row of a given csv file. Skip the header of the file while reading. Also print the number of rows and the field names. (6)

(b) (i) Differentiate between ffill and bfill. (4)

(ii) Provide the output of the given code :

```
import pandas as pd
obj3 = pd.Series(['blue', 'purple', 'yellow'],
            index=[0, 2, 4])
print(obj3.reindex(range(6), method='ffill'))
print(obj3.reindex(range(6), method='bfill'))
```

4. (a) Consider following dataframe.

ord_no	purch_amt	ord_date	customer_id	salesman_id
70009.0	890.00	2012-09-11	3004.0	5001
70002.0	270.65	2012-09-10	3001.0	5006
70007.0	65.26	2012-09-11	3001.0	5005
70008.0	78.00	2012-09-10	3002.0	5003
70006.0	948.50	2012-09-17	3002.0	5002
70005.0	2400.60	2012-07-27	3001.0	5001
70004.0	5760.00	2012-09-10	3001.0	5003
70010.0	1983.43	2012-10-10	3004.0	5006
70003.0	2480.40	2012-10-10	3003.0	5005
70012.0	250.45	2012-06-27	3002.0	5002
70034.0	75.29	2012-08-17	3001.0	5004
70022.0	56.90	2012-06-27	3003.0	5005

With respect to the above dataframe, write the code for the following :

(i) Group the data on the column *ord_date* and calculate the total purchase amount *purch_amt* year wise and month wise.

(2)

(ii) Group the data on the column *customer_Id* and create a list of order date *ord_date* for each group. (2)

(iii) Group on the columns *customer_id*, *salesman_id* and then sort sum of *purch_amt* within the groups. (2)

(b) (i) Write a generator function to print Fibonacci numbers. (4)

(ii) What is the output of the following code :

```
def simpleGeneratorFunc():
    yield 1
    yield 2
x = simpleGeneratorFunc()

print(next(x))
print(next(x))
```

5. (a) Give output of the following code. Justify your answer. (2)

```
var=(1, 2, (3,4))
    var[1]='geet'
    print(var)
```

(b) Write the code to merge the two given datasets using key1, key2. (4)

data1:

	key1	key2	P	Q
0	K0	K0	P0	Q0
1	K0	K1	P1	Q1
2	K1	K0	P2	Q2
3	K2	K1	P3	Q3

data2:

	key1	key2	R	S
0	K0	K0	R0	S0
1	K1	K0	R1	S1
2	K1	K0	R2	S2
3	K2	K0	R3	S3

(c) Write the code to split the given dataset into groups based on *customer_id* and create a list of order date *ord_date* for each group. (4)

	ord_no	purch_amt	ord_date	customer_id
0	70009.0	890.00	2012-09-11	3004.0
1	70002.0	270.65	2012-09-10	3001.0
2	70007.0	65.26	2012-09-11	3001.0
3	70008.0	78.00	2012-09-10	3002.0
4	70006.0	948.50	2012-09-17	3002.0
5	70005.0	2400.60	2012-07-27	3001.0
6	70004.0	5760.00	2012-09-10	3001.0
7	70010.0	1983.43	2012-10-10	3004.0
8	70003.0	2480.40	2012-10-10	3003.0
9	70012.0	250.45	2012-06-27	3002.0
10	70034.0	75.29	2012-08-17	3001.0
11	70022.0	56.90	2012-06-27	3003.0

6. (a) Create a Timeseries Dataframe with date range 01-02-2022 to 30-02-2022 with 1 min frequency interval. The dataframe has two columns populated with random values. (3)

P.T.O.

(b) Identify the need to resample Timeseries data. (2)

(c) Consider following dataset.

Datetime	value1	value2	value3
2020-01.01 00:00:00	2	92	56
2020-01.01 00:01:00	9	78	80
2020-01.01 00:02:00	69	83	43
2020-01.01 00:03:00	47	62	45
2020-01.01 00:04:00	47	90	13
...	...	...	...
2020-02.27 23:56:00	73	81	35
2020-02.27 23:57:00	20	66	58
2020-02.27 23:58:00	42	16	48
2020-02.27 23:59:00	32	40	19
2020-02.28 00:00:00	37	63	95
83521 rows x 3 columns			

(i) Resample for 10min with sum function for *value1*, mean for *value2* and max for *value 3*. (3)

(ii) Downsample data to 30s. (2)

7. (a) Create a DataFrame of 8 rows and 8 columns containing random integers in the range of 1 to 10. Compute the correlation of each row with the preceding row. (2)

(b) Consider the following table that lists the last week Delhi's AQI.

AQI	Date
67	2/10/2022
79	3/10/2022
80	4/10/2022
90	5/10/2022
99	6/10/2022
110	7/10/2022
112	8/10/2022
140	9/10/2022
165	10/10/2022
178	11/10/2022

(i) Plot a line graph showing AQI (Air Quality Index) against date with line colour as red, line width as "4pixels" and dashed line style. (4)

P.T.O.

(ii) Add title "Delhi AQI for last ten days". (1)

(iii) Set label for x-axis "Date" and y-axis "AQI". (1)

(iv) Show grids in the background. (1)

(v) Set marker as '*'. (1)

(12)

[This question paper contains 12 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 1546 **G**

Unique Paper Code : 2342011101

Name of the Paper : Programming using Python (DSC-1)

Name of the Course : **B.Sc. (H) Computer Science**

Semester : I

Duration : 3 Hours Maximum Marks : 90

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. **Section A** is compulsory.
3. Attempt **any 4** questions from **Section B**.
4. Parts of a question must be answered together.

P.T.O.

SECTION A

(Compulsory)

1. (a) Give the pseudocode or flowchart for finding the largest of three numbers. (3)

(b) Give type of error in the statements given below : (3)

```
x, y, z = 20, '10', 0
d = [1, 2, 3]
```

(i) x / z

(ii) x + y

(iii) d[3]

(c) Determine the output of following code. State the values of **n** and **sum** for all iterations. (3)

```
n, sum = 371, 0
while n > 0:
    sum = sum + (n % 10) ** 3
    n = n // 10
print(sum)
```

(d) Explain any two access modes available for file handling in python. Use suitable examples. (3)

(e) Determine output of the following code snippet (3)

```
myStr = 'ihleD fo ytisrevinU'
myStr = myStr[: : -1]
print(myStr + ' ' + '110007')
print(len(myStr))
```

(f) Write a function **studentData(n)**, that returns a dictionary with keys as the student roll number and value as student name. The function should accept roll number and name, for **n** students, as input from the user.

Example, the returned dictionary should look like :

{101: 'Sahil', 102: 'Sam',...} (5)

(g) In the given code snippet, state the value of L1 after execution of each statement (3)

```
L1 = [10, 20, 30,20]

L1.append(80)

print(L1)

L1.remove(20)

print(L1)

(L1.extend('aroma')

print(L1)
```

(h) Consider sets **a** and **b**: (3)

a = (5, 12, 33, 14, 55}

b = {101, 13, 14, 55, 16}

Find the value of c for each of the following statements :

(i) c = a.union(b)

(ii) c = a & b

(iii) c = a.symmetric_difference(b)

(i) Write a function **factors(n1)** that returns a set of all the factors of the number **n1**. (4)

SECTION B

2. (a) Write a python program which contains the following functions : (7)

(i) **readflle(file1)** that prints the total number of lines present in file **file1**.

(ii) **copy(file1, file2)** that copies even lines of the file **filel** in file **file2**.

(b) Evaluate the following expressions : (8)

(i) 2 + 3 * 5 ** 2 % 10 - 6

(ii) 1 > 2 < 3

(iii) ~ (-6) == 5

(iv) 8 >> 3

3. (a) Find the output of the following code : (5)

```
d = {'RED':4, 'GREEN': 14, 'BLUE':24}

dkeys = list(d.keys())

print(dkeys[0])

print('blue' in d)

d['ORANGE'] = 12

d['GREEN'] += 10

print(d)
```

(b) Write a function **process(str1)** that performs the following : (10)

(i) Calculates the frequency of each character in the string **str1**, using dictionary type. Print this dictionary.

(ii) Function should return the string which has the words in the reverse order.

Example: if **str1** = 'Best of luck Savita!', the function should return the string 'Savita! luck of Best'.

4. (a) State the value of y after each step: (7)

```
x = 'quick sand'

y = x[3]

y += x[-4:-6:-1]

y += x[9] + x[-9]
```

```
y += x[-5] + x[-3] + x[3]

y += x[5] + x[2] + x[-2]

y = y.partition(' ')

y = y[0] + '@' + '.'.join(y[2].split(' '))

print(y)
```

(b) Describe the following string functions with examples : (8

(i) capitalize()

(ii) isdigit()

(iii) upper()

(iv) isalpha()

5. (a) Consider the following set of statements : (7

```
import copy

list1 = [ 1, 2, [ 3, 4]]
```

```
list2 = copy.copy(list1)

list3 = copy.deepcopy(list1)

list3[0] = 690

list1[2] [0] = 75
```

Find and justify the values of list1, list2 and list3.

(b) Generate a list containing the cube of the odd numbers from **1** to **n**, using : (8)

(i) a user-defined function **myCube(n)**

(ii) list comprehension

6. (a) Determine the output of the following code: (7)

```
x, y = 4, 5

sum = 0

while (y > 0):
```

```
        if (y & 1):
            sum = sum + x
        x = x << 1
        y = y >> 1
        print(x, y)
    print(sum)
```

(b) Write a program that does the following checks on the age entered by the user : (8)

(i) age should not contain alphabets or specia characters

(ii) age should not be less than 21

Raise and handle appropriate exception(s).

7. (a) Compute the output of the following code : (7

```
t1 = (1, 2, 3, 7, 9, 0, 5, 7)
t2 = (23, [24, 25])
```

```
print(max(t1))
print(t1[1:3])
print(t1.count(7))
t2[1][0]= 5
print(t2)
t3 = t1 + tuple('India')
print(t3)
```

(b) Define a class **Drone** that contains following data members : (8)

Instance variables: **droneId** - id of drone

Class variable: **totalCount** - for keeping count of all the drones manufactured

The class should contain the following methods:

(i) **__init__()** - initialize data members and increment **totalCount**

(ii) **getId()** - returns **droneId**

(iii) **getTotalCount()** - returns **totalCount**

(iv) **__del__()** - to destroy the object and decrement the **totalCount**

(13)

[This question paper contains 8 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 1527 **G**

Unique Paper Code : 2342012301

Name of the Paper : Data Structures

Name of the Course : **B.Sc. (H) Computer Science**

Semester : III (DSC)

Duration : 3 Hours Maximum Marks : 90

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. **All** questions in **Section A** are compulsory.
3. Attempt any **four** questions out of **six** in **Section B**.

Section – A

1. (a) What will be the maximum number of nodes in a Binary tree with depth d? (2)

P.T.O.

(b) What would be the output after the following code segment is executed on the following linked list

10 → 30 → 20 → 90 → 100

```
node *p;

p = head;

while (p->next->next)

{

    p=p-> next;

}

cout<< p-> data;
```

(2

(c) For the given queue - a, b, c, d, List the sequenc of enqueue and dequeue operation to obtain th following queue : d, c, b, a (2

(d) Store the following univariate polynomial in a singly linked list

$$5x^3 - 6x^2 - 3x + 2 \quad (3)$$

(e) Solve the following recurrence relation using Master's theorem-

$$T(n) = 2T(n/2) + n\log n \quad (3)$$

(f) Write a function for finding the minimum element in a Binary Search tree (3)

(g)
```
void fun(int x)
{
  if (x>0)
  {
    fun( x-1);
    cout << x;;
    fun(x-l);
```

```
        }
    }
void main()
{
    fun(3);
}
```

What will be the output for the above cod snippet? Create a recursion tree for the same. (5

(h) Convert the following expression to postfix usin a stack. Show the status of stack after eac operation

(A+B) * (C-D) / F – X*Y / Z (5

(i) Given a two dimensional array A[5][10]. A stored at address is 1000 and each element is c size 4. Find the address of A[3][5] using both ro major and column major order. (5

Section – B

2. (a) What is the advantage of using a doubly linked list over a singly linked list? Write a function to remove duplicate elements from a sorted doubly linked list. (2+6)

(b) Draw a binary tree T such that (5+2)

- Each node of T stores a single character
- A preoder traversal of T yields *mnopxyz*
- An inorder traversal of T yields *npomyzx*

Also give the post-order traversal of T

3. (a) Write a function to count all the occurrences of an element in an integer type array. (5)

(b) Evaluate the following postfix expression using a stack. Show every step.

4 3 * 2 / 1 8 2 ^ ^ + 2 – 3 +

(^ operator depicts exponent) (5)

(c) Draw the expression tree for the following : (

2 + 5 * 3 ^ 2 + 9 + ((1+8) * 3)

4. (a) For a given set of values, write a program f
printing the Next Greater Element (NGE) for eve
element. Use stack data structure. Write the NG
for the following elements 4,5,2,25. Also, expla
the time complexity of the code. (6+2+

(b) Write a recursive function for computing n
Fibonacci number via binary recursion. (

5. (a) Create a class to implement ADT queue usi
two stacks. Write functions - enqueue, dequeu
and empty. (3+

(b) Let $f(n) = 3n^2 + 4n \log n + 5n$. Show th
$f(n) \in O(n^2)$. (

(c) Sort the following array using insertion sort

10, 9, 11, 7, 8, 5

Show the status of array after each iteration. (4)

6. (a) Create an AVL tree by inserting the following items successively. Show the status of tree after each insertion

10, 15, 50, 12, 11, 30, 40, 60, 7

Delete 15 from the above tree. (6+4)

(b) Write a function to return the i^{th} element of a singly linked list. Compare the time complexity of accessing an element in an array and a linked list. (3+2)

7. (a) Consider a max heap with following values-

50, 30, 20, 15, 10, 8, 16

(i) Insert a new node with value 60.

