

## Part 1, Paper-I, Computer Fundamentals

1. What is meant by radix of a number system?
2. Subtract 0111 from 0011 using 1's complement method.
3. Add the following octal numbers:  $37 + 53$
4. What is maxterm and minterm?
5. Draw a K-map for the following:  $f(A,B,C,D) = AB + AC' + C + AD + AB'C + ABC$
6. Is the number 101 101 01110 in BCD format? Explain why or why not? Convert the number to its equivalent Hex code.
7. Perform operation on 8-bit numbers using signed 2's complement notation:  $-25 + 75$ .
8. Why is it necessary to normalize a floating point number? Is 00101100 a normalized 8-bit binary number? How can a number be normalized?
9. How are floating point numbers represented?
10. Compare between super computer and main frame computer.
11. What are the disadvantages of Pseudo Code over flow chart?
12. Write a flow chart to find out the largest number among three numbers.
13. Design an algorithm to calculate the prime numbers between a range.
14. Explain absorption law.
15. Distinguish between weighted and non weighted codes.
16. What are error detection codes?
17. Explain EBCDIC and ASCII codes.
18. Show that the 1's complement of the excess-3 representation of the 9's complement of the same number.
19. What do you mean by self complement codes?
20. What is Hamming distance?
21. Encode data bits 0101 into a 7-bit even parity Hamming code.
22. Simplify the following Boolean function using K-Map and show its truth table:  
 $f(A,B,C,D) = \sum m(1,3,4,9,10) + \sum d(2,7,12)$
23. What are assembler directives? Give examples.
24. Write an algorithm to find the  $K^{\text{th}}$  largest element of a given array of  $n$  elements.
25. Write the consensus theorem in sum-of-product form and prove it.
26. State the Huntington's postulates of Boolean Algebra.
27. Simplify the following:  $(A+B+C')(B+C'+D)(A+D)$
28. Add  $(-25) + 18$  in binary using 2's complement addition.
29. Convert AC7.C6F into Decimal.
30. What is biased exponent?
31. What are the essential properties of a time sharing system?
32. Draw the schematic layout of 7-segment display unit.
33. How can data be erased from an EEPROM?
34. Prove by using Boolean Algebra  $x'y+xz+yz=x'y+xz$ .
35. What is the function of bootstrap loader?

36. State the main characteristics of machine language, assembly language and high level language.
37. What are application and system software?
38. How are binary integers represented in computers?
39. Draw the block diagram of a computer.
40. What do you mean by ALU?
41. When does an overflow occur during an arithmetic operation? How can it be detected?
42. State and prove the two De Morgan's Laws for three variables.
43. Compare between mini and personal computers?
44. Distinguish between compiler and interpreter.
45. Why 2's complement representation is preferred for negative number over 1's complement representation?

## **Part 1, Paper-I, Introduction to Basic Electronics**

1. What do you mean by the quiescent point of a transistor amplifier?
2. Draw the circuit diagram of a common-emitter transistor amplifier and explain its operation graphically.
3. Compare between enhancement and depletion mode of MOSFET.
4. Describe the use of an OPAMP as an inverting amplifier.
5. Explain the use of an OPAMP as a differentiator.
6. Give the differences between LED and LCD?
7. What is the percentage of regulation?
8. Give the significance of the load line.
9. What is common mode rejection ratio?
10. What is the voltage gain of a inverting amplifier?
11. Distinguish between unipolar and bipolar devices.
12. What is mean by virtual ground in a OPAMP?
13. State and explain Thevenin's theorem.
14. Draw the circuit diagram of bridge rectifier and explain its operation.
15. Explain the operation of SCR used as a switch.
16. In a transistor, is the doping in the emitter and collector same?-explain.
17. Define drain resistance and Transconductance
18. Explain Amplification factor of FET.
19. How does the constructional feature of a MOSFET differ from that of a JFET?
20. What are the basic differences between astable, monostable and Bistable Multivibrators?
21. Explain the operation of OPAMP used as an integrator.
22. What are the differences between ideal OPAMP and Practical OPAMP?
23. Compare between Thevenin's and Norton's theorem.
24. Write differences between p-type and n-type semiconductors.
25. Explain Totempole output.
26. Draw the Schmitt trigger circuit.
27. What are the four hybrid parameters? Why are they called hybrid parameters.
28. Describe the mechanism of Avalanche and Zener breakdown.
29. Describe the operation of a transistor amplifier.
30. How can you convert a monostable multi vibrator to astable multi vibrator?
31. With a neat circuit explain the operation of a full-wave rectifier using junction diodes.  
Does it give a perfect DC?
32. Compare between p-channel and n-channel MOSFET.
33. Draw the structure of an n-channel depletion type MOSFET. Explain its operation.
34. How does 'closed loop' operation change the performance of an OPAMP?
35. Why MOSFET has higher input impedance than JFET?
36. What do you mean by Fermi level?

37. What is the position of Fermi level in an intrinsic semiconductor? How does its position change when donors and acceptors are added to the semi-conductors?
38. Distinguish between extrinsic and intrinsic semiconductors.
39. State Kirchhoff's current law and Kirchhoff's voltage law.
40. Prove that in a transistor operating in a CE –configuration, the active region , the collector current  $I_c = \beta I_B + (\beta+1)I_{co}$

## Part 1, Paper-I, Digital System Design

1. What is Fan in and fan out?
2. Explain Propagation Delay.
3. What is Principle of Duality?
4. Define SOP and POS of Canonical Form.
5. Explain De'Morgans' Theorem.
6. What do you mean by Universal Gates? Prove that NAND and NOR are universal gates.
7. Describe the disadvantages of K-Map.
8. What do you mean by Equivalence Circuit?
9. Draw the circuit diagram of a 2-input TTL NAND gate and explain its operation.
10. Show that the set (XNOR,OR) is universal.
11. Prove that NOR and NAND operations are not associative.
12. Construct Half Adder and Full Adder using Basic Gates / Logic Gates / NAND / NOR Gates.
13. Construct Full Adder and Full Adder using Basic Gates / Logic Gates / NAND / NOR Gates.
14. Design a 4-bit parallel Adder / Subtractor Circuit.
15. What is BCD Adder?
16. Design a 2-bit Magnitude Comparator Circuit.
17. Explain reflected codes.
18. Distinguish between Decoder and De – Mux?
19. How can a decoder be used as a demultiplexer?
20. Draw the circuit diagram of 4 bit priority encoder and explain its operation.
21. Implement a logic circuit to identify whether a four bit number is in valid BCD or not.
22. Design a code converter that converts 2-4-2-1 message into gray code.
23. Design a BCD to Ex-3 converter.
24. Design a 5x32 decoder using 3x8 decoders and other gates.
25. Simplify the expression  $F = \pi (1,3,5,8,9,11,15)$  using K-map and realize the optimized function using only NOR gates.
26. Implement the following logic expression by 16 : 1 multiplexer:  $Y = \sum(0,2,4,7,8,9,12,13,14)$  and implement the same expression by 4 : 1 multiplexers.
27. Draw and explain the operation of a parity-bit generator.
28. Distinguish between A/D and D/A converter.
29. Distinguish between ROM and PLA.
30. Design a master – slave J-K flip flop and explain its function.
31. What is the drawback of master – slave J-K flip flop over the edge triggered flip flop?
32. Design a counter with a counting sequence of 0-2-7-5-6-0....using all J-K flip flops and basic logic gates.
33. What is race around condition?
34. Why De Bouncer switch is so named?

35. What is the importance of D flip flop?
  36. Convert a D flip flop into T flip flop.
  37. Define noise margin.
  38. What is the purpose of ring counter?
  39. What is Johnson counter?
  40. Distinguish between combinational and sequential circuits.
  41. Compare asynchronous and synchronous counter.
  42. Write the truth table and find out the next state output of T (toggle) flip flop.
  43. Distinguish between latch and flip flop.
  44. What is shift register?
  45. Design a logic diagram of a 3-bit bi-directional shift register.
  46. Draw and explain the logic diagram of a static RAM cell using RS Latch.
  47. What do you mean by ripple counter?
  48. Design a J-K flip flop using S-R flip flop.
  49. Design a MOD-7 counter using T flip flop.
  50. Design a MOD-10 asynchronous counter.
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## Part 1, Paper-I, Computer Organization- I

1. What is the importance of Fetch Cycle?
2. Explain the function of Program Counter and Stack Pointer.
3. What are the one-address, two-address and three-address instructions?
4. What is the importance of Program Status Word?
5. How data can be rewritten on a programmable ROM and EPROM?
6. Explain the primary and secondary memories of a computer.
7. What do you mean by memory mapped I/O and I/O mapped I/O?
8. How many 128x8 RAM chips are needed to provide a memory capacity of 2048 bytes?  
How many lines of address must be used to access 2048 bytes?
9. Explain the functionalities of IAS computer.
10. Explain Addressing modes with examples.
11. Draw and explain the block diagram of a I/O module between CPU and devices.
12. Define access time, access rate and memory cycle time.
13. What is the basic difference between DRO and NDRO?
14. What is flash memory.
15. Distinguish between ROM and RAM.
16. Draw the block diagram of a ROM cell having 1Kx8 bits and explain its functionality.
17. Draw the logic symbols of : i) Non inverting tristate buffer, ii) Inverting tristate buffer, iii) High inverting tristate buffer.
18. Compare between EPROM and EEPROM.
19. What do you mean by zero addressing?
20. What is the function of SISO?
21. Define machine cycle and instruction cycle.
22. Describe how information is read in memory cell.
23. Compare and contrast CISC and RISC architecture.
24. Give a comparative note on SCSI, PCI and USB bus structures.
25. Show the bus connections with a CPU to connect four RAM chips of size 256x8 bit each and a ROM chip of 512x8 bits. Assume the CPU has 8-bit data bus and a 16-bit address bus. Clearly state the generation of chip select signals.
26. Write a program to evaluate the arithmetic statement:  $X=A-B+C*(D-E)/(F+G)$ , i) using a general register computer with one address instructions. ii) using a general register computer with three address instructions.
27. State the characteristics of Von Neumann computers and IAS computers.
28. Draw the general instruction word format and indicate the number of bits in each part.
29. Briefly explain the instruction cycle with the help of a flowchart.
30. Illustrate the basic three instruction code formats of 16 bits of a basic computer having 4 K memory locations of 16 bit words.
31. What is bus arbitration technique?
32. What is Cache memory?

33. What do you mean by cycle stealing?
34. What is the use of accumulator?
35. Distinguish between direct and indirect instruction.



## **Part 1, Paper-IIA, System Software Fundamentals and Operating System**

1. Define multiprogramming.
2. What is meant by segmentation?
3. What is semaphore?
4. What is starvation? Name a scheduling algorithm that may lead to starvation.
5. What is device driver?
6. What is client – server architecture?
7. What is forward referencing? Discuss how a typical assembler handles forward referencing.
8. Define loading and linking.
9. Briefly explain advantages and disadvantages of an absolute loader for a computer system.
10. What is parsing? What is the role of a parse tree?
11. What is the purpose of Inter Process Communication and how is it achieved using Monitors?
12. Explain the terms: Waiting time, Turnaround time, Response time and Throughput.
13. Consider the following reference string: 1,3,2,7,2,1,4,6,2,4,2,3,7,8,3,2,4,2,3,6. How many page faults will occur for 3 page frames for each of the following algorithm? FIFO and LRU.
14. Compare Microkernel and monolithic kernel.
15. Distinguish between Real memory and Virtual memory.
16. Consider a two-level paging system with first level of 8 bits and second level of 12 bits. If the address space uses 32 bit, what is the size of the page and how many pages are there in the logical address space?
17. Assume a single CPU system with 5 processes in the ready queue. Suppose time quantum is 10 milliseconds. What is the maximum waiting time for a process to get the CPU in the RR scheduling?
18. What is Interrupt handler?
19. Differentiate between paging and demand paging.
20. Name the system directories that hold- i) device drivers and ii) temporary files for a UNIX system.
21. What the purpose are of */etc* folder in UNIX file system?
22. Do you think that WINDOWS is an example of a distributed OS? Explain.
23. What is super block in UNIX?
24. What is a file server?
25. Explain dispatcher.
26. What is turnaround time of process?
27. Design process state diagram.
28. What do you mean by PCB?
29. Explain context switching.

30. What is the purpose of system calls?.What is the meaning of the term “busy waiting”?
31. Define wait-for-graph. Differentiate between an assembler and an interpreter.
32. Describe in details the design of a two pass assembler.
33. What do you mean by program relocation?
34. What is preemptive and no preemptive scheduling?
35. Differentiate between paging and segmentation.
36. Explain the address translation mechanism in paging in details.
37. What is Belady’s anomaly? Discuss a page replacement algorithm which does not follow Belady’s anomaly.
38. :Long term scheduler selects a good process mix of I/O-bound and CPU-bound process”- Justify.
39. What are the three main requirements of a solution of the critical-section problem?
40. How are those requirements preserved in Bakery algorithm for multiple-process solution?
41. What are the various phases of a compiler?
42. Describe the different tasks of pass-1 and pass-2 of a two pass assembler.
43. What is a bootstrap loader?
44. What do you mean by mutual exclusion?
45. Explain demand paging.
46. What is relocating loader? What is absolute loader?
47. Define multitasking. Define ageing.
48. What is interrupt handler? Briefly describe Banker’s Algorithm in the context of deadlock.
49. Why is shell not part of kernel?
50. Define the three major activities of an operating system with regards to memory management.
51. Suppose the memory is partitioned into five blocks of 100KB, 500 KB, 200 KB, 300 KB, and 600 KB, how would the first-fit, best-fit and worst-fit algorithms place processes of 212 KB, 417 KB, 112 KB, and 426 KB (in order)?
52. What is binary semaphore and counting semaphore?
53. Describe a producer-consumer problem. Give a solution to this problem using semaphore.
54. How are protection and sharing achieved in segmentation?
55. Consider the following table:

Process Name	Arrival time (ms)	CPU Time Needed (ms)
P1	0	10
P2	0	8
P3	2	3
P4	5	7
P5	11	1

- i) If the CPU scheduling is SJF with preemptive, what would be the average waiting time and average turnaround time?
- ii) If the CPU scheduling is round robin with time quantum of 3 ms, what would be the average waiting time and average turnaround time?
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## Part 1, Paper-IIA, Data Structure-I

1. What is Abstract data Type (ADT)?
2. Consider a two-dimensional array  $A(M \times N)$  with  $M$  rows and  $N$  columns. Derive the position of the  $A[i,j]$  element with respect to the base address for  $i \leq M$ ; and  $j \leq N$
3. Consider the following arithmetic infix expression:  $Q = A + (B * C - (D / E - F) * G) * H$ . Convert infix expression  $Q$  into equivalent postfix expression.
4. What is the advantage of a doubly linked list as compared to a singly linked list?
5. Write the algorithm to reverse the links in a singly linked list such that the last node becomes the first node.
6. Write recursive routine to print the reverse of a string passed to it as parameter.
7. What is queue? Mention an application of queue that would improve your daily life.
8. Imagine we have two empty stacks of Integers,  $s_1$  and  $s_2$ . Draw a picture of each stack after the following operations:  $\text{push}(s_1, 3)$ ;  $\text{push}(s_1, 5)$ ;  $\text{push}(s_1, 7)$ ;  $\text{push}(s_1, 9)$ ; while. Not. ( $\text{emptyStack}(s_1)$ ) Begin  $\text{pop}(s_1, x)$ ;  $\text{pop}(s_1, x)$ ;  $\text{push}(s_2, x)$  End while [variable  $x$  is to store the data temporarily in between the operations].
9. Compare recursion and iteration.
10. What are the limitations of arrays?
11. Consider the following arithmetic expression in postfix notation:  $7\ 5\ 2\ +\ *\ 4\ 1\ 5\ -\ /$  - (i) Find the value of the expression using stack (showing its contents in each step) (ii) Find the equivalent prefix form of the above expression.
12. Write an algorithm that converts an infix expression into postfix expression.
13. What is the main advantage of postfix notation over infix notation?
14. Write an algorithm that deletes the last node of a single linked list.
15. Given a single circular linked list containing a set of data. Write an algorithm that finds the distance (that is, the number of nodes) between given two elements in the list.
16. What do you mean by storage class?
17. What is header file in C?
18. What do you mean by tail recursion?
19. Discuss break and continue statement.
20. Distinguish between stack and queue.
21. What do you mean by data structure?
22. Distinguish between syntax and semantics.
23. Differentiate between function and macro.
24. You are supplied with two polynomials. Give a data structure to represent these polynomials. Explain with an example.
25. What values are automatically assigned to those array elements which are not explicitly initialized?
26. A stack is to be implemented using an array. Give the statement(s) to perform push operation, when the associated declarations are: `int stack [100]; int top=0;`

27. A two dimensional array TABLE[6][8] is stored in row major order with base address 351. What is the address of TABLE[3][4]?
  28. Consider the infix expression:  $4+3*(6*3-12)$ . Suppose that a stack-based algorithm is used to convert the expression from infix to postfix notation. What is the minimum size of the stack needed for the algorithm to work properly in this case? Explain your answer.
  29. Write an algorithm to split a linked list of positive integers into two lists, in such a manner that the first linked list contains the odd numbered nodes and second linked list contains the even numbered. Provide an explanation of the algorithm.
  30. What are the characteristics of a list?
  31. Why stacks and queues are claimed as linear data structures?
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## Part 2, Paper-III, Discrete Mathematical Structure

### Graphs

1. What is directed and undirected graph?
2. What is simple graph? What is regular graph?
3. What is in-degree and out-degree of vertices of a directed graph.
4. What is the maximum number of edges in a simple disconnected graph with  $N$  vertices?
5. Explain rooted tree, binary tree, spanning tree.
6. Distinguish between a path and a circuit in context of a graph.
7. What is Euler Path?
8. Prove that if a graph  $G$  has a vertex of odd degree, there can be no Euler circuit in  $G$ .
9. Describe the Kruskal algorithm for finding the minimum spanning tree for a graph  $G$ .
10. Describe the Prim's algorithm for finding the shortest spanning tree for a graph  $G$ .
11. Find the minimum and maximum possible height of a binary tree with  $n$  vertices.
12. When a graph is said to be an arbitrarily traceable from any of its vertices.
13. Prove that in a complete graph  $G$  with  $m$  vertices, there are  $(m-1)/2$  edge disjoint Hamiltonian circuits if  $m$  is an odd number  $\geq 3$ .
14. Define incidence matrix and adjacency matrix and illustrate with suitable example.
15. Explain with example Breadth first search (BFS).
16. Explain with example Depth first search (DFS).
17. Compare Breadth first search and Depth first search algorithm.
18. Prove that the distance between vertices of a connected graph is a metric.
19. Define eccentricity and center of a graph  $G$  and illustrate with suitable example.
20. Prove that a  $G$  is an Euler graph if and only if it can be decomposed into circuits

### Mathematical logic(Predicate Logic and Proposition)

1. Show that  $(p \rightarrow q) \wedge (p \rightarrow r)$  and  $p \rightarrow (q \wedge r)$  are logically equivalent.
2. Show that  $(p \rightarrow r) \wedge (q \rightarrow r)$  and  $(p \vee q) \rightarrow r$  are logically equivalent.
3. Show that  $(p \rightarrow q) \vee (p \rightarrow r)$  and  $p \rightarrow (q \vee r)$  are logically equivalent.
4. Show that  $(p \rightarrow r) \vee (q \rightarrow r)$  and  $(p \wedge q) \rightarrow r$  are logically equivalent.
5. Show that  $\neg p \rightarrow (q \rightarrow r)$  and  $q \rightarrow (p \vee r)$  are logically equivalent.
6. Show that  $p \leftrightarrow q$  and  $(p \wedge q) \vee (\neg p \wedge \neg q)$  are logically equivalent.
7. Show that  $\neg(p \leftrightarrow q)$  and  $p \leftrightarrow \neg q$  are logically equivalent.
8. Show that  $p \rightarrow q$  and  $\neg q \rightarrow \neg p$  are logically equivalent.
9. Show that  $\neg p \leftrightarrow q$  and  $p \leftrightarrow \neg q$  are logically equivalent.
10. Show that  $\neg(p \oplus q)$  and  $p \leftrightarrow q$  are logically equivalent.
11. Show that  $\neg(p \leftrightarrow q)$  and  $\neg p \leftrightarrow q$  are logically equivalent.
12. Show that  $\neg p \rightarrow (q \rightarrow r)$  and  $q \rightarrow (p \vee r)$  are logically equivalent.
13. Show that  $p \leftrightarrow q$  and  $(p \rightarrow q) \wedge (q \rightarrow p)$  are logically equivalent.