(ii) Delete a node with value 50. (5)

(14)

[This question paper contains 8 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 1674 **G**

Unique Paper Code : 2343012003

Name of the Paper : Microprocessors (DSE)

Name of the Course : **B.Sc. (Hons.) Computer Science (NEP)**

Semester : III

Duration : 3 Hours Maximum Marks : 90

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. The paper has **two** sections. All questions in **'Section A'** are compulsory.
3. Attempt any **four** questions from **'Section B'**.
4. Parts of a question must be answered together.

Section A

1. (a) In the real mode, show the starting and ending addresses of each segment located by the following segment register values :

(i) 1000H

(ii) 1234H

(b) What is a displacement? How does it determi the memory address in a MOV DS:[2000H], A instruction?

(c) Describe the operation of each of the followin instructions :

(i) PUSH AX

(ii) POP ESI

(d) If AX = 1001H and DX = 20FFH, list the sum and the contents of each flag register bit (C, A, S, Z, and O) after the ADD AX, DX instruction executes. (3)

(e) Differentiate between the operation of a JMP DI with a JMP [DI]. (3)

(f) Which microprocessor pins are used to request and acknowledge a DMA transfer? (3)

(g) Describe the operation of the INTO instruction. (3)

(h) How is the interrupt request pin (INTR) enabled in the strobed input mode of operation of the 82C55? (3)

(i) Evaluate the address lines and data lines required to map 32K x 8 memory. (3)

(j) Explain the concept of memory banks in 8086 microprocessors. Which 8086 pin is used to enable even-bank memory? (3)

Section B

2. (a) Differentiate between the following instructions :

(i) DAA and AAA

(ii) MUL and IMUL (5)

(b) What is 8237 DMA controller? Discuss t three software commands used to control operation.

(c) Give the functions of the following pins 8086 :

(i) NMI

(ii) READY

(iii) INTR

(iv) ALE

(v) TEST (5)

3. (a) What is the purpose of a segment register in the real mode operation of the microprocessor? Determine the memory location addressed by the following real mode 80286 register combinations:

(i) SS = 2300H and BP = 3200H

(ii) DS = A000H and BX = 1000H (5)

(b) Explain the following instructions : **(any two)**

(i) MOVS

(ii) LAHF

(iii) ROL (5)

(c) Differentiate between the architectures of Pentium and Pentium-pro microprocessor. (5)

4. (a) What are the steps followed whenever a software interrupt instruction executes? (5)

(b) Explain register indirect addressing mode with the help of an example. Also, explain the following instructions :

(i) MOV [BP], DL

(ii) MOV [DI], [BX] (5)

(c) Why is demultiplexing of buses required in 8086? How is demultiplexing done using ALE pin? Explain. (5)

5. (a) Draw and explain the Read Bus Cycle for 8086, 8088 microprocessor. (5)

(b) Explain PUSH and POP operations with respect to Stack addressing mode. What values appear in SP and SS if the stack is addressed at memory location 02200H? (5)

(c) Describe any two Operation Command Words (OCW) for 8259A Programmable Interrupt Controller. (5)

6. (a) Select the correct instruction to perform each of the following tasks : (5)

(i) Shift DI right three places, with zeros moved into the leftmost bit

(ii) Rotate all the bits of AL left three places

(iii) OR DX with SI and save the result in SI

(iv) Subtract BX from CX

(v) XOR the data stored 30 words after the location addressed by BP with DI and save the result in DI

(b) List the different pins in Minimum mode and Maximum mode operation of 8086/8088 microprocessors. (5)

(c) Draw a descriptor that describes a memory segment that begins at location 03000000H and ends at location 05FFFFFFH. This memory segment is a data segment that grows upward in the memory system and can be written. The descriptor is for a Pentium 4 microprocessor. (5)

7. (a) Consider a memory device, 256K x 8 DRAM:

(i) Specify the number of data pins, address pins, selection pins and control pins of the given memory device.

(ii) Explain diagrammatically how address pins are demultiplexed in the given memory device? (5)

(b) List and explain any three conditional jump instructions which follow the comparison of unsigned numbers. (5)

(c) What is the purpose of the Direction Flag? Write arithmetic instructions to set and reset this flag. (5)

(15)

[This question paper contains 8 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 4548 **G**

Unique Paper Code : 32347504

Name of the Paper : Microprocessor

Name of the Course : **B.Sc. (H) Computer Science : DSE**

Semester : V

Duration : 3 Hours Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt all questions from **Section-A**.
3. Attempt any **four** questions from **Section-B**.
4. Attempt all parts of a question together.

SECTION A

1. (a) Consider the segment and offset addressing scheme. Find the unknown values for each of the following physical addresses :

(i) F000H : ABCDH = ?

(ii) ? : FFFFH = D0FFFH

(b) What are the default segment registers assigne to DI and BP registers? (2

(c) In 8086 microprocessor, in which memory bani odd addresses are stored? Which 8086 pin is usec to enable this bank of memory? (3)

(d) Why the demultiplexing of the buses (address and data bus) are required on 8086/8088 microprocessor? Why not leave the buses multiplexed? (3)

(e) What is the purpose of Auxiliary carry flag bit? Name the arithmetic operations that set this flag bit. (3)

(f) Given DS = 1211H, SS=1000H, BX = 0140H, DI = 3000H, ARRAY = 1110H. Determine the

data addressing mode and the effective address for each of the following instructions assuming real mode memory addressing :

(i) MOV BX, [2200H]

(ii) MOV CX, [BL+4]

(iii) MOV CX, [EBX+2*EDI]

(iv) MOV DX, [BP-100H] (4)

(g) Explain the four types of Bit Test instructions: BT, BTC, BTR, and BTS. (4)

(h) Explain following string instructions, with an example : (4)

(i) MOVSD

(ii) LODSW

(i) Develop a far procedure that copies contents the word sized memory location CS : DATA1 in AX,BX,CX,DX and SI.

(j) Name the Type of Interrupt for the followin cases :

(i) Two interrupts occur at the same time.

(ii) A logic 1 placed on NMI input pin of the microprocessor.

(iii) When an instruction mentions an invalid opcode?

(iv) When the overflow condition exists?

(v) The protected mode P bit (P = 0) in a descriptor indicates that the segment is not present or not valid.

SECTION B

2. (a) Draw the descriptor format of 80386 microprocessor and explain. (5)

(b) Given the contents of sources as TEMP = 01H, BX = 0011H, EAX = 09876543H; find the content of destination register after executing each of the following commands : (5)

(i) MOVZX EBX, TEMP

(ii) MOVSX CX, BL

(iii) BSWAP EAX

(iv) MOV ECX, 44H

(v) XCHG AX, BX

3. (a) Explain the function of the following pins of 8086 microprocessor. (4)

(i) ALE

(ii) $DT/\overline{R}$

(iii) $M/\overline{IO}$

(iv) $\overline{TEST}$

(b) How does the CALL instruction differ from th JMP instruction? Explain the working of Far JM instructions using an example. (6

4. (a) Design a decoder circuit to map F0000H-FFFFF on 8K × 8 memory. (4

(b) Explain the following Data addressing mode with an example

(i) Base-plus-index addressing

(ii) Scaled-index addressing (6)

5. (a) List any four conditional jump instructions which follow the comparison of unsigned numbers. (4)

(b) Explain operation of the 8255 programmable peripheral interface. (6)

6. (a) Draw and explain the format of Command Register of DMA Controller. (5)

(b) Describe the initialization control words (ICW's) of Programmable Interrupt Controller 8259A. (5)

7. (a) Describe the operation of the following units of Pentium Pro microprocessors with the help of diagram :

(i) Retire Unit

(ii) Dispatch and Execute Unit (4)

(16)

[This question paper contains 12 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 886 **G**

Unique Paper Code : 2342571101

Name of the Paper : Programming Fundamentals Using C++

Name of the Course : **B. A. (Prog) & BSc (Non-Major)**

Semester : I

Duration : 3 Hours Maximum Marks : 90

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Section A is compulsory.
3. Attempt any four questions from Section B Parts of a question must be answered together.

Section A

1. (a) For the following statements state true or false: (3)

   (i) Return type of an overloaded function does not play any role in overload resolution.

   (ii) Constructors can be declared as private members of a class.

   (iii) The eof() function returns 0 if end-of-file condition is reached.

   (b) Write a program to declare an array of integers using dynamic declaration. Take input values from the user and store them in the array. Display the contents of the array. (3)

P.T.O.

(c) What would be the output produced on the execution of the following code segment: (3)

```
#include<iostream>
using namespace std;
int main()
{
    int x = 0;
    x = 400*400/400 ;
    cout<<"Value of x = "<<x<<endl;

    int atry[5] = {1,2,3,4,5};
    cout<<*(atry)<<"\t\t"<<*(atry + 1)<<endl;
    return 0;
}
```

(d) Identify the errors in the following C++ statements: (3)

```
i)   int mul(int a,b);
ii)  float code = "7.7";
iii) int b = 6;
      int  *p = b;
```

(e) What would be the output produced on the execution of the following code segments: (3)

```
i)   int i = 1;
     do
     {
        i++;
       cout<< "Value of  i = "<<i;
     }while(i>5);
```

ii)
```
for(int n=0 ; n<10 ; n++)
{
     if(n==4)
         continue;

     cout<<n<<endl;
}
```

iii)
```
int x = 12;
int y = 5;
cout<<(x>y);
```

(f) What is a destructor function? Can destructors be overloaded? (3)

(g) Write a function swap() to swap two numbers using reference variable (without using third variable). (3)

(h) Rewrite the following code using ternary operator. Additional variables can be declared if necessary. (3)

```
int main()
{
     int number ;
     cout<<"Enter an integer: " ;
     cin >> number ;
     if (number >= 40)
     {
         cout<<"Passed "<<endl;
      }
     else
     {
         cout<< "Failed: "<<endl;
     }
    return 0;
}
```

P.T.O.

(i) Identify the errors in the following code. Correct the code and give output produced upon the execution of the corrected code. (3)

i)
```
#include<iostream.h>
int main()
{
    int x = 80;
    int y& = x;
    x++;
    cout<<x;
   return 0;
}
```

ii)
```
cin>>x ;>>y;
```

(j) What would be the output produced on the execution of the following (3)

```
#include<iostream>
int main()
{
      int a[] = {1, 2, 3, 4, 5, 6} ;
      cout<<(1+3)[a]<<endl;
      cout<<a[0]<<endl;
      cout<<(a+1)[2]<<endl ;
      return 0 ;
}
```

Section - B

2. (a) Write a program in C++ to define a function `calc_volume ()` that returns the volume of a cylinder. Take `radius` and `height` of the cylinder as input from the user and send them as parameters to `calc volume ()` function. (Volume of cylinder= `3.14*radius* radius *height`) (5)

(b) State whether the following statements are true or false. (5)

(i) A function can return a value by reference.

(ii) Class members are `public` by default.

(iii) A class should have at least one constructor.

(iv) 'this' pointer points to the object that is currently used to invoke a function.

(v) `private` data members of parent class are not accessible to object of child class.

(c) What would be the output produced on the execution of the following code segment: (5)

```
#include<iostream>
using namespace std;

class inventory
{
      static int number;
      float cost;


    public:
      void getnumber()
        {
           cout<<"Number ="<<number<<endl;
        }

        void getdata(int a)
          {
               cost = a;
               number++;
          }
};

int inventory::number;

int main()
{
        inventory a, b;
        a.getnumber ();
        a.getdata(100);
        b.getdata(200);
        a.getnumber ();
        b.getnumber ();

        return 0;
}
```

P.T.O.

3. (a) What would be the output produced on the execution of the following code segment: (5)

```
include<iostream>
using namespace std;

class Base1
{
    public:
        Base1()
        {
            cout<<"I am in Base1 class\n";
        }
};

class Base2
{
    public:
        Base2()
        {
            cout<<"I am in Base2 class\n";
        }
};

class Derived: public Base1,public Base2
{
    public:
        Derived()
        {
            cout<<"I am in Derived class\n" ;
        }
};


int main()
{
    Derived d;
    return 0;
}
```

(b) Consider the following class: (5)

```
class Bank
{
   float balance;
   int account_number;

};
```

Add the following member functions to the class with their definitions:

(i) Add default constructor.

(ii) Add a parameterized constructor to initialize private data members of the class.

(iii) Add a function to deposit some amount in the bank account.

(iv) Define function `get_info()` to display `balance` and `account_number`.

Create an object of Bank class and call the above defined functions in the main() function.