14. Show that  $p \leftrightarrow q$  and  $\neg p \leftrightarrow \neg q$  are logically equivalent.

### Algorithm

1. Describe an algorithm that takes as input a list of  $n$  integers and produces as output the largest difference obtained by subtracting an integer in the list from the one following it.
2. Describe an algorithm that takes as input a list of  $n$  integers and finds the number of negative integers in the list.
3. Describe an algorithm that locates the first occurrence of the largest element in a finite list of integers, where the integers in the list are not necessarily distinct.
4. Let  $k$  be a positive integer. Show that  $1^k + 2^k + \dots + n^k$  is  $O(n^{k+1})$ .
5. Determine whether each of the functions  $\log(n+1)$  and  $\log(n^2+1)$  is  $O(\log n)$ .
6. Define what the worst-case time complexity, average case time complexity, and best-case time complexity (in terms of comparisons) mean for an algorithm that finds the smallest integer in a list of  $n$  integers.
7. What are the worst-case, average-case, and best-case time complexities, in terms of comparisons, of the algorithm that finds the smallest integer in a list of  $n$  integers by comparing each of the integers with the smallest integer found so far?
8. Show that  $8x^3 + 12x + 100 \log x$  is  $O(x^3)$ .
9. Give an algorithm to determine whether a bit string contains a pair of consecutive zeros.
10. How can you produce a big- $O$  estimate for a function that is the sum of different terms where each term is the product of several functions?

### Set Function Relation Equivalence

1. What is "Power set" of a set?
2. Define Cartesian product.
3. How many different elements does  $A \times B \times C$  have if  $A$  has  $m$  elements,  $B$  has  $n$  elements, and  $C$  has  $p$  elements?
4. How many different elements does  $A^n$  have when  $A$  has  $m$  elements and  $n$  is a positive integer?
5. Show that  $A \times B \neq B \times A$ , when  $A$  and  $B$  are nonempty, unless  $A = B$ .
6. Explain why  $A \times B \times C$  and  $(A \times B) \times C$  are not the same.
7. Explain why  $(A \times B) \times (C \times D)$  and  $A \times (B \times C) \times D$  are not the same.
8. Show that  $(A \cup B) \subseteq (A \cup B \cup C)$ .
9. Show that  $(A \cap B \cap C) \subseteq (A \cap B)$ .
10. Show that  $(A - B) - C \subseteq A - C$ .
11. Show that  $(A - C) \cap (C - B) = \emptyset$ .
12. Show that  $(B - A) \cup (C - A) = (B \cup C) - A$ .

13. Determine whether the symmetric difference is associative; that is, if  $A$ ,  $B$ , and  $C$  are sets, does it follow that  $A \oplus (B \oplus C) = (A \oplus B) \oplus C$ ?
14. Suppose that  $g$  is a function from  $A$  to  $B$  and  $f$  is a function from  $B$  to  $C$ .
  - a) Show that if both  $f$  and  $g$  are one-to-one functions, then  $f \circ g$  is also one-to-one.
  - b) Show that if both  $f$  and  $g$  are onto functions, then  $f \circ g$  is also onto.
15. If  $f$  and  $f \circ g$  are one-to-one, does it follow that  $g$  is one-to-one? Justify your answer.
16. If  $f$  and  $f \circ g$  are onto, does it follow that  $g$  is onto? Justify your answer.
17. Find  $f \circ g$  and  $g \circ f$ , where  $f(x) = x^2 + 1$  and  $g(x) = x + 2$ , are functions from  $\mathbf{R}$  to  $\mathbf{R}$ .
18. Let  $f(x) = ax + b$  and  $g(x) = cx + d$ , where  $a$ ,  $b$ ,  $c$ , and  $d$  are constants. Determine necessary and sufficient conditions on the constants  $a$ ,  $b$ ,  $c$ , and  $d$  so that  $f \circ g = g \circ f$
19. Find the inverse function of  $f(x) = x^3 + 1$ .
20. Suppose that  $f$  is an invertible function from  $Y$  to  $Z$  and  $g$  is an invertible function from  $X$  to  $Y$ . Show that the inverse of the composition  $f \circ g$  is given by  $(f \circ g)^{-1} = g^{-1} \circ f^{-1}$

### Recurrence Relation

1. Find a recurrence relation for the number of bit sequences of length  $n$  with an even number of 0s.
2. A string that contains only 0s, 1s, and 2s is called a **ternary string**. Find a recurrence relation for the number of ternary strings of length  $n$  that contain two consecutive 0s.
3. Find the solution to  $a_n = 7a_{n-2} + 6a_{n-3}$  with  $a_0 = 9$ ,  $a_1 = 10$ , and  $a_2 = 32$ .
4. Find the solution to  $a_n = 5a_{n-1} - 6a_{n-2}$  with  $a_0 = 1$ ,  $a_1 = 0$ .
5. Find the solution to  $a_n = 4a_{n-1} - 4a_{n-2}$  with  $a_0 = 6$ ,  $a_1 = 8$ .
6. Find the solution to  $a_n = 4a_{n-2}$  with  $a_0 = 0$ ,  $a_1 = 4$ .
7. Find all solution to the recurrence relation to  $a_n = -5a_{n-1} - 6a_{n-2} + 42 \cdot 4^n$
8. Find all solution to the recurrence relation to  $a_n = 4a_{n-1} - 4a_{n-2} + (n+1)2^n$
9. Find a recurrence relation for the number of ways to climb  $n$  stairs if the person climbing the stairs can take one, two, or three stairs at a time.
10. Find a recurrence relation for the number of bit strings of length  $n$  that do not contain three consecutive zeros.

### Counting Principle

1. Describe "Pigeonhole Principle".
2. How many numbers must be selected from the set  $\{1, 2, 3, 4, 5, 6\}$  to guarantee that at least one pair of these numbers add up to 7?
3. How many numbers must be selected from the set  $\{1, 3, 5, 7, 9, 11, 13, 15\}$  to guarantee that at least one pair of these numbers add up to 16?
4. A company stores products in a warehouse. Storage bins in this warehouse are specified by their aisle, location in the aisle, and shelf. There are 50 aisles, 85 horizontal locations in each aisle, and 5 shelves throughout the warehouse. What is the least number of



products the company can have so that at least two products must be stored in the same bin?

5. A group contains  $n$  men and  $n$  women. How many ways are there to arrange these people in a row if the men and women alternate?
6. In how many ways can a set of two positive integers less than 100 be chosen?
7. In how many ways can a set of five letters be selected from the English alphabet?
8. How many subsets with an odd number of elements does a set with 10 elements have?
9. How many subsets with more than two elements does a set with 100 elements have?
10. How many ways are there for eight men and five women to stand in a line so that no two women stand next to each other?
11. Suppose that a department contains 10 men and 15 women. How many ways are there to form a committee with six members if it must have the same number of men and women?
12. Suppose that a department contains 10 men and 15 women. How many ways are there to form a committee with six members if it must have more women than men?
13. How many bit strings of length 10 contain at least three 1s and at least three 0s?
14. How many bit strings contain exactly five 0s and 14 1s if every 0 must be immediately followed by two 1s?
15. How many ways are there for a horse race with four horses to finish if ties are possible?

### **Probability Theory**

1. For two events A and B, if  $P(A) = 0.3$ ,  $P(B) = 0.2$  and  $P(AB) = 0.1$ , find the probability that exactly one of the events will happen.
2. If A and B are two events such that  $P(A) = P(B) = 1$ , then show that,  $P(A+B) = 1$ ,  $P(AB) = 1$
3. An integer is chosen at random from the first 100 positive integers, what is the probability that the number is divisible by 6 or 8?
4. There are two identical boxes containing 4 white and 3 red balls. One box is chosen at random and a ball is drawn from it. Find the probability that the ball is white, what is the probability that it is from the first box if the ball drawn is white?
5. A box contains 5 red, 3 white 6 blue balls. If 3 balls are drawn at random, determine the probability that all 3 are blue, 2 are red 1 is white and one of each color is drawn?
6. What is the probability of getting 53 Sundays in a leap year ?
7. A, B and C tosses a coin in order. The first one to toss head will win. What are their respective probabilities?
8. Two dice are thrown at random and face value is noted, If A is the event that first die shows 2 or 5 or 6 and B is the event of sum of the face values is 9, check whether A and B are independent?
9. Three firms A, B, and C supply 25%, 35% and 40% of chairs needed to a college. Past experience shows that 5%, 4%, and 2% of the chairs produced by these companies are

defective. If a chair was found to be defective, what is the probability that chair was supplied by firm A?

10. Three urns are given each containing red and white balls. Urn I contains 6 red and 4 white balls, Urn II contains 2 red and 6 white balls and Urn III contains 1 red and 2 white balls. An urn is selected at random and a ball is drawn. If the ball is red what is the chance that it is from first Urn?
11. The chance of two students to win a competition are  $\frac{1}{2}$  and  $\frac{1}{3}$  respectively. If they participate in the same competition what is the probability that at least one will win?
12. A box contains 2 silver and 4 gold coins and a second box contains 4 silver and 3 gold coins. If a coin is selected at random from one box, what is the probability that it is a gold coin?
13. Suppose there are two bags with first bag contain 3 white and 2 black balls, second bag contains 2 white and 4 black balls. One ball is transferred from bag I to bag II and then a ball is drawn from the latter. It happens to be white. What is the probability that the transferred ball is white?
14. A problem in statistics is given to 3 students A,B and C whose chances of solving it are  $\frac{1}{2}$  ,  $\frac{3}{4}$  and  $\frac{1}{4}$  respectively. What is the probability that the problem will be solved?
15. Two players A and B alternatively throw a pair of die. A wins if A throws 6 before B throws 7 and B wins if B throws 7 before A throws 6,. If A begins, then find the probability that A wins.

## Part 2, Paper-III, Numerical Methods and Algorithms

1) a) What do you mean by convergence test in Gauss seidal method?

b) Solve the equations using Gauss Seidal method?

$$3x+20y-z=-18, 2x-3y+20z=25, 20x+y-2z=17$$

c) What is percentage error and relative error? Compute y (1) correct up to 4 decimal places by R-K 4<sup>th</sup> order method for the differential equation  $dy/dx=x+y$ , where  $y(0)=1$  and  $h=0.05$ . [2+6+6]

2. a) Find the smallest root of the equation  $e^{-x} = \sin x$  up to 4 decimal places using Newton Raphson method.

b) Solve the following system of equations using Gaussian elimination method:

$$x+y+z=9, 2x-3y+4z=13, 3x+4y+5z=40$$

c) Find a root of the equation  $x^3-3x-5=0$  by Regula Falsi method up to 3 decimal places. [5+5+4]

3.a) Find a real root of the equation  $x^3-4x-9=0$  using bisection method in 4 iterations

b) Find the inverse of the following matrix using Gauss Jordon method

$$\begin{pmatrix} 3 & -1 & 1 \\ -15 & 6 & -5 \\ 5 & -2 & 2 \end{pmatrix}$$

c) Compute the value of  $\int_0^{\pi/4} dx/(1+x^2)$  using composite Trapezoidal rule with 10 subintervals and compare it with the exact value. [4+4+6]

4) a) The function  $y=\sin x$  is tabulated as given, find the value of  $\sin \pi/3$ . Correct upto 5 decimal places.

x	0	$\pi/4$	$\pi/2$
$\sin x$	0	0.70711	1.0

b) Compute  $y(1.1)$  correct upto 5 decimal places using Taylor series method when  $y(x)$  satisfies the equation  $dy/dx= xy$  with  $y(1.0)=2$ . [4+4]

5) a) Find the value of  $f(6)$  using the following table. Correct upto 5 decimal places

X	0	1	2	3	4	5
f(x)	41	43	47	53	61	71

b) Use Euler's method evaluate  $y(1.5)$  correct upto 3 decimal places from  $dy/dx = 1/2(x+y)$  with  $y(0)=2$  taking  $h=0.5$  .[4+4]

6)a) Solve the following system by Gaussian Elimination method:

$$x+y+z=9, 2x-3y+4z=13, 3x+4y+5z=40$$

b) Solve by Euler,s modified method ,the following differential equation for  $x=0.02$  by taking step length  $h=0.01$  and  $y(0)=1, dy/dx= x^2+ y$ [5+5]

7)a) Find a positive root of  $x+\ln x-2=0$  by Newton Raphson method correct upto 6 significant figures.

b) Derive Trapezoidal or Simpson's  $1/3^{\text{rd}}$  rule.[5+5]

8) a) Find a root of the equation  $\sin x+\cos x=1$ ,by Secant method correct upto 4 significant figures. b) Solve the following system by matrix inversion method:[5+5]

$$2x+y+z=10, 3x+2y+3z=18, x+4y+9z=16$$

9)a) Using the method of least squares, find a relation of the form  $y=ax^b$  that fits the data.

X	2	3	4	5
Y	27.8	62.1	110	161

b) Find a root of the equation  $xe^x-2=0$ , by Regula-falsi method correct upto 3 significant figures [5+5]

10) a) Derive Trapezoidal rule.(b) Applying the method of L-S find an equation of the form  $y=ax+bx^2$  that fits the following data

X	1	2	3	4	5	6
Y	2.6	5.4	8.7	12.1	16.0	20.2

c) Simpson's  $1/3^{\text{rd}}$  rule to compute  $\int 1/(1+x^2)$  correct upto 6 decimal places. Taking 11 ordinate and hence find the value of  $\int$  [5+5+5]

11)a) Using the method of least squares, find a relation of the form  $y=a+bx$  that fits the data

X	-2	0	2	4	6
Y	1	3	6	8	13

b) Check whether the following system of equations are diagonally dominant. If not, rearrange them and solve by Gauss seidal method [5+5]

$$-2x+3y+10z=32, x+10y-z=-22, 10x+2y+z=9$$

12) a) Find the inverse of matrix using Gauss Jordan method

$$A = \begin{pmatrix} 2 & 3 & -1 \\ 4 & 4 & -3 \\ 2 & -3 & 1 \end{pmatrix}$$

b) Given the following data, find  $f(1.5)$  &  $f(7.5)$  assuming it to be a polynomial of three in  $x$ . [5+5]

x	1	2	3	4	5	6	7	8
y	1	8	27	64	125	216	343	512

13) a) If the number  $x=2.45789$  and is correct upto 5 significant figures then  $\Delta x=?$  and also find relative and percentage error.

b) Prove the property  $(A+B)^T = A^T + B^T$  with an example

c) Find the sum of  $0.123 \times 10^3 + 0.456 \times 10^2$ . Write the result upto 3 significant digits. [2+2+2]

14) What do you mean by convergence of N-R method? Find the percentage error in approximate representation of  $4/3$  by 1.33. State the limitations of N-R method. [2+2+2]

15) a) Compute  $y(0.2)$  correct upto 4 decimal places using Taylor series method when  $y(x)$  satisfies the equation  $dy/dx = 1+xy$  with  $y(0)=2$  and  $h=0.2$ .

b) Find the inverse of the following matrix using modified Gauss elimination method. [4+5]

$$\begin{pmatrix} 3 & -1 & 1 \\ -15 & 6 & -5 \\ 5 & -2 & 2 \end{pmatrix}$$

- 16) a) Find the positive real root of  $x \log_{10} x = 1.15$  using bisection method.  
 b) Applying the method of L-S find an equation of the form  $y = a + bx + cx^2$  that fits the following data

X	1.0	1.5	2.0	2.5	3.0	3.5	4.0
Y	1.1	1.3	1.6	2.0	2.7	3.3	4.1

- c) Find a root of the equation  $3x - \cos x - 1 = 0$ , by Secand method correct upto 4 significant figures. [4+4+4]

- 17) a) Given the following table, find  $f(6)$  using Lagrange's Interpolation formula assuming it to be polynomial of degree 3 in  $x$

X	3	7	9	10
Y	168	120	72	63

- b) Derive the Newton's forward or backward formula. [4+4]

- 18) a) Find by suitable interpolation method, the value of  $f(2.5)$  from the following data:

X	2	3	4	5
Y	14.5	16.3	17.5	18.0

- b) Apply Simpson's  $1/3^{\text{rd}}$  rule to solve  $\int_0^6 \sin x \, dx$  using 12 intervals. [4+4]

- 19) If  $\Delta x = 0.0005$  and  $\Delta y = 0.0002$  be the absolute errors in  $x = 3.14$  and  $y = 7.43$ . Find the relative error in computation of  $x + y$ . If  $f(x) = 4 \cos x - 6x$ , find the relative percentage error in  $f(x)$  for  $x = 0$ , if error in  $x = 0.005$ . [2+2]

- 20) a) Solve the following equations using Guass Jacobi's method.

$$x - 1/4y - 1/4z = 1/2 \quad -1/4x + y - 1/4w = 1/2 \quad -1/4x + z - 1/4w = 1/2 \quad -1/4y - 1/4z + w = 1/2$$

- b) Evaluate  $f(15)$ , given the following table using Newton's difference formula: [5+5]

X	10	20	30	40	50
Y	46	66	81	93	101

21) Write the computational formulae for 4<sup>th</sup> order R-K method. What is the order of error in this procedure? Compute  $y(0.4)$ , by R-K method correct upto 5 decimal places from the equation  $dy/dx=xy, y(0)=2$ , taking  $h=0.2$  [2+2+6]

## Part 2, Paper-III, Formal Language and Automata Theory

1. (a) What do you mean by Regular Expression (RE)? (b) Write RE for each of the following languages: (i) the set of all binary strings where there are no three consecutive zeros (0). (ii) The set of all binary strings where every zero (0) is immediately followed by three or more ones (1). (iii) the set of all binary strings whose lengths are multiples of three. (c) Let  $L$  be the set of all palindromes of  $\{p, q\}$ . Construct a grammar  $G$ . (d) Define a parse tree or derivation tree for a context-free grammar (CFG),  $G = (V_n, \Sigma, P, S)$  (The symbols have their usual meaning) Illustrate with suitable example. [2+(2\*3)+4+4]

2. (a) Explain the state minimization algorithm for a DFA. Illustrate your algorithm with a non-trivial example. (b) Comment critically on the following statement - **For any NFA, there exist an equivalent DFA and vice-versa.** [(5+5)+6]

3. (a) Define Mealy and Moore Machine. (b) Construct a nondeterministic finite automaton accepting  $\{ab, ba\}$ , and use it to find a deterministic automaton accepting the same set. (c) Write a brief note on the Chomsky classification of languages. [4+6+6]

4. (a) State and prove Arden's theorem. (b) Construct a regular grammar  $G$  generating regular sets represented by  $P = a^*b(a+b)^*$ . (c) Design a Turing machine over  $\{1, b\}$  which can compute concatenation function over  $\Sigma = \{1\}$ . If a pair of words  $(w_1, w_2)$  is the input, the output has to be  $w_1w_2$ . [6+4+6]

5. (a) What do you mean by regular grammar? Find a regular grammar  $G$  that will generate the language  $L$  which consists of all words in  $a$  and  $b$  with even number of  $a$ 's. (b) Design an FSM that outputs 1, if  $k$  1's have been input, where  $k$  is a multiple of 3 and output 0 otherwise. Draw the state diagram. (c) What do you mean by a parse tree? For what types of grammars parse tree representation is possible? [6+6+4]

6. (a) When two FSMs are said to be equivalent? (b) Design an FSM that performs serial binary additions (carry bit is ignored). (c) Find DFA equivalent to the NFA for which the state table is given below and  $S_2$  is the accepting state. [2+8+6]

	a	b
S0	S0, S1	S2
S1	S0	S1
S2	S1	S0, S1

7. (a) Write the steps for converting a non-deterministic finite automaton (NFA) to deterministic finite automaton (DFA). (b) Find a grammar generating  $\{a^n b^n c^i \mid n \geq 1, i \geq 0\}$ . (c) Give a formal recursive definition of regular expression over a set of strings  $\Sigma$ . [5+6+5]



8.(a) Write a brief note on Chomsky classification of grammars. (b) Construct a context free grammar  $G$  generating all integers with sign. Use the grammar to obtain  $-35$ . (c) Design a Turing machine over  $\{1, b\}$  which can compute concatenation function over  $\Sigma = \{1\}$ . If a pair of words  $(w_1, w_2)$  is the input, the output has to be  $w_1 w_2$ . [5+(4+2)+5]

9.(a) Compare and contrast Mealy and Moore Machines. (b) What is regular expression? Why is it required? Give a regular expression for decimal fractions written as  $+123.456, -789.012, +0.3456, -78.091234$  etc. Justify your answer. (c) Consider the following grammar: ( $s$  is the starting symbol and other symbols have their usual meanings):  $S \rightarrow AB, A \rightarrow A1|0, B \rightarrow 2B|3$ . Identify the type of grammar according to Chomsky classification. Justify your answer. Find the language generated by grammar. Justify your answer. (d) What do you mean by the equivalence of deterministic and nondeterministic finite automaton. [3+(3+2+2)+(2+2)+2].