(c) What are the different ways of declaring a string in C++? List any three built-in string functions available in C++ and the input and output parameters of each function. (5)

4. (a) Identify the errors (if any) in the following code. Correct the errors and give the output:

i)
```
int n = -1;
if(n + 1)
   cout<<"if clause";
else
   cout <<"else clause";
```

P.T.O.

ii)
```
class abc
{
  ~abc()
   {
    cout << "I love coding"<<endl;
   }
public:
     abc()
      {
       cout << "My idea of fun"<<endl;
      }
};

int main()
{
   abc obj;
}
```

(b) Write a program that accepts `name` and `marks` from the user and writes them to a text file `File1`. For example, if the name is 'Amit' and marks are 90, then the contents of the file should be: `Amit has scored 90 marks` (5)

(c) (i) Can constructors be declared in the `private` section of a `class`? Give reasons to support your answer. (5)

(ii) What would be the output produced on the execution of the following code segment:

```
#include <iostream>
using namespace std;
int main()
```

```
{
    int i, x[5], y, z[5];
    for(i = 0; i < 5; i++)
    {
        x[i] = i;
        z[i] = i + 3;
        y = z[i];
        x[i] = y++;
    }
    for(i = 0; i < 5; i++)
        cout << x[i] << "  ";
}
```

5. (a) Consider the following class definitions: (5)

```
class A
{
    int i;
    public:
            int j;
    protected:
            int c;
};
class B: protected A
{
    char d;
    public:
            B();
};
```

List the public, private and protected data members of class B.

(b) Write a program to take a string and a character value from the user. The program should check whether the character is present in the string or not and display appropriate messages. (5)

(c) What would be the output produced on the execution of the following code segment: (5)

10

```
#include <iostream>
using namespace std;

double division(int a, int b)
{
    if (b == 0)
    {
        throw "Division by zero exception!";
    }
    return (a / b);
}

int main()
{
    int x
    try
    {
        x = division(50, 5);
        cout<<x<<endl;
        x = division(50, 0);
     }
    catch(const char* msg)
    {
        cout<<msg<<endl;
    }

    return 0;
}
```

6. (a) What would be the output produced on the execution of the following code segment: (5)

```
#include<iostream>
template<class T>
T max(T x, T y)
{
   return(x>y ? x : y);
}

int main()
{
    int i = 5, j = 7, k;
    long l = 10, m = 25, n;
    k = max<int>(i,j);
    n = max<int>(l,m);
    cout<<"value of k ="<<k;
    cout<<"value of n="<<n;
    return 0;
}
```

(b) (i) Which header file is required to be included in a program for performing file input/output? (5)

(ii) Identify the error in the following program. Write the changes needed to correct the error.

```
#include <iostream>
using namespace std;
int main()
{
   try
   {
      throw 10;
    }
   catch (...)
   {
      cout<<"default exception \n";
   }
   catch (int param)
   {
      cout<<"integer exception \n";
   }

  return 0;
}
```

(c) What is polymorphism? Distinguish between early binding and late binding in the context of polymorphism. (5)

7. (a) What would be the output produced on the execution of the following code segment: (5)

```
#include<iostream>
using namespace std;
int main(){

    int x[5] = { 1, 2, 3, 4, 5 };
    int *p  =  x;
    int i;
    for (i = 0; i < 2; i++)
    {
        int temp = *(p + i);
        *(p) = *(p+4-i);
        *(p) = temp;
    }
    for (i = 0; i < 5; i++)
        cout<<x[i]<<" ";
    return 0;
}
```

(b) Create a class `teacher` having name and `qualification` as data members. (5)

Define member functions - `getdata()` and `put data ()`. The function getdata () assigns values to data members and putdata () displays the same.

Create an array of 10 objects of `teacher` type in function `main()`. Call member functions to display the data for all teachers.

(c) Write a program to compute the sum of terms of Fibonacci series up to `n` terms, taking `n` as input from the user. (5)

(1000)

(17)

[This question paper contains 8 printed pages.]

Your Roll No.....

G

Sr. No. of Question Paper : 906

Unique Paper Code : 2342571101

Name of the Paper : Programming Fundamentals Using C++

Name of the Course : **B. A. (Prog) & BSc (Non-Major)**

Semester : I

Duration : 3 Hours

Maximum Marks : 90

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. **Section A is compulsory.**
3. Attempt **any four** questions from **Section B** Parts of a question must be answered together.

Section A

1. (a) Differentiate between while and do..while loop giving suitable example for each. (3)

   (b) Assume the memory address of variable a is 400 and an integer variable is of size 4 bytes. Write the output that will be produced on the execution of the following code segment: (3)

```
int a = 7;
int *c = &a;
cout<<c<<endl;
cout<<c+1<<"\t"<<c+2<<"\t"<<endl;
```

P.T.O.

(c) Write the output that will be produced on the execution of the following code segment: (3)

```
int sum(int x, int y, int z = 0, int w = 0)
{
    return (x + y + z + w);
}
int main()
{
    cout << sum(10, 15)<<endl;
    cout << sum(10, 15, 25) <<endl;
    cout << sum(10, 15, 25, 30)<<endl;
    return 0;
}
```

(d) What is void pointer? What is the use of having void pointers? (3)

(e) Which header file is required to implement file input/output operations in C++? Mention the two ways of opening a file in C++? (3)

(f) List the different visibility modes used for declaring data members and member functions in a `class`? (3)

(g) Find errors, if any, in the following C++ statements: (3)

i) `ifstream.infile("DATA");`
ii) `cin>>a,b;`
iii) `int mul(int a,b);`

(h) Write the output of the following code segment assuming address of x is 2000 and address of p is 3000: (3)

```
int x = 2;
int *p;
p = &x;
cout << *p;
*p = 4;
 cout << p;
cout << *(&x);
```

(i) Differentiate between call by value and call by reference. (3)

(j) For the following statements state whether they are true or false: (3)

(i) Constructors can be declared as `private` members of the class.

(ii) Contructors can have default arguments.

(iii) Contructors can be used to return values from the function.

Section B

2. (a) What are the different types of inheritance? Give suitable diagrams depicting each. (5)

(b) Write an overloaded function `add ()` that does the following:

(i) Accepts two arguments as input

(ii) If the input arguments are integers the function returns their sum. Else, if the arguments are strings it returns a string formed by concatenating the two input strings. (5)

(c) State whether the following statements are true or false: (5)

(i) A function declared as `private` in a `class` is accessible only to member functions of that class.

(ii) Inheritance aids in data hiding.

(iii) `Virtual` functions are used to create pointers to base classes.

(iv) Class members are public by default.

(v) Static data members of a class can be initialized using an object of the class.

3. (a) Identify the error in the following program. Write the corrected code. (5)

```
#include <iostream>
Using namespace std;
class Room
{
     int width, height;
     public:
         void setValue(int w, int h)
         {
             width = w;
             height = h;
         }
}
int main()
{
    Room objRoom;
    objRoom.width = 12;
    objRoom.height = 15;
}
```

(b) Write an inline function for calculating volume of a cube. In which situations would an inline function not work? (5)

(c) Write a program to swap two values using function template. (5)

4. (a) Write the output produced on the execution of the following C++ statements: (5)

```
i) cout<<(30!=25)?10:20;
ii) cout<<55%9;
iii) cout<<(56<=100)||( 10>20&&5>=5);
iv) cout<<8+9*21-10/5;
v) x=5; y=x++;
   cout<<0==0?x:y ;
```

(b) Write a C++ code to display the following pattern on the screen taking number of lines as input from the user. (5)

```
A

BA

CBA

DCBA
```

(c) What is the difference between opening a file using (5)

(i) constructor function

(ii) file object

Give syntax of each of the above methods. Name the input stream and output stream used with files in C++.

5. (a) Define a `class bankAccount`. Include the following members: (5)

Data members

1. `name` of the depositor

2. `accountNumber`

3. `typeOfAccount`

4. `balanceAmount`

Member functions

1. Constructor to assign initial values to data members

2. `deposit ()` to modify balanceAmount

3. `display()` to print name and balance

Create an object of `bankAccount` in `main ()` and call the above mentioned member functions.

(b) What are the different types of errors? List the different types of exceptions in C++. (5)

(c) Write a program to store n numbers in an array. Display the largest number in the array. (Take n as input from user). (5)

6. (a) Write the output that will be produced on the execution of the following code segment: (5)

```
void main()
{
    int num[ ]={80,55,20,35,99};
    int *ptr;
    ptr = num;
    cout <<"\nValue of ptr : "<<*ptr << "\n";
    ptr++;
    cout<<"\nValue of ptr++ : "<<*ptr << "\n";
    ptr--;
    cout<<"\nValue of ptr-- : "<<*ptr << "\n";
    ptr+=3;
    cout<<"\nValue of ptr+3: "<<*ptr << "\n";
    ptr=ptr-1;
    cout <<"\nValue of ptr-1: "<<*ptr << "\n";
}
```

(b) Consider the following class definition. (5)

```
class One
{
    public:
        static int x;
};
```

Create an object of `class One`. Assign a value to variable x and display its value in `main()` function.

(c) Name the type of inheritance for `class B`, `class B`, `class C`, `class D` in the following code segment: (5)

```
class A {…};
class B: public A{…};
class C: public B{…};
class D: public B, public A{…};
```

7. (a) Write a program to write the following statements in the file" File1": (5)

```
"Together we may learn."
"May our learning be bright and luminous."
```

Print the contents of `"File1"`.

(b) Write the output that will be produced on the execution of the following code segment: (5)

i)

```
for (int i=1; i<4; i++)
{
    for (int j=1; j<=i; j++)
    cout << j << " ";
    cout << "\n";
}
```

ii)

```
void increment( )
{
     static int i  ;
     cout<< i  <<endl;
     i = i + 1 ;
}
int main( )
{
    increment( );
    increment( );
    increment( );
 }
```

(c) Write a program to print the sum of the following series: (5)

$1+1/2^2+ 1/3^3+1/4^4+ \ldots +1/n^n$

Take n as input from the user.

(1000)

(18)

[This question paper contains 12 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 974 **G**

Unique Paper Code : 2342201102

Name of the Paper : A1 – Programming Fundamentals using Python

Name of the Course : **B.A. Program**

Semester : I

Duration : 3 Hours Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. **Section A** is compulsory.
3. Attempt **any four** questions from **Section B**.
4. Parts of a question must be answered together.

Section A

(Compulsory)

1. (a) List one similarity and one difference between List and Dictionary data type. (2)

(b) What will be the output of the following code? (2)

```
a = [1, 2, 3, 4, 5, 6, 7, 8, 9]
print (a [ :5])
```

(c) What are mutable and immutable data types in python? Write two examples of each. (3)

(d) What is the value of sum after the execution of the following code? (2)

```
sum = 0
for i in range (0,18,3):
    if i%6 == 0:
        sum = sum + 1
print(sum)
```

(e) Indicate the error (if any) in the given statement (2)

```
str = "Hello Python"
str[5] = "T"
```

(f) Explain the use of following strings module functions briefly : (3)

(i) isalpha()

(ii) swapcase()

(iii) split ()

(g) Draw a flowchart to find the sum of the first 10 natural numbers. (3)

(h) Write and explain any 4 data types used in python with suitable examples of each. (4)

(i) Write the output of the following statements: (5)

(i)
```
name = "Kavita"
print("hello", name, "2+2 is", 2+2)
```

(ii)
```
print(max(59, 80, 95.6, 33))
```

(iii)
```
print(min ("hello", "how", "are", "you", "Sir"))
```

(iv)
```
print("978" + "34")
```

(v)
```
print((eval("93 + 8")))
```

(j) What do you understand about Syntax errors and Semantics errors? Explain these with suitable examples. (4)

Section – B

2. (a) Perform the following operations on the list given below and write the output of each. (4)

list1 = ["Red", "Green"]

list2 = [10, 20, 30]

(i) list2 * 2

(ii) print(list1+["Blue"])

(iii) len(list1)

(iv) list2[-1]

(v) list2[0:2]

(vi) min(list2)

(vii) sum(list2)

(viii) 40 in list2

(b) Write a python program to calculate the area of a rectangle, sides of the rectangle should be entered by the user using the built-in input function. Also, validate user entered data before calculating the area. (5)

(c) Rewrite the following code segment using while loop (6)

(i)
```
total = 0
for count in range (1, 21) :
    total +=count
print(total)
```

(ii)
```
import math
total = 0
for count in range(1,11,3):
    total += math.pow(count, 2)
print(total)
```

3. (a) Give the output of the following code segments: (6)

(i) total = 0

```
count = 20
while count > 5:
    total += count
    count -= 1
print(total)
```

(ii) i = 20

```
if(i == 10):
    print(" The value of i is 10 ")
elif(i==15):
    print(" The value of i is 15 ")
elif(i==20):
    print(" The value of i is 20 ")
else:
    print(" i is not present ")
```

(iii) sum = 0

```
for i in range (0,18,3):
    if i%6 == 0:
        sum= sum + 1
print(sum)
```

(b) A dictionary named 'Grades' is created as

Grades = {"Sahil":90, "Abhijeet":65, "Garima": 38}

What do the following statements do? (6)

(i) print(Grades.keys())

(ii) print(Grades.values())

(iii) print(len(Grades))

(iv) Grades ["Kuruss"] = 99)

(v) print (Grades.items())

(c) What is the use of the format() function? Explain with the help of suitable examples. (3)

4. (a) Differentiate between "continue", "pass" and "break" statements in python with suitable examples of each. (3+3)

Write the output of the following code segment

```
for letter in "statement":
    if letter == "m":
        continue
    print("Current letter:", letter)
```

(b) Write a function Printdict() that prints a dictionary where the keys are numbers between 1 and 5 and the values are cubes of the keys. (5)

(c) Show the output of the following code. (4)