10.(a) State Arden's Theorem. (b) Construct a nondeterministic finite automaton accepting  $\{ab, ba\}$ . Convert it to a deterministic finite automaton accepting the same set. Is the deterministic finite automata state minimized? Justify your answer. (c) Design a Turing Machine  $M$  to recognize the language  $\{1^n 2^n 3^n | n \geq 1\}$ . Show all the steps clearly.

11.(a) State and prove Arden's Theorem. (b) Is  $L = \{a^{2^n} | n \geq 1\}$  regular? (c) Construct a regular grammar  $G$  generating the regular set represented by  $P = (a + a(b + aa)^* b)^* a (b + aa)^* a$ . [5+5+6]

12.(a) Construct a Mealy machine which can output EVEN, ODD according as total numbers of 1's encountered is even or odd. The input symbols are 0 and 1. Then convert it into its equivalent Moore Machine. (b) Construct a FSM that recognizes only pattern 1011. (c) Construct DFA equivalent to the grammar:  $S \rightarrow aS | bS | aA, A \rightarrow bB, B \rightarrow aC, C \rightarrow \Lambda$ . [6+5+5]

13. (a) Explain the procedure with a suitable example to convert a given non-deterministic finite automata into an equivalent finite automata. (b) Define Chomsky classification of grammars. (10+6)

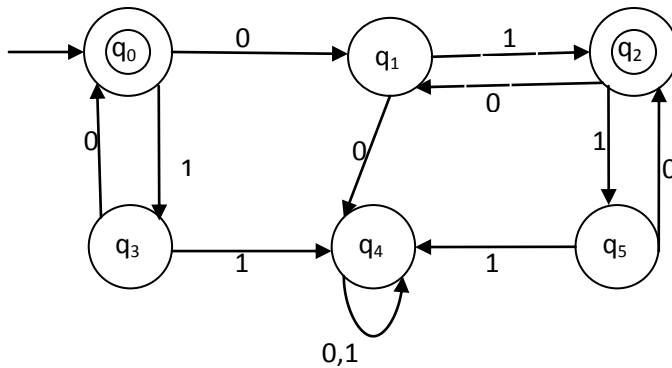
14. (a) Write a regular expression for each of the following regular grammar set (i) The set of all strings over  $\{0, 1\}$  which has at most two zeroes. (ii) The set of all strings over  $\{0, 1\}$  not containing the substring "00". (b) Let  $L$  be the set of all palindromes over  $\{a, b\}$ . Construct  $G$  generating  $L$ . (c) Let  $G = (\{S, A_1, A_2\}, \{a, b\}, P, S)$  Where  $P$  consists of  $S \rightarrow AA_1 A_2 a, A_1 \rightarrow ba A_1 A_2 b, A_2 \rightarrow A_1 ab, a A_1 \rightarrow baa, b A_2 b \rightarrow abab$ . Test whether  $w = baabbabaaabbaba$  in  $L(G)$  [(2+2)+8+4].

15. (a) Explain NFA with an example. How does it differ from DFA? (b) A FSM is given by :  $\delta(q_0, 0) = q_2, \delta(q_0, 1) = q_1, \delta(q_1, 0) = q_3, \delta(q_1, 1) = q_0, \delta(q_2, 0) = q_0, \delta(q_2, 1) = q_3, \delta(q_3, 0) = q_1, \delta(q_3, 1) = q_2$ , where  $Q = \{q_1, q_2, q_3, q_4\}, \Sigma = \{0, 1\}, F = \{q_0\}$ . The symbols have their usual meanings. Justify whether or not the strings 101101 and 11111 are accepted by the above FSM. (c) Represent the following set by regular expression:  $\{a^n | n \text{ is divisible by 2 or 3 or } n=5\}$  [(4+2)+(3+3+4)].

16(a) Define DFA and NFA. Let L be a language accepted by a NFA. Show that there exists a DFA that accepts L? (b) Construct NFA accepting the language  $\{a^i b^j, i, j \geq 0\}$ . Then find an equivalent DFA. Obtain a regular grammar generating the same language. [8+(6+2)]

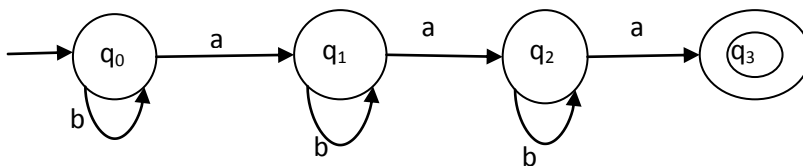
17.(a) Define a Turing machine and the notion of Turing computability. (b) Give a regular expression for representing the set L of strings in which every 0 is immediately followed by at least two 1's. Check whether that regular expression  $R = \epsilon + 1^*(011)^*(1^*(011)^*)^*$  also describe the same set of strings or not. (c) Write a brief note on Chomsky classification of grammars. [4+6+6]

18. (a) Construct the minimum state automaton for the given transition diagram:



(b) Write down the regular expression for the following expression: (i) the set of all strings that begin or end with 00 or 11 (ii)  $L = \{a^n b^m \mid n \geq 1, m \geq 1, nm \geq 3\}$  (iii)  $\Sigma = \{0, 1, 2\}$  which contains at least one '1' and at least one '2' (iv)  $L = \{a^n b^m \mid n \geq 3, m \leq 2\}$  (v) the set of strings of 0's and 1's in which either the strings are all 0's or else there is a single 0's followed by some 1's [8+(1+2+2+2+1)]

19. (a) State and prove ARDEN's theorem. (b) Find regular expression for the given diagram



© Construct DFA for equivalent  $RE = (0+1)^*(011)$  [(2+6)+4+4]

20.(a) Construct a FSM that recognizes the only pattern 1011 (b) Construct a DFA equivalent to the grammar:  $S \rightarrow aS \mid bS \mid aA, a \rightarrow bB, B \rightarrow aC, C \rightarrow \Lambda$ . © Construct a Mealy machine which can output EVEN, ODD according as the total number of 1's encountered is even or odd. The input symbols are 0 and 1. Then convert it into its equivalent Moore machine. [5+5+6]

21. (a) State and prove Arden's theorem (b) Write down the regular expression for the following expression:

(i) the set of all strings that begin or end with 00 or 11 (ii)  $L = \{a^n b^m \mid n \geq 1, m \geq 1, nm \geq 3\}$  (iii)  $\Sigma = \{0, 1, 2\}$  which contains at least one '1' and at least one '2' (iv)  $L = \{a^n b^m \mid n \geq 3, m \leq 2\}$  [2+6+2X4]

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will appear in memory using chaining method?(4+3+2+3)

Record: A,B,C,D, E, X, Y, Z

H(k) : 4, 8, 2, 11, 4, 11, 5, 1

13) Explain internal and external nodes with proper example. Suppose there are 8,13,14,15 nodes in four different binary trees, which of them could have formed a full binary tree? Justify your answer. (2+4)

14) )”Any comparison based algorithm to sort 4 elements requires 5 comparisons”-Comment on the line critically. Explain Radix sort with an suitable example.(2+6)

15) What do you mean by threaded binary tree? How is a binary tree threaded for in-order traversal ? What do you mean by almost complete binary tree. Define with an example. Explain internal and external nodes with proper example. (2+2+2+2)

16) Discuss different ways of representing a binary tree and suggest an application for each of the representations. Suppose the following list of letters are inserted into an empty binary search tree: J,R,D,G,T,E,M,H,P,A,F,Q Find the final tree T and find the inorder traversal of T.(5+2+1)

17) In a circular queue represented by array, how can you specify the number of elements in the queue in terms of FRONT,REAR,MAXQ. Write a function to delete a node having given value n from a single linked list.(3+5)

18) Discuss the disadvantages of liner probing. Explain open addressing technique. What should be the characteristics of a hash function? Explain chaining method. Demonstrate insertion of the keys 5,28,19,15,20,33,12,17,10 into a hash table with separate chaining based collision resolution strategy, let the table have a slot and use the division hash function.(2+4+4+2+4)

19)Compare and contrast among array, stack, linked list and queue with proper example. Describe a node structure in a circular linked list. Write the algorithm to create a circular linked list. (6+2+4)

20) All complete binary trees are strictly binary tree, but vice versa is not true always, justify your answer with proper example. What will be the maximum number of nodes in a binary tree of depth 7(assuming depth of root is 1) Form a binary tree using the following preorder and post order expression. Preorder: g,b,q,a,c,k,f,p,d,e,r,h; Postorder:q,k,f,c,a,b,e,h,r,d,p,g (4+2+2)

21)Define an algorithm and explain its characteristics. How it is related with big O notation? How many comparisons is required to locate a data item using binary search techniques of a list of 1000 data items.(4+2+2)

22) Write down an algorithm to push an element into the stack. Write the following infix expression into postfix using stack:  $a*(b+d)/e-f*(g+h/k)$  (5+3)

24) Why hashing is more beneficial than other indexing method? Sort the following elements using quick sort, explain briefly:44,33,11,55,77,90,40,60,99,22,88,66.Among quick and heap sort, which is better according to you? Explain in details. (2+2+3)

25. Define a B-tree of order K. Insert the following records in sequence of B-tree of order 3. Show each steps of insertion.  $P_{leaf}=2,8,5,1,7,3,12,9,6$  (5)

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## Part 2, Paper-IVA Programming through C Language

1.(a)A stack is to be implemented using array. The associated declarations are: `int stack[100]; int top=0;` Write steps to perform push operations(b) Do you think Computing Fibonacci series is suitable for being implemented by recursion or iterations? Give reasons. (c) Write a program to implement non-recursive merge sort algorithm.[7+2+5]

2.(a)Write a program that contains an array of pointers to some strings. Your program is supposed to search out string with maximum length. (Suppose a pointer is holding the starting address of an array. Write a short program and pass the pointer to a functions to increment the pointer so that any arbitrary element within the array can be accessed according user's choice.(c)Do you think macros are sometimes advantageous over functions in C program? Explain with suitable example. [6+4+4]

3.(a)Explain an efficient way to store a sparse matrix in memory.(b) If an array is passed to a function and some of its elements are modified by the function, are these alterations be identified in the parent program? Explain.(c) What is the purpose of extern variable? State the differences between an extern variable declarations and definition.[7+3+(2+2)]

4.(a)Write a C program to count the total no, of 1's in the binary representation of an integer.(b) Write a program in C to check whether a five digit integer is palindrome or not.[Your program should check the validity of integer](c)what do you mean by function pointer ? [6+6+2]

5.(a)What do you by storage class of a variable? Explain with suitable examples.(b) Discuss break and continue statements with suitable examples.(c)What is register variable?[6+6+2]

6.(a)Convert the following function into a recursive functions:

```
void main(int val){  
    int i;  
    for(i=1;i<val;i++)  
        printf("Value-%d",i);  
}
```

(b)Write a function in C that accepts a 'float' arguments and returns the string equivalent of it.(c)Illustrate any four different types of operators in C with suitable examples.[4+6+4]

7.(a)Write a program in C to check whether the bit pattern of a given integer variable is palindrome or not.(b)What is the purpose of macro? Explain with suitable examples. (c)What is type casting? Why is it necessary?(d) Explain how for loop can be implemented using while loop.[6+3+3+2]

8.(a)What is pointer? Discuss the pointer arithmetic. (b)Write a program to copy the content of the source string the destination string without using strcpy library function(c)What is static variable? What is difference between static variable and external variable (d)what is the purpose of malloc function? Write down the difference between malloc and calloc function.[3+4+4+3]

9.(a)What is the difference between structure and union? Explain .(b)Consider the following structure declaration:

```
struct nd
```

```
{
```

```
    int x; int y;
```

```
}
```

```
typedef struct nd complex;
```

write three functions called sum, mult and show that will add two complex numbers, multiply two complex numbers and display the complex number in (x+iy) form respectively.(c)Write a c program that will take the name of a text file from command line and will print all the words starting with a vowel into another file named vowel.txt.[2+6+6]

10.(a)A break statement is used to exit a loop or a switch case structure. What happens if the break statement is used outside any such construct? Differentiate between break and continue statement with example.(b)Why do unconditional jumps have to be avoided in the programs?(c) Why a structure is called a heterogeneous data type? Explain the concept of self referential structure with an example. (d)When and why do we get the error message 'L value required' in function main()? [4+2+4+4]

11.(a)Are the expression  $x[m+n]$  and  $m+n[x]$  equivalent? Give reasons for your answer.(b)What is the output of the following code segment:

```
#define min((x,y)((x)<=(y))?(x):(y))
```

```
#define max(x,y)((x)>=(y))?(x):(y)
```

```
int a=14,b=21,c=54,d=45;
```

```
printf("Large-%d\tSmall=%d\n",max(c,d)-1,min(a,b)=1)
```

(c) Distinguish between struct and union in C. (d) Using bit wise operator write a function to count the numbers of 0's in the binary representation of an integer. Your program should have proper documentations/comments [3+4+2+5]



12.(a) Write a C like algorithm to find the Least Common Multiple(LCM) of two positive integers. One way to achieve this is to find the Greatest Common Divisor(GCD) of the integers and divide the product of the integers by this GCD. Write algorithm to find LCM directly without the use of GCD. (b) What type of problems may occur (if any) with the following C – code segments. Explain briefly in each case:

```
(i) int x[SIZE],*pi;
```

```
for(pi=&x[0],pi<&x[SIZE];)
```

```
    *++pi=0;
```

```
(ii)int getmax(int x[10]){
```

```
    int j,max=x[0];
```

```
    for(j=1;j<10;j++)
```

```
        If(x[j]>max)
```

```
            max=x[j];
```

```
    return max;
```

```
}
```

©Write a C program to print the name of your program. That is, the name of the program that it is executing.[5+(3+3)+3]

13.(a)Give the output of the following C program segments and justify how the output is obtained

```
#define PRINT(int) printf(“int=%d\n”,int)
```

```
#define PRINT(x,y,z) print(“x=%d\ty=%d\tz=%d\n”,x,y,z)
```

```
main(){
```

```
    int x=1,y=1,z=1;
```

```
    x+=y+=z;PRINT(x<y?y:x);
```

```
    x=y=z=-1;++x||++y&&++z;
```

```
    PRINT(x,y,z);
```

```
    x=y=z=1;++x&&++y||++z;
```

```
    PRINT(x,y,z);  
}
```

(b)What is expected to happen when the following C code is executed on two given integers A and B. Justify how you achieve to the conclusion,

```
A=A^B;
```

```
B=A^B;
```

```
A=A^B;
```

(c)Write a program using C to compute the roots of a quadratic equation  $ax^2+bx+c=0$ , given the values of a, b and c.

(d)Given the follows:

```
Char *message="Be with God";
```

```
Char message[]="Be with God";
```

How do the above definitions differ?[5+3+6+2]

14.(a)Distinguish between a variable and a constant in C. Explain the difference between variable definition and variable declaration with suitable examples.(b)Write a recursive function that returns the Greatest Common Divisor(GCD) of its two positive arguments(positive integer)(c)"C does not do boundary checking on the elements of an array"-Do you agree with this statement? Explain how an array references is resolved by C.(d)Write a C function that accepts a 'float' argument and returns the string equivalent of it.[3+5+3+5]

15. (a)What are different storage class in C? What does it define? Explain each storage class together with their use. (b) What is the meaning of `#include<stdio.h>` and why this line is to be given in a C program?(c) Write a complete C program that reads an integer from standard input device and outputs the number of 1's in its binary representations to a standard output device. Note that if the integer read is negative then 2's complement will be considered as its binary representation.(d)An integer is divisible by 11 if the sum of the digits in odd position equates to the sum of the digits in even position of the integer. Write a program in C to find whether a given integer is divisible by 11 following above rule [(1+1+3)+(1+1)+5+4]

16. Answer any two questions from (i),(ii),(iii),(iv) and answer (v) as compulsory:

(i)What will be output after execution?

```
int i=0;
```

```
while(i<5){
    if(i<3){
        i+=2;
        printf(“%d\n”,i);
        continue;
    }
    else{
        printf(“%d\n”,++i);
        break;
    }
}
printf(“loop terminated.....\n”);
}
```

(ii) Consider the program segment:

```
main(){
    int a=1,b=2,c;
    c=f1(a*b)+f2(a*b)+f2(b);
}

int f1(int a){
    int b=0,n=0;
    n+=a;
    return b;
}

int f2(int b){
    static int a=1;
    a+=b;
```

```

        return a;
    }

```

What will be the value of c after execution of the above program?

(iii) With respect to the following program segment, Write whether the subsequent remark are true or false:

```

typedef struct{
    int month,day,year;
    }data;
struct{
    int acc_no;
    char acc_type,name[80];
    float balance;
    data lastpaymentl
    } customer,*pc=&customer;

```

(a) customer.balance and (\*pc).balance refer to the same value.

(b)\*(customer.name+2) and customer.name[2] both refer to pc->(name+2).

(c)\*((\*pc).name+2) refers to the second character of customer's name.

(iv)When not to use recursion?-Discuss.

(v)Evaluate  $(3 < 4) ? (5 < 6) ? 1 : 2 : (10 > 8) ? 3 : 4 [3 \times 2 + 2]$

17.(a)In a 2D Cartesian coordinate system, a point has two components namely(abscissa, ordinate). A line is an object connecting two such points. Using C structures how do you represent a point and a line. Write a function in C that accepts a line structure and returns 1, if the line is horizontal,2, if the line is vertical,3, if the line is oblique(b) The Euler's number ,e is used as the base of natural logarithm. It can be approximated using the formula:

$e=1+(1/1!)+(2/2!)+(3/3!)+\dots\dots\dots+(n/n!)$ . Write a program that approximates e using loop that terminates when the difference between two successive values of e differ by less than 0.000001.[7+7]

18.(a)What would be printed from the following program segment:

```

void main(){
    Char c[]="programming",*p;
    int i;
    for(p=&c[5];p>=&c[0];p--)
        printf("%c",*p);
    printf("\n");
    for(p=c+5,i=0;p>=c;p--,i++)
        printf("%c",*(p+i));
}

```

(b)Write a function that, given a string, a width and an empty string for output, centers the string in the output area. The function is to return 1 if the formatting is successful and 0 if any errors such as string length greater than width are found. (c) What will be the output of following c code?

```

int x=0,y=0,z=1;
if(z=y){
    y++;z--;
}else
    --x;
printf("%d\t%d\t%d",x,y,z);[4+8+2]

```

19.(a)Write a function that returns number of days between two dates, which are accepted by the function as its arguments.(b)**Whatever we can do using an array can also be achieved using pointers in C**-Justify the statement with suitable examples. What benefits result if we do so?(c)Write a function that uses bitwise operators to print the binary representation of an integer number[6+4+4]

20.(a)Write a program in C to eliminate multiple spaces in a string. For example, a string such as "The quiz was great !!!" to "the quiz was great!!!".(b)If the standard input is **part**. Then what will be the output of the following program?

```
#include<stdio.h>
```

```

main(){
    mystery();
}
mystery(){
int c;
if((c=getchar())!=EOF){
    mystery(); putchar(c);
}
}

```

(c) Define the output of the following program segment

```

#define PRINT(x,y,z) printf("x=%d\ty=%d\tz=%d",x,y,z)
main(){
int x,y,z;x=y=z=1;++x||++y&&++z;PRINT(x,y,z);
x=y=z=1; ++x&&++y||++z; PRINT(x,y,z);
x=y=z=-1; ++x&&++y||++z; PRINT(x,y,z);
x=y=z=-1;++x||++y&&++z; PRINT(x,y,z);}[6+4+6]

```

21.(a) Write a program in C to find roots of a quadratic equations  $ax^2+bx+c=0$ , where values of a, b and c are given (b) Write a recursive function that returns the greatest common divisor of its two arguments (positive integer) (c) Give the output and specify error if any for following C code:

```

#define multiply(a,b) a*b
main(){
    int a=4,b=2;
    printf("%d",multiply(a+b,a-b));
}[7+5+4]