S1 = {"A","B","C"}

S2 = {"C","D","E"}

(i) print(S1.union(S2))

(ii) print(S1.intersection(S2))

(iii) print (S1.difference(S2))

(iv) print (S1.symmetric_dif ference(S2))

5. (a) Write a Python function smallerXY(X, Y) that accept two integers X and Y and returns the smaller of two. Write another function smallerXYZ (X, Y, Z) that uses the function smallerXY to find a minimum of three numbers X, Y, Z. (5)

(b) What do you mean by the scope of a variable? Differentiate between local and global scope of variables with suitable examples of each. (5)

(c) Evaluate the following expressions involving arithmetic operators : (5)

(i) $-7 * 20 + 8 / 16 * 2 + 54$

(ii) $7 ** 2 // 9 \% 3$

(iii) $(7 - 4 * 2) * 10 / 5 ** 2 + 15$

(iv) $5 \% 10 + 10 - 25 * 8 // 5$

(v) 'hello' * 2 – 5

6. (a) Write a Program to Prompt for a Score between 50 and 100. If the Score is out of range, raise an appropriate exception. If the score is between 50 and 100, print a grade using the table given below. (8)

Score	Grade
>=90	"A"
>= 80	"B"
>=70	"C"
>=60	"D"
<60	"E"

(b) Write the output of the following functions on the given string : (7)

s= " This is an online Gaming Platform"

print(s.lower())

print(s.count("i"))

print(s.find("o"))

print(s.rfind("o"))

print(s.split("an"))

print(s.swapcase())

print(s.capitalize())

7. (a) Evaluate the following expressions : (5)

(i)
```
d=dict()
for x in range (1,10+1):
    d[x]=x**2
print(d)
```

(ii)
```
a = (24 ** 2 // 4 % 25 / 19 * 8)
b = (4 << 8 >> 2)
print(a)
print(b)
```

(iii)
```
t1 = (42, 36, 50)
t1= t1 + (18, 23, 5)
print(t1)
```

(iv)
```
print (4.00 / (2.0 + 2.0))
```

(v)
```
x = 2+9* ((3*12) - 8) / 10
print(x)
```

(b) Write a Python function fact(n) that returns the factorial of a number (e.g.: Factorial of number 5, is 5! where 5! = 5*4*3*2*1 i.e., 120). Take n as input from the user. (5)

(c) Write a program to calculate the area of a circle using the formula : (5)

Area of Circle = pi * $(r)^2$; use math.pi to calculate the area of the circle.

(19)

[This question paper contains 8 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 821 **G**

Unique Paper Code : 2342572301

Name of the Paper : Computer System Architecture

Name of the Course : **B.A. (Prog.) / Computer Science**

Semester : III

Duration : 3 Hours Maximum Marks : 90

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Question No. **1** in **Section-A** is compulsory.
3. Attempt any **4** questions from among questions **2** to **7** in **Section-B**.
4. Parts of a question must be answered together.

Section–A

1. (a) Demonstrate the validity of the following identities by means of truth tables :

$$x + y.z = (x + y).(x + z) \quad (3)$$

(b) Perform the following conversions :

(i) $(218.39)_9$ to $(\_)_{10}$

(ii) $(234)_{10}$ to $(\_)_{12}$

(3

(c) How can you obtain a T flip-flop from JK flip-flop? Demonstrate using block diagram. (3)

(d) The state of a 12-bit register is 100010110111. What is its content if it represents :

(i) The decimal digits in BCD representation

(ii) The decimal digits in Binary coded octal representation

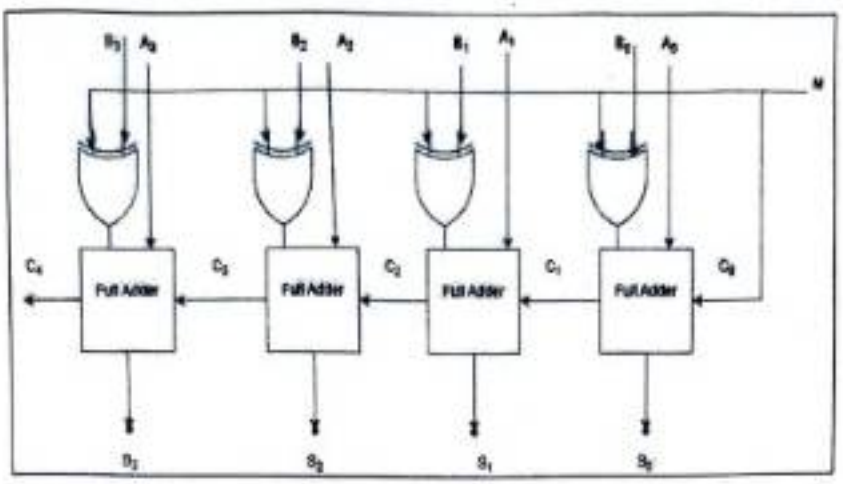
(iii) The decimal digits in Binary coded hexadecimal representation (3)

(e) Simplify the following Boolean expression to minimum number of literals using Boolean algebra :

$(BC' + A'D)(AB' + CD')$ (3)

(f) The binary adder-subtractor circuit has the following values for the input-mode M and the data input A and B. Determine the values of the outputs S_3, S_2, S_1, S_0, and the carries generated i.e. C_4, and C_0.

$M = 1$, $A = 1011$, $B = 0101$ (3)



(g) Explain auto-decrement addressing mode with examples. (3)

(h) Explain the "branch and save return address" operation with the help of a memory diagram. (3)

(i) Explain the importance of following condition bits:

(i) FGO-flag

(ii) E-flag

(iii) I-flag (3)

(j) Differentiate between half adder and full adder with the help of an example. (3)

Section–B

2. (a) Simplify the following Boolean expression in sum-of-product (SOP) using K-map form and draw the logic diagram of the simplified expression.

$(A' + C)(A' + C')(A+B+C'D)$ (4

(b) Describe what happens during an interrupt cycl with the help of memory diagram? Also Write th micro-instructions for the interrupt cycle. (5

(c) A combinational circuit is specified by the followin three Boolean functions :

$F_1(A, B, C) = \Sigma(3, 5, 6)$

$F_2(A, B, C) = \Sigma(1, 4)$

$F_3(A, B, C) = \Sigma(2, 3, 5, 6, 7)$

Construct the truth table for the above-mentioned circuit and implement the circuit with a decoder constructed with NAND gates. (6)

3. (a) Differentiate between combinational and sequential circuits and give two examples of each. (2+2)

(b) Perform the following arithmetic operations with binary numbers in signed 2's complement representation. Use 8-bit to accommodate each operand along with its sign. Identify in each case, if this operation results in overflow or not.

(i) (−75) + (−45)

(ii) (−75) + (+45) (2+3)

(c) Write the micro-instructions for the execute sequence of following machine instructions:

(i) Indirect mode STORE

(ii) Direct mode ISZ

(iii) Indirect mode BUN (6)

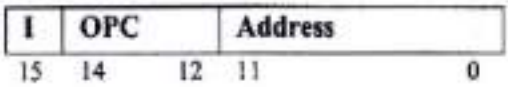
4. (a) What is meant by bus request and bus grant with respect to direct memory access? (2)

(b) (i) Perform subtraction on the given unsigned numbers using the 10's complement of the subtrahend :

6428 – 3409

(ii) Construct the characteristic table for SR flip-flop. (3+2)

(c) The initial content of PC is 120. The content of memory at 120 is C1A0. The content of the memory at 1A0 is 0250. The content of memory at address 250 is 0134. Assuming the instruction has the format as mentioned below :



And 3-bit opcode for BUN is $(100)_2$ and BSA is $(101)_2$.

(i) Specify the instruction that will be execu next and the addressing mode to be us

(ii) Specify the micro-instruction to be execu sequentially for the fetch and execu sequence for the given instruction

(iii) Show the contents in hexadecimal registers PC, AR, DR, IR, and SC of t basic computer.

Give the answer in a table with 6-columns. Colum 1 must contain the micro-instructions (response part ii). Column 2-6 must display the contents f each register and a row for each timing signa Show the content of registers after the positiv transition of each clock-pulse. (8

5. (a) Explain Index-register addressing mode with th help of an example. Also specify when/ where i it used. (4

(b) Assuming the given data stored in 8-bit register Perform the following operations and represen the result obtained in hexadecimal :

$A = (7C)_{16}$, $B = (65)_{16}$

(i) A (AND) B

(ii) A (XOR) B

(iii) 2's complement of B

(iv) A – B

(v) Circular Shift right 2 times A. (5)

(c) A computer uses a memory unit of 64M words of 36-bits each. A binary instruction code is stored in one word of the memory. The instruction has four parts :

(i) An addressing mode field to specify one of the four-addressing modes,

(ii) Operation code,

(iii) A register code part to specify one of the 14 registers and an address part.

How many bits are there in addressing mode part, opcode part, register code part, and the address part? Draw the instruction format, clearly specifying the indexes and the number of bits for each part. (6)

6. (a) Represent $(-84)_{10}$ in 10 bits register using following representation :

(i) Sign-magnitude representation

(ii) 1's complement Representation

(iii) 2's complement representation. (4)

(b) How many address lines, data input lines and data output lines are present in a memory unit represented by 4096×16? How many 256×8 memory chips are needed to provide a memory capacity of 4096×16? (5)

(c) A two-word instruction is stored at location 500 with its address field at location 501. The address field has the content as 600. The content of memory word at address 600 is 650. A processor register R1 contains the number 300. Evaluate the effective address if the addressing mode of the instruction is

(i) Immediate (ii) Direct

(iii) Indirect (iv) Relative

(v) Register-indirect

(vi) Indexed with R1 as the index-register.

(6)

7. (a) Draw the flowchart for the execute sequence of all memory reference instructions along with the control conditions. (6)

(b) Write short notes **(any three)** :

(i) Memory mapped I/O

(ii) ISZ instruction

(iii) Register reference Instructions

(iv) Octal to decimal decoder (9)

(20)

[This question paper contains 8 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 841 **G**

Unique Paper Code : 2342572301

Name of the Paper : Computer System Architecture

Name of the Course : **B.A. (Prog.) Computer Science**

Semester : III

Duration : 3 Hours Maximum Marks : 90

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Question No. **1** in **Section-A** is compulsory.
3. Attempt any **4** questions from among questions **2** to **7** in **Section-B**.
4. Parts of a question must be answered together.

Section-A

1. (a) Give two instructions required to set E=1 in basic computer. (2)

P.T.O.

(b) State and prove associative law on the following expression using truth table.

$AB + B'C + A'C$ (3)

(c) Which addressing mode is used to implement register-reference instructions. Justify your answer. (3)

(d) Show the representation of +8 and –7 in : (3)

(i) Signed Magnitude Representation

(ii) Signed 1's complement representation

(iii) Signed 2's complement representation

(e) Explain how ROM is different from RAM and give its applications. (3)

(f) The 8-bit registers AR, BR, CR, and DR initially have the following values: (4)

AR = 11110010

BR = 11111111

CR = 10111001

DR = 11101010

Determine the 8-bit values in each register after the execution of the following sequence of microoperations.

CR ← CR^DR, BR←BR+1 AND DR to CR, increment BR

AR ← AR–CR Subtract CR from AR

(g) Implement OR and AND gates using only NAND gates. (4)

(h) Give reason why : (4)

(i) SC ← 0 is written at the end of execute sequence of all instructions.

(ii) IR ← M[PC] is not valid.

(i) Draw the diagram representing the I/O buses and Interface-modules. (4)

Section-B

2. (a) Given the Boolean function (10)

$F = xyz' + xy'z + x'y'z'$

(i) List the truth table of the function.

(ii) Draw the logic diagram using the original Boolean expression.

(iii) Simplify the algebraic expression using Boolean algebra.

(iv) List the truth table of the function from the simplified expression and show that it is same as the truth table in part i.

(v) Draw the logic diagram from the simplified expression and compare the total number of gates with the diagram of part ii.

(b) Simplify the Boolean function F together with don't care conditions d in sum of products (SOP) form. Also draw the logic diagram of the simplified expression.

$F(w,x,y,z) = \Sigma(1, 2, 5, 7, 8, 10)$

$d(w,x,y,z) = \Sigma(3, 6, 11, 15)$ (5)

3. (a) The memory unit is specified by the number of words times the number of bits per word. How many address lines and input-output data lines are needed for 8 M X 32 memory unit? Also draw its diagram. (5)

(b) Explain the designing of a 2-to-4-line decoder implemented using NAND gates. (6)

(c) Explain 4-bit binary adder using the logic diagram. (4)

4. (a) Write the micro-operations for implementing the following memory reference instructions of basic computer.

(i) Direct STA

(ii) Indirect BUN

(iii) Direct ISZ (6)

(b) The content of PC in the basic computer is 2A8 (all numbers are in hexadecimal). The content of AC is 7E02. The content of memory at address 2A8 is 935C. The content of memory at address 35C is 07AB. The content of memory at address 7AB is 219 A. (9)

(i) What is the instruction that will be fetched and executed next?

(ii) Show the binary operation that will be performed in the AC when the instruction is executed.

(iii) Go over the instruction cycle to perform the above operation and give the content of registers PC, AC, AR, DR, IR, I at the end of execute cycle.