```

22.(a) "C does not do boundary checking on the elements of an array"-Do you agree with this statement? Explain how an array reference is resolved by C (b) Consider the following:

- (i) four integer variable **d**, **m**, **y** and **yd** is defined within main functions.
- (ii) Read the values of **y(year)**, **yd(day of that year)** inside main
- (iii) Write a function to compute **d(date)** and **m(month)** for these values of **y and yd**.
- (iv) Print the values of **d** and **m** for main function

For example, if y=2007 and yd=61 then d should be 2 and m should be 3 that is 2<sup>nd</sup> march, 2007 is the 61<sup>st</sup> day of the year. (leap year should also be considered) (c) What is the meaning #include<stdio.h> in C program? [4+8+4]

23.(a) Write a complete program in C that asks the user to enter a list of integers. The program has to output the largest value entered and the number of time it was entered (b) Write a program in C that asks the user to enter an integer and check if it is an odd (using bitwise operators). If the entered number is odd then outputs number of 1's in its binary representation (using bitwise operators). otherwise out the integer is even. (c) In the following program, how can you print 11 using 'ptr'?

```
void main(){
    int arr[]={-2,5,0,29,11,7,10};char *ptr;ptr=(char*)arr;
}
```

(d) What is the purpose of rewind() in C programming? How can you achieve the same effect of rewind() by fseek() function? [6+6+2+2]

24.(a) Write a program that reads an integer from the keyboard and then calls a recursive function print it out in reverse. For example the user enter 4762, it prints 2674. (b) Write a C function that reads two positive integers and output the LCM of these integers. (c) Give C-type declaration for each of the following situation in C (i) an array of pointers (ii) a pointer to an array (iii) a pointer to a function (iv) a function returning pointer [8+4+4]

25.(a) What do you mean by storage class in C? Clearly explain the differences between **static** and **extern** storage classes. (b) Suppose that x, y, and z are variables of type **float** in a program. If these variable has the values 1.1, 2.2, 3.3 respectively, then the statement PRN3(x,y,z);

Should cause the line

X has value 1.1 and y has value 2.2 and z has value 3.3 to be printed, Write the macro definition for PRN3() (c) Use a do-while loop to compute the sum of every third integer beginning with 2 for all integers less than 100 that is the summation of 2, 5, 8, 11, ..... etc [8+4+4]

26.(a) What does the following algorithm approximate? Assume m>1 and e>0

```
X=m;y=1;
```

```
While(x-y>e){
```

```
    X=(x+y)/2; y=m/x;
```

```
}
```

```
Print(x);
```

Choose and justify your answer from any of the following:

(i)  $\log m$  (ii)  $m^2$  (iii)  $m^{1/2}$  (iv)  $m^{1/3}$

(b) Distinguish between a variable and a constant in C. Explain the difference between variable definition and variable declarations with suitable examples. (c) Write a C function that accepts a 'float' argument and returns the string equivalent of it. [5+(1+3)+7]

27(a) What is the difference between: (i) `printf()` and `fprintf()`. (ii) function and macro. (iii) union and structure (b) Write a program that inputs several numbers in a file called "data" and store odd and even numbers in separate files namely "odd" and "even" respectively. Also show the content of every file. [3+3+3+5]

28. What will be output and why? [2X7=14]

(i) `void main(){`

```
printf("%d"); printf("tim");
```

```
}
```

(ii) `void main()`

```
{ char x,y,z; printf("%d",scanf("%c %c %c",&x,&y,&z));
```

```
}
```

(iii) `int incr( int i){`

```
    static int count=0;
```

```
    count=count+i;
```

```
    return count;
```

```
}
```

```
void main()
```



```

{   int i,j;
    for(i=0;i<=4;i++)
        j=incr(i);
    printf("%d",j);
}

```

```

iv) void main(){
    char x[]="whatisit";
    char *y="whatisit";
    puts(x);    puts(y);
}

```

```

v)void main(){
    for(int i=0;i<10;i++)
        printf("%d ",i&1);
}

```

```

vi)void main(){
    int a=5,*b=&a;
    printf("%d",a*b);
}

```

```

vii)void main(){
    while(printf("%d",printf("az")))
        printf("by");
}

```

29.a)What is a pointer value and address, explain it with example(b)Briefly describe the storage class and storage variables (c)What do you mean by size of operator? Can this operator be used to tell the size of an array passed to a function(d)What is an argument? Differentiate between formal and actual argument.(e)What do you mean by predefined macros? Is it better to use a macro or a function?[2+4+(2+1)+(1+2)+2]

30a) What will be the output, explain. (2×2=4)

```
i) main(){
    int i=0,sum=0,x;printf("Enter a number");scanf("%d",&x);
    while(i<10)
        {
            Sum+=x*x;
            i++;
        }
    Printf("Sum=%d",sum);
}
```

```
ii) main(){
    int x=4,y=0,z;
    while(x>=0){
        if(x==y)
            break;
        else
            printf("\n%%d",x,y);
        x--;
        y++;
    }
}
```

b) State true or false: (3×1=3)

i) When you pass an array as a parameter to a function, the entire array is copied and is available to function .

ii) Is the array declaration and initialization correct: `int a[2][2]={ 1,2,3,4}`

iii) All structures elements are stored in contiguous memory locations

c) What is recursion? Write an example in c using recursion.(3)

d) Point out the error, if any: (2)

```
i) main(){int a;a=message();
    }
    message(){
        printf("Vivekananda college");return;
    }
```

e) Write the differences between structure and union.(2)

### Part 3, Paper-V, Microprocessor and Computer Organization II

1.(a)What is interrupt?(b) What are various interrupt line of 8085?Discuss their main features.(c)Explain how we allow multiple devices to interrupt using INTR line[2+12+2]

2.(a)How many machine cycles are required for the instructions-(i)MOV $r_1, r_2$  (ii)MVI r, data (iii)LXI rp, data Justify your answer.(b)Explain the requirement of stack pointer register while executing subroutines.(c)How may register pairs are there in 8085?(d) Compare and contrast between PUSH and POP operations[6+2+2]

3.(a)Show the interfacing circuit of 32 memory chips of size (2KX8) with 8085 microprocessor. Find out the starting end address of the memory area occupied by each memory chip. (b)If the speed of I/O devices do not match the speed of the microprocessor, what type of data transfer techniques are used?(c) What are the differences between- (i)Burst Mode DMA data transfer and (ii) Cycle stealing technique of DMA data transfer ?(d) If the clock frequency is 5 MHz, how much time is required to execute an instruction of 18T states?[8+2+4+2]

4.(a)Briefly describe how a DMA data transfer is performed in a computer system with suitable block diagram(b)What do you mean by virtual memory?(c)Briefly explain the hardwired control approach to control design.(d)What do you mean by polling?[6+2+6+2]

5.(a)Explain the function of the following program:

```
MVI A, 07H
ORA A
JM OUTPUT
OUT 01H
OUTPUT: CMA
ADI 01H
OUT 01H
HLT
```

(b)What is meant by micro-instruction? Explain parallelism in microinstruction and state its advantages.(c)What are meant by vector interrupts? State the instructions required to unmask and enable the 8085 TST 6.5 interrupt input.[4+2+(4+2)+(1+3)]

6.(a) With proper illustrations explain how the bus AD7&-AD0 is demultiplexed in 8085(b) Explain the role of Flag register in 8085.What is program counter? Explain in detail(c)Show the timing diagram of opcode fetch operation[5+(5+2)]

7.(a) Draw the timing diagram of IN instruction (b) What are the uses of NOP operation? (c) Explain the function of the following instructions (i) XCHG (ii) OUT (d) How many T states are required to execute the following 8085 instructions?

MVI B, OFH

START: DCR B

JN Z START [6+2+(2+2)+4]

8.(a) Write an assembly language program in 8085 to find the second maximum among the ten numbers stored in memory location without using sorting method. (b) Write an assembly language program in 8085 to find out how many positive numbers, negative numbers and zeros in a data set. The numbers are stored in memory (c) Draw a diagram for interfacing a 4X4 matrix keyboard. **Or** What are the differences between 8085 and 8086 microprocessors? [6+6+4]

9.(a) Why is address bus of 8085 MPU used in multiplexed way? What is the purpose of demultiplexing the bus? How can it be done? (b) What are the conditions under which the WAIT and HOLD states are introduced in the 8085? What is meant by micro-instructions? (c) What is the significance of RST 5.5, RST 6.5 and RST 7.5 interrupts? [(2+2+4)+(4+2)+2]

10.(a) Compare and contrast memory mapped and I/O mapped I/O. (b) What are the differences between hardwired control and micro programmed control schemes? (c) Distinguish between synchronous and asynchronous mode of data transfer. (d) What do you mean by 'instruction set completeness'? (e) What is DMA? Compare and contrast the alternative forms of DMA. [4+3+3+2+4]

11.(a) Explain what is a subroutine and a nested subroutine. (b) How parameters be passed from the main program in an 8085 MPU to a subroutine? Explain the process of passing a return value to the caller. [6+(6+4)]

12.(a) Explain Booth's algorithm for 2's complement multiplication. (b) Write down the binary representations of decimal number 345.299, assuming IEEE 754 single precision and IEEE 754 double precision format (c) Describe in detail one technique for performing floating-point division in a digital computer. [6+4+6]

13(a) How do you justify the usage of cache memory? (b) Briefly explain the different address mapping methodologies of cache memory (b) What is virtual memory? (c) What are horizontal and vertical micro-programming? Write micro-program routines in RTL (register transfer logic) notation for (i) ADD (ii) STORE (iii) FETCH [2+4+2+(2+6)]

14. Answer the following with respect to the 8085 processor: (a) What is the purpose of the ALE signal? Illustrate with a schematic diagram how 16-bit address and 8-bit data bus can be

generated using ALE for the purpose of interfacing an external device.(b)How can the READ signal be used to extend a READ or WRITE machine cycle?(c)What happens when the RESET signal is activated? Suggest a simple circuit for power-on reset. (d) It is required to interface a few I/O ports using memory mapped I/O technique. Will the IO/M signal be required for the purpose? Justify your answer [(2+3)+3+(3+2)+3]