5. (a) Covert the following decimal numbers to the base indicated. (2+2+2)

(i) 7562 to octal

(ii) 1938 to hexadecimal

(iii) 175 to binary

(b) Write the formula to find the (r–1)'s complement. Find the 7's complement of $(2345)_8$. (3)

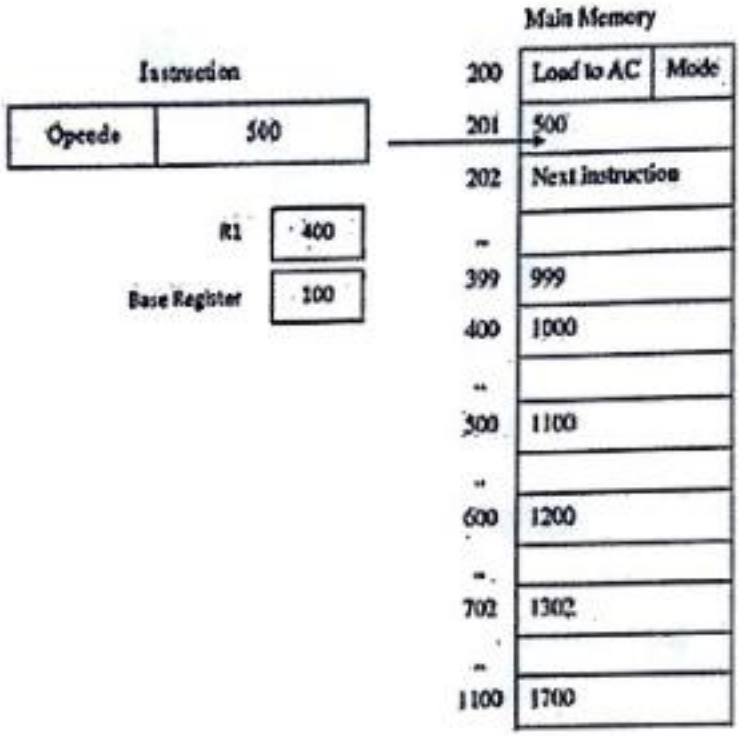
(c) Perform the following arithmetic operations using 7-bit registers and detect the overflow, if any :

(+42) + (+33) and (–42) –(+33)

Use signed 2's complement representation for negative numbers. (6)

6. (a) A two-word instruction to perform the load operation is stored in memory at an address 200 as represented in the memory map given below.

The address field of the instruction is stored at address 201. The mode field specifies an addressing mode. R1 is the general purpose register, which has the value of 400. Base register contains the value 100.



Determine the effective address and the operand to be loaded for the following address modes :

(i) Direct

(ii) Immediate

(iii) Indirect

P. T. O.

(iv) Relative

(v) Base register Addressing

(vi) Register indirect addressing (12)

(b) Demonstrate how interrupt is handled by drawing the memory diagram before and after the execution of an interrupt. (3)

7. (a) Differentiate between (attempt any **two**) :

(i) Programmed I/O and Interrupt driven I/O techniques

(iii) Main memory and Auxiliary memory

(iii) Isolated vs Memory mapped I/O (6)

(b) Explain data transfer from I/O device to CPU in programmed I/O with the help of suitable diagram and flow chart. (9)

(21)

[This question paper contains 8 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 936 **G**

Unique Paper Code : 2342202302

Name of the Paper : Data Mining – I

Name of the Course : **B.A. Programme**

Semester : III

Duration : 3 Hours Maximum Marks : 90

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. **Section A** is compulsory.
3. Attempt any **four** questions from **Section B**.
4. Parts of a question must be answered together.
5. Use of scientific calculator is allowed.

P.T.O.

Section A

1. (a) Why is k-nearest neighbour algorithm called as a lazy learner? (2)

(b) In a dataset it is found that an itemset {ab} is infrequent. Will the itemset {abc} be infrequent or frequent? Give reason. (2)

(c) Write the formula for calculating Euclidean distance. Calculate the Euclidean distance between the two points P1(3, 4, 2) and P2(4, 7, 4). (3)

(d) Convert the given categorical attribute X with possible values {RED, GREEN, BLUE, YELLOW, PINK, WHITE} into asymmetric binary attributes. (3)

(e) Describe any two feature subset selection approaches. (4)

(f) Determine the type of attribute for the following : (5)

(i) Height of students in a class

(ii) Date of joining of employees

(iii) Color of cars

(iv) Grades of the students

(v) Gender of people

(g) Consider the attribute X with values {2, 2, 3, 2, 4, 3, 2, 5, 4}. Compute mean, median, mode, range and variance. (5)

(h) What is meant by standardization? Write its formula. In a dataset, the mean and standard deviation of the variable 'age' is 22 and 3 respectively. Standardize the value of age = 32.5. (6)

Section B

2. (a) Based on the dataset given below, classify a new instance with x1 = 2 and x2 = 5 as positive or negative using k-Nearest Neighbour technique for k = 5. Use the distance function as Euclidean distance. (10)

x1	x2	Y
2	3	-
5	7	+
6	6	+
1	2	-
7	5	+
1	4	-
4	1	-
7	3	+

(b) Briefly describe the process of knowledge discovery in databases. (5)

3. (a) How does underfitting and overfitting affect a model's generalization capability? Describe one measure to address each. (5)

(b) Using K-Means clustering technique, cluster the given dataset into 2 groups. Compute the new cluster centres after two iterations of K-Means algorithm. Which records will belong to these clusters? Calculate the sum of squared error (SSE) at the end of each iteration. Use (1, 1) and (5, 7) as initial centroids and Euclidean distance as distance metric. (10

Record No.	A	B
R1	1	1
R2	2	2
R3	3	3
R4	5	7
R5	3	5

4. (a) Identify the type of data mining task for each of the tasks given below : (5)

(i) Projecting the sales volumes for the next quarter using historical data.

(ii) Identifying relationships between items that are frequently purchased together in a supermarket.

(iii) Finding different customer groups for targeted marketing strategies.

(iv) Identifying fraudulent credit card transactions.

(v) Estimating amount of rainfall over next few days.

(b) Consider the given dataset for determining whether a person will buy a car or not based on his income, marital status and gender. (10)

(i) Calculate the overall Gini Index.

(ii) Determine the attribute that will be selected as root of the decision tree according to the Gini Index.

Income (x1)	MaritalStatus (x2)	Gender (x3)	BuyCar (y)
Low	Yes	MALE	No
Medium	Yes	FEMALE	Yes
High	Yes	FEMALE	Yes
Low	No	MALE	No
Medium	No	FEMALE	No
High	No	MALE	Yes
Low	Yes	MALE	Yes
Medium	Yes	FEMALE	No
Medium	No	MALE	Yes
High	No	MALE	No

5. (a) State two assumptions of Naive Bayes classifier. Using Naive Bayes 10 classification algorithm, estimate the class label Y for a new instance with values x1 = BLUE, x2 = LARGE and x3 = FULL for the dataset given below. Calculate all the prior and posterior probabilities. (10)

X1	X2	X3	Y
BLUE	LARGE	FULL	YES
RED	SMALL	HALF	YES
BLUE	SMALL	FULL	NO
RED	LARGE	HALF	NO
RED	LARGE	FULL	YES
BLUE	SMALL	HALF	NO
BLUE	SMALL	HALF	YES
RED	LARGE	FULL	YES

936

(b) What is dimensionality reduction? Why is it used? (5)

6. (a) Explain the process of rule generation in association rule mining. Consider the given dataset and answer the following : (10)

(i) Compute all frequent item sets of size one and two, considering 1/3 as the minimum support.

(ii) Generate association rules using frequent two item sets with a minimum confidence of 60%.

Transaction	Items
T1	A, B, C
T2	A, B
T3	B, C
T4	A, C
T5	B

(b) Differentiate between random sampling and stratified random sampling. Give one example of each. (5)

7. (a) Briefly describe the potential problems in data collection. (5)

(b) Differentiate between supervised and unsupervised techniques. Give examples for both. (5)

(c) Consider the given confusion matrix given below and compute the following : (5)

		Actual Values	
		True	**False**
Predicted Values	**True**	10	11
	False	4	20

(i) Number of false positives

(ii) Number of true negatives

(iii) Accuracy

(iv) Precision

(v) Recall

(22)

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 1304 **G**

Unique Paper Code : 6202452301

Name of the Paper : Data Structures

Name of the Course : **Bachelors of Vocation ((Software Development) IT/ITES)**

Semester : III

Duration : 3 Hours Maximum Marks : 90

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. This paper has **two** sections: **Section A** is compulsory.
3. Attempt any **four** questions from **Section B.**

Section A

1. Write short notes on the following :

   (i) Binary search tree

   (ii) Circular linked list

P.T.O.

(iii) Binary trees

(iv) Stack and its features

(v) Queue

(vi) B+ tree

(vii) Linear and non-linear data structures

(viii) Complete and almost complete binary tree

(ix) Hashing

(x) Bubble and insertion sort (3*10)

Section B

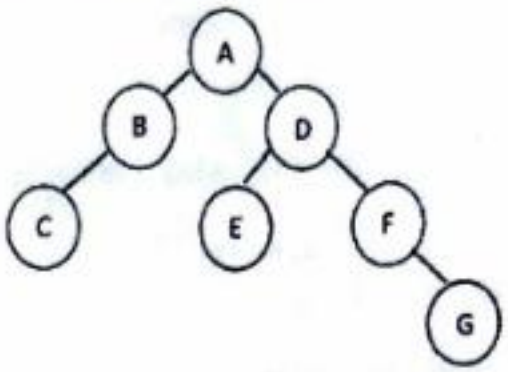
2. (a) What is a linked list? Illustrate its advantages and disadvantages. (3)

(b) Write an algorithm to insert a node at the beginning and end of a singly linked list. (6)

(c) Write an algorithm to delete a node from the end and any specific position from a circular linked list. (6)

3. (a) What are the advantages of complete binary tree? Explain the operations of complete binary tree with suitable examples. (5)

(b) Determine the sequential representation of the following binary tree using an array: (5)



(c) Write an appropriate algorithm for the recursive tower of Hanoi problem (for more than one disk in the system). (5)

4. (a) Evaluate the following postfix expression :

Q: 5 6 2 + * 12 4 / - (5)

(b) Convert the following arithmetic expression using stack :

(i) from infix to postfix

Q: A * (B + D) / E - F * (G + H / K) (5)

(ii) from infix to prefix

Q: (D - C) * (B - A) (5)

5. (a) Construct a binary search tree with the following elements :

100, 90, 110, 120, 70, 65, 73, 89, 130, 125, 135, 127, 140, 98, 85, 75, 115

Then delete the elements 120 and 70 from the constructed binary tree. (7)

(b) Consider the following elements :

5, 12, 14, 1, 2, 4, 18, 19, 17, 15, 25, 24, 22, 11, 30, 31, 28, 29, 13

Insert these elements into an empty binary tree of order 5. (8)

6. (a) Write an algorithm to determine the factorial of any number using recursion in any programming language. (7)

(b) What is the difference between singly and doubly linked list. Write the algorithm to delete a node at any position from the doubly linked list. (8)

7. (a) Differentiate between max-heap and min heap. Construct a min heap H using the following data :

40, 60, 30, 10, 20, 50

Show heap after each insertion. (8)

(b) In the hash table of size m=10 insert the keys 43, 135, 72, 23, 99, 19, 82 using linear probing. (7)

(23)

[This question paper contains 8 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 1753 **G**

Unique Paper Code : 2342572301

Name of the Paper : Computer System Architecture

Name of the Course : **B.Sc. (Prog.)**

Semester : III

Duration : 3 Hours Maximum Marks : 90

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Question No. **1** in **Section-A** is compulsory.
3. Attempt any **4** questions from among questions **2** to **7** in **Section-B**.
4. Parts of a question must be answered together.

Section-A

1. (a) State associative law. Prove or disprove algebraically if associative law holds for NOR operation or not. (3)

P.T.O.

(b) List the truth table of the function :

$F = x'yz + xy' + x'y$ (3)

(c) What do you understand by edge-triggered circuits? List the characteristic tables for SR flip-flop and T- flip-flop. (3)

(d) Subtract 10001 from 10011 using 2's complement. (3)

(e) Represent $(-48)_{10}$ using following representation:

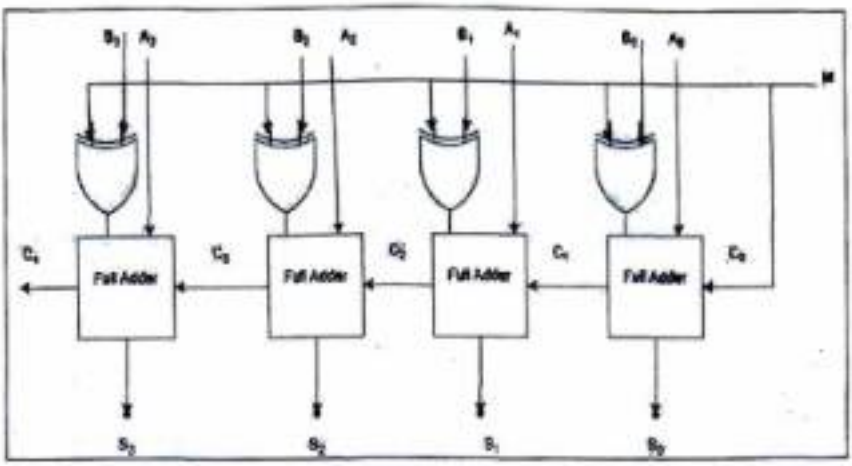
(i) Sign-magnitude representation

(ii) 1's complement Representation

(iii) 2's complement representation. (3)

(f) The binary adder-subtractor circuit has the following values for the input-mode M and the data input A and B. Determine the values of the outputs S_3, S_2, S_1, S_0, and the carries generated i.e. C_4, and C_0. (3)

M = 0, A = 1100, B = 1101



(g) Identify the addressing mode that facilitates :

(i) Program relocation

(ii) The implementation of pointers to memory

(iii) Indexing of data (3)

(h) Write the micro-instructions for the complete instruction cycle (from time signal T_0 onwards) for the BUN (Indirect mode) machine instruction along with control conditions. (3)

(i) Explain the importance of following condition bits:

(i) IEN-flag

(ii) R-flag

(iii) O-flag (3)

(j) Draw the flowchart for the CPU program to input data. (3)

P.T.O.

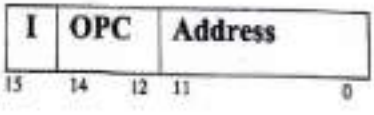
Section-B

2. (a) Simplify the following Boolean function F using a 4-variable K-Map and draw the logic diagram of the simplified function using NAND and inverter gates only.

$F(A, B, C, D) = \Sigma (1,3,4,5,10,11,12,13,14,15)$ (4)

(b) Design a 3-bit combinational circuit-2's complementor. The output generates the 2's complement of the input binary number. (5)

(c) What is meant by fetch sequence? Consider the instruction that can be accommodated in one word of 4096 × 16 size memory. The Instruction has the format as mentioned below :



Write the micro-instructions for the fetch sequence of the instructions having the above-mentioned instruction format. (6)

3. (a) How many half adders and OR gates are required to implement a full adder? Explain and justify with

the help of a diagram. (2+2)

(b) (i) Determine the base of the number for the following operation to be correct:

$$24 + 17 = 40$$

(ii) Perform the arithmetic operation (+85) + (+35) with binary numbers in signed 2's complement representation. Use 8-bit to accommodate each operand along with its sign. Identify, if this operation results in overflow or not. (2+3)

(c) Explain the Interrupt cycle with the help of a flowchart. (6)

4. (a) Perform the following conversions : (4)

(i) $(198.46)_{12}$ to $(\_)_{10}$

(ii) $(234)_{10}$ to Binary, Hexadecimal and Octal.

(b) Describe the functioning of a 4-bit binary-incrementer with the help of diagram. (5)

(c) The initial content of PC is 7FF. The content of memory at 7FF is EA9F. The content of the memory at A9F is 0C35. The content of memory at address C35 is FFFF. Assuming an ISZ indirect is to be fetched from memory and executed.

(i) Specify the micro-instruction to be executed at each timing signal.

(ii) Show the contents in hexadecimal of registers PC, AR, DR, IR, and SC of the basic computer.

Give the answer in a table with 6-columns. Column-1 must contain the micro-instructions. Column 2-6 must display the contents for each register and a row for each timing signal. Show the content of registers after the positive transition of each clock-pulse. (6)

5. (a) (i) How many 32K × 8 RAM chips are needed to provide a memory capacity of 256K bytes?

(ii) How many lines of the address must be used to access 256K bytes? (4)

(b) (i) The content of a 4-bit register is initially 1011. The register is shifted 3 times to the right with the serial input being 10110. Show the content of the register after each shift.

(ii) Write the formula to find the r's complement where r represent the base of the number. Also find the 5's complement of $(234)_5$. (3+2)

(c) What is the difference between isolated I/O and memory mapped I/O? What are the advantages and disadvantages of each? (6)

6. (a) What is meant by register addressing mode? Explain the benefits of using this addressing mode. (4)

(b) Find the complement of F = wx + yz; then show that

F . F' = 0 and

F + F' = 1. (5)

(c) A two-word instruction is stored in memory at an address designated by the symbol M. The address field of the instruction (stored at M+1) is designated by the symbol A. The operand used during the execution of the instruction is stored at an address symbolized by B. An index register contains the value X. Draw the memory map diagram for the given case study. State how B is calculated from the other addresses if the addressing mode of the instruction is :

(i) Immediate

(ii) Direct

(iii) Indirect

(iv) Relative

(v) Indexed (6)

7. (a) A computer uses a memory unit of 128K words of 32-bits each. A binary instruction code is stored in one word of the memory. The instruction has four parts: an addressing mode field to specify one of the eight-addressing modes, and operation code, a register code part to specify one of the 30 registers and an address part. How many bits are there in addressing mode part, opcode part, register code part, and the address part? Draw the instruction format clearly specifying the bit numbers required for each part. (6)

(b) Differentiate between (Attempt any **three**):

(i) Index-register addressing mode and Base-register addressing mode

(ii) Register-Reference and memory reference Instructions.

(iii) Combinational and sequential circuits

(iv) Peripheral devices and CPU. (9)

(24)

[This question paper contains 16 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 3213 G

Unique Paper Code : 52413302

Name of the Paper : COMPUTER APPLICATIONS IN BUSINESS

Name of the Course : **CBCS Examination December-2023**

Semester : III

Duration : 3 Hours Maximum Marks : 100

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt **all** questions.
3. **All** questions carry equal marks.
4. Answers may be written either in English or Hindi; but the same medium should be used throughout the paper.

छात्रों के लिए निर्देश

1. इस प्रश्न-पत्र के मिलते ही ऊपर दिए गए निर्धारित स्थान पर अपना अनुक्रमांक लिखिए।

2. सभी प्रश्नों के उत्तर दीजिए ।

3. सभी प्रश्नों के अंक समान हैं ।

4. इस प्रश्न - पत्र का उत्तर अंग्रेजी या हिंदी किसी एक भाषा में दीजिए, लेकिन सभी उत्तरों का माध्यम एक ही होना चाहिए ।

1. State true or false with reasons (Answer any **ten**) (2×10)

(a) Indent is the spacing between the paragraphs.

(b) Autotext and autocorrect perform the same function in MS word.

(c) Changes to the slide master only affect the slide master itself, and do not reflect on the existing slides in the presentation.

(d) To add a hyperlink to your presentation, you must first create a new slide.

(e) The PPMT and IPMT functions return different values.

(f) ABS function is an example of statistical functions

(g) In Microsoft PowerPoint, the slide show in View option displays all the slides in a presentation as thumbnails.

(h) Mail Merge can be used to send a variety of documents

(i) An audio clip and video strip can be used in a PowerPoint presentation.

(j) The ruler is used to move the document up and down.

(k) COUNTA and COUNTIF are both statistical functions but they serve different purpose.

(l) Cell address D$10 in a formula is an absolute cell reference

2. Differentiate between any **four** of the following : (5×4)

(a) Workbook and Worksheet

(b) Slide animation and Slide transition

(c) Formulas and Functions in Excel

(d) Paragraph formatting and Page formatting in word processors

(e) Traditional database and DBMS

3. (a) Explain steps for creating a letter by Mail Merge feature of MS-Word? (5)

(b) What do you mean by slide show? Explain the procedure of copying a slide from one presentation to another. (5)

(c) How can we print a worksheet? (5)

(d) Explain "undo", "redo", "Repeat" and "Find" commands MS-Word. (5)

Or

(a) What are "Headers and Footers" in MS word? Write steps to insert them in document. (5)

(b) Explain "wrap text" and "Merge and center" commands on MS Excel. (5)

(c) What are the steps for creating a graph in a worksheet. (5)

(d) "PowerPoint demonstrates different views of slides." Discuss briefly. (5)

4 (a) What are operators in excel? Discuss their various types. (10)

(b) Write command for the operation (a)-(d) based on the worksheet shown below: (10)

	A	B	C	D	E	F	G	H
	Roll no.	Name	English	Economics	Accounts	Total	Percentage	Grade
1	BCP1	Anu	99	67	90			
2	BCP2	Beena	98	92	98			
3	BCP3	Krish	89	76	87			
4	BCP4	Nisha	89	98	89			
5	BCP5	Ram	94	100	95			
6								
7	First position obtained by							

(i) Write a formula to calculate the total marks obtained by each student.

(ii) Write a formula to calculate the percentage marks obtained by each student.

(iii) Display the name of the student having overall maximum marks in the cell G7.

(iv) Calculate the grade of each student on the basis of the following guidelines.

If marks	Then grade
>=80	A
>=60<80	B
>=50<60	C
<50	F

Or

(a) Explain financial functions and logical function with the help of two examples each. (10

(b) Radha ltd pays its employees the salar components on the basis of Basic pay. Th components of salary are computed according t the following contract of service : (10

- Dearness Allowance is paid @10% subject t the maximum ₹5,000
- House Rent Allowance is paid @ 30% of Basi salary and Dearness Allowance rounded t nearest 10.
- If the distance covered by the employee is upt 10 kms, Transport Allowance is ₹300 per k otherwise it is ₹4,500
- Prepare Payroll statement as per the followin schedule:

Payroll for the month of November 2023

EmpId	Employee name	Distance	Basic	DA	HRA	TA	Gross Pay
Total							

5. (a) Briefly explain ER-Model. Prepare an ER-diagram for the following and indicate the nature of relationships between the entities

- A manager is appointed in a department
- A shop has many departments
- There are many shops in a mall (10)

(b) What is a relational data model? Explain any five rules of E. F. Codd for a database to be relational. (10)

Or

(a) What is normalisation? Explain the different forms of normalisation. (10)

(b) A college has many students and teachers; a student can study from many teachers and a teacher can teach many students. Prepare a relational table from the tables given below and also identify the primary key, foreign key, and composite key. (10)

Student table

Name of the field	Description
Roll_No	(Roll number) of student
Name	Name of the Student
Mobile No	Mobile number of student
Address	Address of the student

Teacher Table

Name of the field	Description
TID	Identity of the teacher
TPan	Pan number of the teacher
TName	Name of the teacher
TDesignation	Designation of the teacher
TMNo.	Mobile number of the teacher

Assume the record details on your own.

1. कारणों सहित बताएं सत्य है या असत्य (किन्हीं दस प्रश्नों का उत्त
दीजिए) (2×10

(क) इडेंट पैराग्राफ के बीच खाली जगह है।

(ख) ऑटो टेक्स्ट और ऑटो करेक्ट MS Word में एक ही कार्य करते हैं।

(ग) स्लाइड मास्टर में परिवर्तन केवल स्लाइड मास्टर को ही प्रभावित करते हैं, और प्रस्तुति (presentation) में मौजूदा स्लाइड्स पर प्रतिबिंबित नहीं होते हैं.

(घ) अपनी प्रस्तुति में हाइपरलिंक जोड़ने के लिए, आपको पहले एक नई स्लाइड बनानी होगी।

(ङ) PPMT और IPMT फंक्शन अलग-अलग वैल्यू देते हैं।

(च) एबीएस फंक्शन सांख्यिकीय कार्यों का एक उदाहरण है।

(छ) Microsoft PowerPoint में, दृश्य विकल्प में स्लाइड शो प्रस्तुति में सभी स्लाइड्स को थंबनेल के रूप में प्रदर्शित करता है।

(ज) मेल मर्ज का उपयोग विभिन्न प्रकार के दस्तावेज भेजने के लिए किया जा सकता है।

(झ) किसी PowerPoint प्रस्तुति में ऑडियो क्लिप और वीडियो स्ट्रिप का उपयोग किया जा सकता है।

(ञ) स्क्रलर का उपयोग दस्तावेज को ऊपर और नीचे ले जाने के
किया जाता है।

(ट) COUNTA और COUNTIF दोनों सांख्यिकीय कार्
लेकिन वे अलग-अलग उद्देश्य पूरा करते हैं।

(ठ) एक फॉर्मूला में सेल एड्रेस DS10 एक पूर्ण सेल संदर्भ

2. निम्नलिखित में से किन्हीं चार के बीच अंतर स्पष्ट कीजिए : (5×

(क) वर्कबुक और वर्कशीट

(ख) स्लाइड एनीमेशन और स्लाइड ट्रांजिशन

(ग) एक्सेल में फॉर्मूला और फंक्शन

(घ) वर्ड प्रोसेसर में पैराग्राफ फॉर्मेटिंग और पृष्ठ फॉर्मेटिंग

(ङ) पारंपरिक डेटाबेस और DBMS

3. (क) MS-Word के मेल मर्ज फीचर द्वारा एक पत्र तैयार करने
उपयोग होने वाले चरणों को स्पष्ट कीजिए? (

(ख) स्लाइड शो से क्या तात्पर्य है? स्लाइड को एक प्रस्तुति से दूसरी प्रस्तुति में कॉपी करने की प्रक्रिया को स्पष्ट कीजिए। (5)

(ग) हम वर्कशीट कैसे प्रिंट कर सकते हैं? (5)

(घ) MS-Word की "अनडू", "रीडू", "रिपीट" और "फाइंड" कमांड की व्याख्या कीजिए। (5)

अथवा

(क) MS word में "हेडर और फुटर" क्या हैं? उन्हें दस्तावेज में सम्मिलित करने के लिए चरण बताएं। (5)

(ख MS Excel पर "टेक्स्ट रैप" और "मर्ज और सेंटर" कमांड की व्याख्या कीजिए। (5)

(ग) वर्कशीट में ग्राफ बनाने के लिए चरण क्या हैं। (5)

(घ) "PowerPoint स्लाइड्स के विभिन्न दृश्यों को प्रदर्शित करता है" संक्षेप में चर्चा कीजिए। (5)

4. (क) Excel में ऑपरेटर क्या हैं? उनके विभिन्न प्रकारों के बारे में चर्चा कीजिए। (10)

(ख) नीचे दिखाई गई वर्कशीट के आधार पर ऑपरेशन (क) -
के लिए कमांड लिखिए :

	क	ख	ग	घ	ङ	च	छ	ज
	रोल नं.	नाम	अंग्रेजी	अर्थशास्त्र	अकाउंट्स	कुल	प्रतिशत	ग्रे
1	बीसीपी1	अनु	99	67	90			
2	बीसीपी 2	बीना	98	92	98			
3	बीसीपी 3	त्रिश	89	76	87			
4	बीसीपी 4	निशा	89	98	89			
5	बीसीपी 5	राम	94	100	95			
6								
7	प्रथम स्थान प्राप्त किया गया है							

(i) प्रत्येक छात्र द्वारा प्राप्त कुल अंकों की गणना करने
लिए एक फॉर्मूला लिखिए।

(ii) प्रत्येक छात्र द्वारा प्राप्त प्रतिशत अंकों की गणना
के लिए एक फॉर्मूला लिखिए।

(iii) सेल G7 में समग्र अधिकतम अंक प्राप्त करने वाले
का नाम प्रदर्शित कीजिए।

(iv) निम्नलिखित दिशानिर्देशों के आधार पर प्रत्येक छात्र
ग्रेड की गणना कीजिए।

यदि अंक है	तो ग्रेड होगा
>=80	A
>=60<80	B
>=50<60	C
<50	F

अथवा

(क) दो उदाहरणों की सहायता से वित्तीय फंक्शन और तार्किक फंक्शन को समझाएं। (10)

(ख) राधा लिमिटेड अपने कर्मचारियों को मूल वेतन के आधार पर वेतन घटकों का भुगतान करती है। वेतन के घटकों की गणना सेवा के निम्नलिखित अनुबंध के अनुसार की जाती है : (10)

- महंगाई भत्ते का भुगतान @10% किया जाता है जो अधिकतम ₹5,000 के अधीन है।
- मकान किराया भत्ता मूल वेतन का @ 30% और महंगाई भत्ता निकटतम 10 तक दिया जाता है।
- यदि कर्मचारी द्वारा तय की गई दूरी 10 किलोमीटर तक है, तो परिवहन भत्ता ₹300 प्रति किमी है अन्यथा यह ₹4,500 है।

• निम्नलिखित अनुसूची के अनुसार पेरोल स्टेटमेंट
कीजिए :

नवंबर 2023 के महीने के लिए पेरोल

कर्मचारी आईडी	कर्मचारी का नाम	दूरी	मूल वेतन	महंगाई भत्ता	मकान किराया भत्ता	परिवहन भत्ता	म
कुल							

5. (क) ईआर-मॉडल को संक्षेप में समझाएं। निम्नलिखित के लिए
ईआर-आरेख तैयार कीजिए और संस्थाओं के बीच संबंधों
प्रकृति को इंगित कीजिए।

• एक विभाग में एक प्रबंधक नियुक्त किया जाता है

• एक दुकान में कई विभाग हैं

• एक मॉल में कई दुकानें हैं

(ख) एक रिलेशनल डेटा मॉडल क्या है? डेटाबेस के रिलेशनल
के लिए ई. एफ. कॉड के किन्हीं पांच नियमों की व्याख्या की

अथवा

(क) सामान्यीकरण क्या है? सामान्यीकरण के विभिन्न रूपों की व्याख्या कीजिए। (10)

(ख) एक कॉलेज में कई छात्र और शिक्षक हैं; एक छात्र कई शिक्षकों से अध्ययन कर सकता है और एक शिक्षक कई छात्रों को पढ़ा सकता है। नीचे दी गई तालिकाओं से एक रिलेशनल तालिका तैयार कीजिए और प्राइमरी कुंजी, फोरन कुंजी और कम्पॉजिट कुंजी की भी पहचान कीजिए। (10)

छात्र तालिका

फील्ड का नाम	विवरण
रोल नं.	छात्र का (रोल नंबर)
नाम	छात्र का नाम
मोबाइल नं.	छात्र का मोबाइल नंबर
पता	छात्र का पता

शिक्षक तालिका

फील्ड का नाम	विवरण
टीआईडीTID	शिक्षक की पहचान संख्या
टीपैन	शिक्षक की पैन संख्या
टीनेम	शिक्षक का नाम
टी डेजिग्नेशन	शिक्षक का पदनाम
टीएमनं.	शिक्षक का मोबाइल नंबर

रिकॉर्ड विवरण स्वयं लीजिए।

(25)

[This question paper contains 8 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 5827 **G**

Unique Paper Code : 62413326

Name of the Paper : Computer Application in Business

Name of the Course : **B.A. (Prog.)**

Semester : III

Duration : 2 Hours Maximum Marks : 38

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.

2. Attempt **all** questions.

3. Answers may be written either in English or Hindi; but the same medium should be used throughout the paper.

P.T.O.

छात्रों के लिए निर्देश

1. इस प्रश्न-पत्र के मिलते ही ऊपर दिए गए निर्धारित स्थान पर अपना अनुक्रमांक लिखिए ।

2. सभी प्रश्नों के उत्तर दीजिए ।

3. इस प्रश्न-पत्र का उत्तर अंग्रेजी या हिंदी किसी एक भाषा में दीजिए, लेकिन सभी उत्तरों का माध्यम एक ही होना चाहिए ।

1. State True (T) of False (F). Give reasons for the same :

(a) Hard disk is a suitable memory device for long term data storage.

(b) USB (Universal Serial Bus) is a type of compute network.

(c) A firewall protects against software viruses in computer security.

(d) URL stands for Uniform Resource Locator.

(e) Cache memory is used to speed up data access for the CPU. (2×5)

कारण सहित बताएं कि कौन-से कथन सत्य है या असत्य है :

(क) हार्ड डिस्क दीर्घकालिक डेटा भंडारण के लिए एक उपयुक्त मेमोरी डिवाइस है।

(ख) USB (यूनिवर्सल सीरियल बस) एक प्रकार का कंप्यूटर नेटवर्क है।

(ग) एक फायरवॉल कंप्यूटर सुरक्षा में सॉफ्टवेयर वायरस से बचाता है।

(घ) URL का अर्थ यूनिफॉर्म रिसोर्स लोकेटर है।

(ङ) कैश मेमोरी का उपयोग CPU के लिए डेटा एक्सेस को गति देने के लिए किया जाता है।

2. (a) Discuss various types of printers according to their speed, cost, and method of operation. Provide examples of suitable applications for each type

(b) Explore the process of creating and formatting a table in a Word document.

OR

(a) Define system software and discuss some of its key functions in a computer system.

(b) Explain the process to insert headers and footers in Word documents. (2×5

(क) उनकी गति, लागत और संचालन की विधि के अनुसार विभिन्न प्रकार के प्रिंटर पर चर्चा कीजिए। प्रत्येक प्रकार के लिए उपयुक्त अनुप्रयोगों के उदाहरण प्रदान कीजिए।

(ख) किसी Word दस्तावेज में तालिका बनाने और फॉर्मेटिंग करने की प्रक्रिया का अन्वेषण कीजिए।

अथवा

(क) सिस्टम सॉफ्टवेयर को परिभाषित कीजिए और कंप्यूटर सिस्टम में इसके कुछ प्रमुख फक्शन पर चर्चा कीजिए।

(ख) Word दस्तावेजों में हैडर और फुटर सम्मिलित करने की प्रक्रिया को स्पष्ट कीजिए।

3. (a) What is a web browser? Discuss its functions in context of accessing information from internet.

(b) Define URL. Provide a brief explanation of the structure of URL.

OR

(a) Discuss the difference between Webpage, Website, and search engines.

(b) Define a firewall and explain the various types o firewalls used in network security. (2×5

(क) एक वेब ब्राउज़र क्या होता है? इंटरनेट से सूचना प्राप्त कर के संदर्भ में इसके फक्शन पर चर्चा कीजिए।

(ख) URL को परिभाषित कीजिए। URL की संरचना का संक्षि विवरण प्रदान कीजिए।

अथवा

(क) वेबपेज, वेबसाइट और सर्च इंजन के बीच अंतर पर च कीजिए।

(ख) फ़ायरवॉल को परिभाषित कीजिए और नेटवर्क सुरक्षा उपयोग किए जाने वाले विभिन्न प्रकार के फ़ायरवॉल की व्या कीजिए।

4. (a) Distinguish between LAN (Local Area Networ and WAN (Wide Area Network) networks.

(b) Explain the process of inserting a picture in a Word document.

OR

(a) Explain the concept of network topology and why it is important in the design of computer networks.

(b) Discuss the difference between Formulas and Functions in a Spreadsheet? (2×4)

(क) LAN (लोकल एरिया नेटवर्क) और WAN (वाइड एरिया नेटवर्क) नेटवर्क के बीच क्या अंतर होता है?

(ख) Word दस्तावेज़ में चित्र सम्मिलित करने की प्रक्रिया को स्पष्ट कीजिए।

अथवा

(क) नेटवर्क टोपोलॉजी की अवधारणा को समझाएं और कंप्यूटर नेटवर्क के डिजाइन में यह क्यों महत्वपूर्ण है।

(ख) स्प्रेडशीट में फॉर्मूला और फ़ंक्शंस के बीच अंतर पर चर्चा कीजिए?

(26)

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 6263 **G**

Unique Paper Code : 62344330

Name of the Paper : Computer Networks and HTML

Name of the Course : **B.A. Program**

Semester : III [Year of Admission – CBCS-LOCF]

Duration : 3 Hours Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Question No. **1** is compulsory.
3. Attempt any **5** Questions from **Section B.**
4. All parts of a question must be answered together.

Section – A

1. (a) What do you understand by full duplex channel? How is it different from half duplex communication? (5)

   (b) With the help of diagram explain Ring topology also state it's any two advantages and disadvantages over other topologies. (5)

P.T.O.

(c) Describe the use of following HTML tags : (5)

(i) ^{text}

(ii) <tr>

(iii)

(iv)

(v) <hl>

(d) Write the use of following network devices : (2)

(i) Switch

(ii) Repeater

(e) List the different ways of using CSS in HTML documents. (3)

(f) What is crosstalk? Which type of cables are used to minimize crosstalk? (2)

(g) Write the HTML code for creating the following : (3)

$2A_1 + 3A_2 = B^2$

Section – B

2. (a) What is TCP/IP? Diagrammatically represent all the layers of the OSI model. (6)

(b) Describe any two types of unguided media on the basis of propagation methods, range and their applications. (4)

3. (a) Write HTML code for creating a web page containing the below given list items. (5)

List of Operating Systems

i. Linux
   a. Ubuntu
   b. Red Hat
   c. Kali Linux

ii. Windows
   - Windows 7
   - Windows 10
   - Windows 11

(b) What are radio waves? Which type of antennas are used for radio waves? Write any one application of radio waves. (5)

4. (a) Write an HTML code to create the following table : (5)

Student Details		
Name:	Rohan Mittal	Insert an Image named Mypic.jpg here
Course:	B.A. (Programme)	
Address:	Delhi	

(b) With the help of diagram describe different parts of an Optical Fiber. Describe the process of light transmission through optical fiber. (5)

5. (a) What is the use of URL? Briefly explain static and dynamic web pages with examples. (6)

(b) Briefly explain Peer-to-Peer network with the help of an example. (4)

6. Write HTML code to create the below given form. (10)

Application Form

First Name: Last Name:

Date of birth: mm / dd / yyyy Age:

Gender: Male Email Address: Enter email address

Positions Available: ○ Junior Developer ○ Mid-level Developer ○ Senior Developer

Programming Languages: ☐ Java ☐ JavaScript ☐ Python

Password: Confirm Password:

Submit Reset

7. Write short notes any **five** from the following : (10)

(i) FTP

(ii) SMTP

(iii) TELNET

(iv) DNS

(v) Search engines

(vi) HTTP

(27)

[This question paper contains 8 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 4827 **G**

Unique Paper Code : 42347501

Name of the Paper : Data Structures

Name of the Course : **B.Sc. (P) LOCF (DSE)**

Semester : V

Duration : 3 Hours Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. The paper has **two** sections. **All** questions in **'Section A'** are compulsory.
3. Attempt any **five** questions from **'Section B'**. Parts of a question must be answered together.

Section A

1. (a) What is the difference between a binary tree and binary search tree? (2)

P.T.O.

(b) Explain sparse matrix using a diagram. (2)

(c) Differentiate between linear search and binary search using an example. (2)

(d) Give any two applications of a stack. (2)

(e) Explain the situation in which insertion sort works better than quicksort? (2)

(f) What will happen if we attempt to remove a node from an empty linked list? Give one way to solve this problem. (2)

(g) Give two differences between arrays and linked list. (2)

(h) What is row major mapping and column major mapping? Explain with the help of an example. (3)

(i) Define Priority queue. How priority queue can be implemented using linked list. (4)

(j) List two advantages and disadvantages of recursion. (4

Section B

2. (a) Many operations can be performed faster on sorted data than on unsorted data. Explain for which of the following operations is this the case :

(i) Finding an item with a minimum value

(ii) Finding the middle value (median)

(iii) Computing the average of values (6)

(b) Is merge sort the best sorting algorithm? Justify your answer. (4)

3. (a) Consider the following stack of characters, where stack is allocated n = 6 memory cells : (6)

stack: a, d, e, f, g, _

(where "_" means empty memory cell)

Describe the stack as the following operations take place :

(i) push (stack, k)

(ii) pop (stack, item)

(iii) push (stack, l)

(iv) push (stack, s)

(v) pop (stack, item)

(vi) push (stack, t)

(b) Convert the following infix expression to a postfix expression using a stack. Show the status of the stack at each step. What is the maximum number of symbols that appear on the stack at any point of time during the evaluation of this expression?

A * (B + D) / E – F * (G + H / K) (4)

4. (a) Consider the following sequence of letters and asterisks : (6)

C O * M P * U * * T E R *

Consider the queue data structure that has the following two operations enqueue and dequeue. Suppose that for the above sequence, each letter (such as C) corresponds to an enqueue of that letter into the queue and each asterisk (*) corresponds to a dequeue operation on the queue. Show the sequence of the values in the queue using a diagram.

(b) Consider an initially empty circular queue of the size four implemented using arrays. Perform the given sequence of operations and show the position of front and rear after each operation. (4)

(i) enqueue (14),

(ii) dequeue ( ),

(iii) dequeue ( ),

(iv) enqueue (3),

(v) enqueue (7),

(vi) enqueue (9),

(vii) enqueue (0),

(viii) enqueue (2)

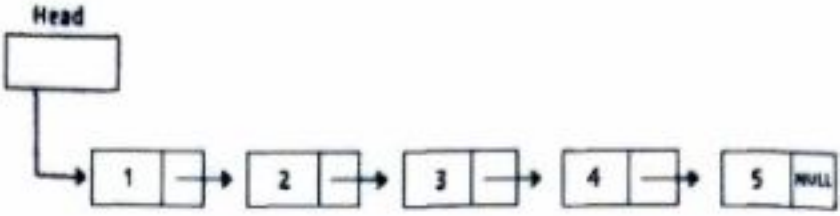
5. (a) Write member functions to perform the following operations on Singly Linked List : (6)

(i) Insert an element after n^{th} element of the list.

(ii) Delete an element present at the end of the list.

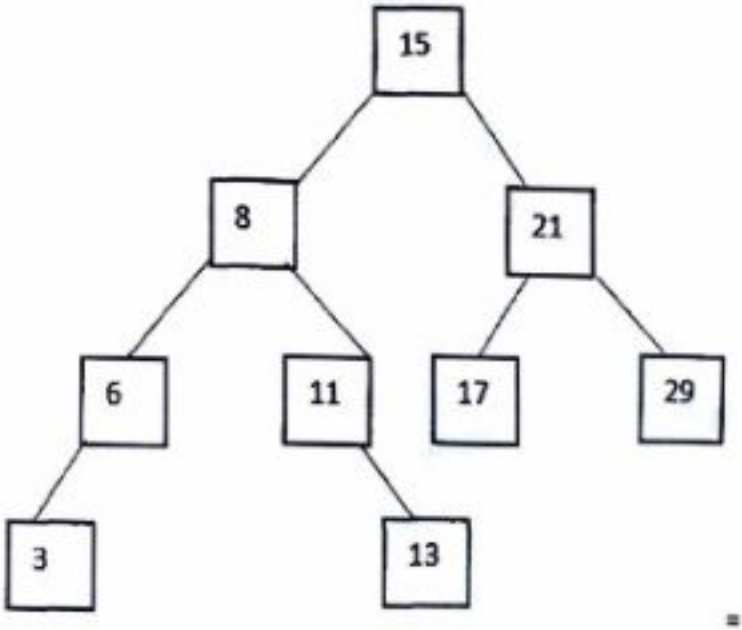
(iii) Search an element with value 'V'.

(b) What will be the output of the following 'func' for the given linked list with first node as head? (4)




```
void func (class Node* head)
{
    if (head = = NULL)
        return; func (head – > next);
        cout << head–>data << " ";
}
```

6. (a) Consider the following binary tree : (6)



Determine the inorder, preorder, postorder traversal of the given tree. Also give the height of the above tree. Is the above tree a complete binary tree? Justify your answer.

(b) Differentiate between the breadth first and depth first traversal with the help of an example using a diagram. (4)

7. (a) What will be the output of the given recursive function : (6)

```
int fun (int i)
{   if fun(i==2)
        return 1;
    else
        return (i–1) * fun(i–1);
}
```

Show the steps and the values to be returned when the following functions are called :

(i) fun(6)

(ii) fun(1)

(b) Write the pseudocode for the recursive function to compute the sum of the 'n' numbers stored in an array. (4)

8. (a) Explain the 'Tower of Hanoi' problem. Also write the recursive function to solve this problem. (6)

(b) Calculate the address of the element A[3][2] of the 2-D array defined as A(5, 5) if the element is stored in :–

(i) Row major order

(ii) Column major order (4)

(28)

[This question paper contains 8 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 4930 **G**

Unique Paper Code : 42347501

Name of the Paper : Data Structures

Name of the Course : **B.Sc. Programme (CBCS-LOCF)**

Semester : V

Duration : 3 Hours Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. **Section A** is Compulsory.
3. Attempt any **Five** Questions from **Section B**.
4. All parts of a question must be answered together.

PART A

(**All** *questions in this section are compulsory.*)

1. (a) Add the two integers 8674 and 321 usi stacks. Show the contents of the stacks at ea step.

(b) Which data structure is best suited to print a s of elements in reverse order and why? Expla using your own example.

(c) Consider the following function :

```
void fun(int n) {
    queue<int> Q;
    Q.enqueue(O); Q. enqueue(1);
    for (int i = 0; i < n; i++ ) {
        int a = Q.dequeue();
        int b = Q.dequeue();
```

```
        cout << b << " ";
        Q.enqueue (a+b); Q.enqueue(b);
    }
}
```

What is the output if the function is invoked as fun(4)? Show the contents of the queue at each iteration.

(d) Write a function to remove an element from the i^{th} position in a singly linked list. (4)

(e) Write a recursive function for Linear Search on an array of integers. The function should return the index of the element if it is found else it should return -1. (4)

(f) Assume a binary tree node contains fields for data, a pointer to the left child(left), and a pointer to the right child(right). Determine the functionality

of the following function if it is invoked with th root of a binary tree.

```
int fun(Treenode* p) {
    if (p == 0) return 0;
    return fun(p->left) + fun(p->right) + 1;
}
```

What will the function return if the root points a full and complete binary tree of height 3? (

PART B

(*Attempt any* **five**)

2. (a) Write a function to merge two sorted arrays in a new sorted array. (

(b) Convert the following infix expression to pref expression. Show the status of the stack at ea step :

Infix expression: 5 + 6 / 3 * 2 + 7 (

3. (a) Write a recursive algorithm for implementing binary search. Show steps involved in searching an element with value 42 in the following array of integers :

{5, 16, 23, 32, 37, 42, 55} (5)

(b) Perform selection sort to sort the following list of integers, show all the steps performed in detail : (53, 32, 96, 64, 22, 11}. (5)

4. (a) Write the enqueue and dequeue functions of a queue implemented using a singly linked list. (5)

(b) What is a priority queue and why is it required? Predict the output of the following code which uses two priority queues. (5)

```
int main() {

  int a[]= {1,2,3,4,5,6,7,8,9,10};

  priority_queue<int,vector<int» pq1(a+3,a+7);
```

```
    priority_queue<int,vector<int>,greater<int
    pq2(a+3,a+7);

    while (!pq1.empty()) {

        cout << pq1.top() << ' '; pq1.pop();

    }

    cout << endl;

    while (!pq2.empty()) {

        cout << pq2.top() << ' '; pq2.pop();

    }

}
```

5. (a) Give necessary class definitions to create a dou linked list. Write a member function to delete element from the i^{th} position in a doubly lin list.

(b) Write a function to search an element 'x' in a singly linked list of integers. The function should return true if the element is found else return false. (5)

6. (a) Consider the following recursive function : (5)

```
double compute(double a, int n) {
    if (n == 0)
        return 1.0;
    else
        return a * compute(a, n-1);
}
```

How many recursive calls will be performed to obtain the result of compute(3,2)? Show the changes in the run time stack during execution of compute(3,2).

(b) Write a recursive function to calculate sum of the digits of a given number. (5)

7. (a) Write a program for level by level traversal of a binary tree. (5)

(b) What is the minimum possible and maximum possible number of nodes in a binary tree with height 'h'? Given h = 4, draw both trees – one with minimum number and one with maximum possible number of nodes. (5)

(29)

[This question paper contains 8 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 6047 **G**

Unique Paper Code : 62347502

Name of the Paper : Programming with Python (LOCF)

Name of the Course : **B.A. Programme LOCF**

Semester : V (Year of Admission 2019 onwards)

Duration : 3 Hours Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. **Section A** is compulsory.
3. Attempt any **5 (five)** questions from **Section B**.
4. All parts of a question must be answered together.

P.T.O.

Section A

1. (a) Construct logical expressions for the following : (3)

   (i) Age is greater than 50 or experience is more than 7

   (ii) Sum of a, b, c is greater than or equal to 20

   (iii) Length of string "examination" is equal to 5

   (b) Identify the valid and invalid identifiers : (3

   import, roll-no1, 1temp, Str1, _factorial, Roll No

   (c) Explain the purpose of constructor and destructo in class. (

   (d) Differentiate between the following operator : (

   (i) = and ==

   (ii) / and //

(e) What is the output of the given code segment? Justify your answer. (3)

```
x=2
def test():
    x=x+1
    print(x)
test()
print(x)
```

(f) What is recursion? Explain it with the help of an example. (4)

(g) Write a range() function to generate the series 20, 18, 16, 14, 12, 10. (2)

(h) Evaluate the following expression : (2)

5 % 7 + 15 – 9 > 6 % 5 * 2 + 6

Section B

2. (a) Write a Python program to calculate the area of a triangle where its three side s1, s2 and s3 are given using the given formula :

s = (s1+s2+s3)/2

area = $\sqrt{s(s-s1)(s-s2)(s-s3)}$ (4)

(b) Write a Python program to find the sum of n terms of the following series : (4)

1 + 1/3.0 + 1/5.0 + ...

(c) When a=15 and b=12, give the output of the given expressions : (2)

```
a = 15          # 15 in binary: 00001111
b = 12          # 12 in binary: 00001100
```

(i)
```
c = a & b
print(c)
```

(ii)
```
c = a | b
print(c)
```

3. (a) Differentiate between break and continu statements. Give suitable examples. (

(b) Rewrite the following Python code using whi loop : (

```
sum=0
for i in range(1,7,2):
        sum += i
```

(c) Write a function called remove vowels (word) which removes all the vowels ('a', 'e', 'i', 'o', 'u') in word and returns the word with the remaining characters. (4)

For example :

word = "Programming@2023"

Output of function removevowels (word) = "Prgrmmng@2023"

4. (a) A dictionary named Grades is created as *key: value* pair of *marks: Name*

Grades = {90: "Sahil", 65: "Abhijeet"}

Write Python statements to do the following :

- To print the values of Grades.
- To delete the *key: value* pair, 65: "Abhijeet".
- To print the maximum marks in dictionary Grades.

- To add a *key: value* pair 99 : "kuruss" in Grades.
- To find sum of the keys of Grades. (5)

(b) Write a Python program to arrange the elements of a given list in ascending order without using any in-built function. (5

5. (a) Consider the tuples tuple1 = (12, 5, 2, 4, 17, 44, 7 6, 10). Write Python statements to perform th following operations :

(i) Display the last element from the tuple1

(ii) Calculate the sum of all the elements i the tuple1.

(iii) Print first half of the tuple tuple1 in on line and the other half in another line.

(iv) Convert tuple1 to a set. (

(b) Write a function to reverse a given number an find sum of digits of the given number. (

For example: If the given number is 2409, t reverse would be 9042 and the sum of digits wou be 2+4+0=9=15.

6. (a) Consider the following sets: (5)

Vehicles = {'Bicycle', 'Scooter', 'Car', 'Bike', 'Truck', 'Bus', 'Rickshaw'}

heavyVehicles = {'Truck', 'Bus'}

lightVehicles = {'Rickshaw', 'Scooter', 'Bike', 'Bicycle'}

Perform the following operations and give the output :

(i) vehicles – heavyVehicles

(ii) heavyVehicles . issubset (Vehicles)

(iii) lightVehicles & heavyVehicles

(iv) lightVehicles | heavyVehicles

(v) heavyVehicles.symmetric_difference (lightVehicles)

(b) Write a Python program to print the prime numbers in a list of integers : (5)

For example: list1 = [13, 34, 55, 67, 3, 89, 70, 200], the output will be 13, 67, 3, 89.

7. (a) Define a class Square. The class should have side of the square as a data member. Define the following methods : (6)

(i) __init__ to initialize the data member side

(ii) area() to calculate area of the square as side * side

(iii) perimeter() to calculate the perimeter of the square as 4 * side

Create an object sql of the class Square, with the side as 20. Calculate its area and perimeter of sql and print it.

(b) Solve the following and write step by step execution : (4)

```
for 1 in range(1, 10, 1) :
    for j in range(i, 20, i) :
        if (i+j < 10) :
            print (i+j)
        else:
            break
```