15.(a)Draw and explain how 16 bit address bus is generated outside 8085 micro processor.(b)Draw a simple circuit to decode three controls signals RD, WR, IO?M and to produce separate read/write control signal for memory and I?O device.(c)Analyze the program and find the content of Accumulator and PSW after execution:

```
MVI A, 07H
RLC
MOV B,A
RLC
RLC
RLC
ORA B[6+4+6]
```

16.(a)Answer the following: (a)It is required to interface four 16 bytes RAM chips with the microprocessor. Assume the memory chips have separate address and data line. Show how the chips can be interfaced with the 8085 microprocessor and also mention the range of address that will be mapped onto the four chips(b)A memory block starting from the address 1800H to 1900H contains some data It is required to move the block of data to the memory block starting from address 18A0H(note that the source and destination blocks have overlapping address).Write an 8085 program segment to achieve this.(c)How many clock cycles are required to execute the following 8085 instructions?(i)MOV B,C (ii) MVI A,12H (iii) RET[7+6+3]

17.(a)Define instruction cycle.(b)Draw and explain the timing diagram of i/o write cycle,(c)Interface one 1KB EPROM and one 1KB RAM to microprocessor 8085 using 74LS138 or any other decoder having address 0000 to 03FFH for EPROM AND 0400-07FF.[2+8+6]

19.(a)Answer the following: (a)What is cache memory? Derive an expression for the expected speedup in memory access time when cache memory is used. Make relevant assumptions. (b)Show a schematic diagram for interfacing a 4X4 matrix keyboard to a microprocessor based system through I/O ports, and hence explain how the event of a key press can be detected.(c)For the 8085, what happens when the HOLD signal is activated. Suggest one typical application of same [(3+3)+7+5]

20.(a) Define programmable and non-programmable registers with examples(b) What is the function of W-Z register pair?(c)Mention three parameters in terms of which peripheral I/O and

memory mapped differ. Discuss their merits and demerits. (d)JMP, CALL and PCHL all are unconditional jump instructions, Distinguish between them [3+2+(3+5)+3]

21(a) 32 double-byte unsigned numbers are stored from address 3050H inwards. Write an assembly language program in 8085 to compute the average of the numbers, and store the result in memory locations 2080H and 2081H (b) In the following, after the POP instruction is executed, what are the contents of ZERO, CARRY and PARITY flags? Assume that the contents of memory locations 2055H and 2056H are 32H and 29H respectively.

```
LXI SP, 2055H
```

```
POP PSW
```

© Draw a schematic diagram to interface a 4X4 matrix keyboard to two input/output ports of a 8085 based microprocessor kit, and hence write an assembly language code segment to detect whether any key has been pressed or not. Make relevant assumptions.[6+4+6]

22.(a)State for main differences of the 8086 microprocessor with respect to the 8085 microprocessor. (b)There are four I/O devices that are to be interfaced with the 8085 microprocessor through the INTR interrupt line. The address of the corresponding interrupt service subroutines are 3050H, 4000H, 5050H and 6021H respectively. Show a schematic diagram of the necessary interfacing circuits, and also explain how the interrupting source can be detected and a branch to the appropriate service routine can take place.(c) Consider the main memory of size 1 Mbytes and a cache memory of size of 64 Kbytes, The cache management uses set associated mapping, with 512 bytes cache block, size and 4 cache blocks per set. State how the CPU address that will be generated will be used to identify the set, block within the set and the byte offset.[4+8+4]

23.(a) What is the use of USART? What are different modes of operation of DMA controller? (b)What is the use of keyboard and display controller? (c) Compare and contrast the interrupts of 8085 microprocessor.(d)Explain the read and write operations with suitable timing diagrams(e)Describe the Minimum Mode Configuration System 8086 with a neat block schematic diagram.[3+3+3+3+4]

24.(a) A simple accumulator based processor has an accumulator(A), a program counter (PC), a temporary register(T), a memory address register(MAR) and a memory data register(MDR) and other standard registers. Draw a schematic diagram for the processor showing the data paths. Hence write down the microinstructions to implement the following assemble level instructions:

(i) ADD 2000H//Add content to memory location 2000H to accumulator A

(ii)JUMP 3050H//Jump to memory location 3050H

(b)Draw a schematic diagram for interfacing an external I/O device to the processor and memory using direct memory access (DMA)(c)A disk unit wants to transfer a 16 Kbyte data block from

disk to memory using DMA mode of transfer. Clearly state the different steps that would be required to carry out the transfer. [(2+6)+4+4]

25.(a)The 8085 microprocessor has 16 address and 8 data lines, with the lower-order 8 bits of the address multiplexed with the data lines, It is required to interface the 8085 with a 64Kbytes memory chip which has separate address and data lines. Show a schematic diagram for the connection, showing only the relevant signal lines.(b)It is required to connect four 4KX4 memory chips to design a 8KX8 memory module. Show the detailed schematic diagram for the connection, clearly stating any assumptions you make. Assume that the address and data lines of the memory chips are separate (non-multiplexed)(c)What are the differences between memory mapped I/O and I/O mapped I/O [6+6+4]

26.(a) It is required to add two 16-digit BCD numbers, Assume that the first number is stored from address 2000H onwards (least significant byte first) and the second number is stored from address 2020H onwards (least significant byte first). Write an assembly language program in 8085 to perform BCD addition of the two numbers, and store the sum from address 2030H onwards (least significant byte first)(b)State three uses of the NOP instructions, (c)The following 8085 program is loaded from memory address 3050H

```
LXI SP, 30FFH  
CALL 3053H
```

Explain what will happen if the program is executed from address 3050H (d) Assume that the accumulator contains 7AH and register B contains B\*H, What will be the contents of the accumulator, and the flags Z and CY, when the following instruction is executed?

(i)SUB B (ii)XRA A (iii)ORA 8FH

(e)Explain the difference between direct addressing, immediate addressing and register indirect addressing. [6+1+3+3+3]

27.(a)What is an interrupt service subroutine (ISS)? Clearly explain stepwise how an ISS is invoked after an interrupt signal is received on the INTR line of the 8085?(b)Explain the set associative cache mapping technique with the help of a diagram(c)Define cache hit ratio, If the access times of the main memory and the cache memory are 50 nanoseconds and 10 nanoseconds respectively, and the cache hit ratio is 0.96, what will be the effective memory access time?(d)For an I/O device that can transfer blocks of data at very high speed there are two alternate methods of data transfer: using interrupt-driven mode and using DMA transfer mode. Which of the two alternatives would you choose and why? [5+5+3+3]

28.(a)The mantissa of the floating-point representation of a number is typically represented in normalized form. What do you mean by normalization of mantissa and why is it necessary? (b) Represent numbers (-125) and (/78 in 8-bit 2's complement form and hence carry out the subtraction (-125)-(-78). (c)State Booth's Algorithm to multiply two integers using 2's

complement method. Why is it considered to be faster than normal shift-and-add multiplication?(d) Illustrate Booth's algorithm by multiplying (-18) and (+12), where the numbers are represented in 6 bits.[4+3+5+4]

29.(a)There are four registers R1,R2,R3,R4 and an arithmetic unit in a processor. It is required to implement three instructions DUMMY1, DUMMY2 and DUMMY3, with the following interpretations:

- (i) DUMMY1-           R1<- R2+R3  
                          R4<- R1+R2
- (ii) DUMMY2-          R1<- R3-R2  
                          R4<- R4-R1
- (iii) DUMMY3-         R1<- R2  
                          R3<- R2  
                          R4<- R2

Assumes that only one register transfer operation can take place in a single clock cycle. Design a hardwired control unit to implement the above three instructions

(b)How the parallelism in microinstructions is typically handled in a micro programmed controller? What is the difference between horizontal and vertical microinstructions formats? (c) Draw the schematic diagram of a 2's complement adder/ subtractor, using a normal parallel adder and gates as a basic building blocks.[8+(2+2)+4]

30.(a)Draw the block diagram of 64KB MOS IC memory which is organized as 4096 words, 16 bits per word (b)What are the advantages of a bipolar memory over MOS memory?(c) What are the differences between dynamic and static MOS memory(d)Explain seek and latency time for disk memories [8+2+2+4]

31(a) Illustrate the steps and timing of data flows when the instruction code 4FH i.e. MOV C, A stored in memory location 2005H is fetched.(b) Calculate the time required to execute the opcode fetch of (i)if the clock frequency is 2 MHz(c)Assume that the accumulator contains data byte 28H and the instruction of (a) is fetched. List out the steps in decoding and executing the instruction[8+2+6]

32.(a)Draw the flowchart and the assembly level program(not using more than 6 instructions) for 8085 to multiply 15H with 14H.Store the MSB of the result in memory location 3310H and LSB in just preceding memory location(b)What are memory mapped I/O and I/O mapped scheme?[8+8]

33.(a)Explain why some instruction require both instruction and execution cycles and others require only instruction cycles. Give examples of both kinds of instruction. (b)What is a micro



program? (c) Explain the difference between a micro operation and the control signal which implements it. [8+4+4]

34. Write short notes on [4X4]

(a) Co-processors (b) Programmable Interrupt Controller (c) Memory Interleaving (d) Instruction Set Completeness.

35. (a) Write assembly language program to convert a BCD number into binary number. Assume CPU to be 8085. (b) Describe a technique to identify a key closure when an  $m \times n$  matrix keyboard is interfaced to an 8085 microprocessor through I/O port. What are other alternative techniques? (c) What are different types of machine cycles for 8085 and how they are related to instruction cycles and T states? [6+6+4]

36. (a) Consider a 4MB SRAM chips of three different internal organizations, offering data widths of 1, 4 and 8 bits. How many of each type of chips would be needed to build a 16 MB memory unit with the following word widths and how they should be connected? (i) 8-bit words

(ii) 32-bit words

(b) A processor with two levels of caches has a CPI of 1. When no level-1 cache miss, at level 1, then hit rate is 90% and a miss incurs 10 cycles penalty. For the two-level cache as a whole the hit rate is 95% (meaning 5% of the time the main memory must be accessed and the miss penalty is 60 cycles)

(i) What is the effective CPI after cache misses are factored in?

(ii) If a single level cache were to be used in lieu of this two-level cache system, what hit ratio and miss penalty would be needed to provide the same performance? [(3+5)+(4+4)]

37. (a) Compare parallel adder and serial adder, (b) Explain the Booth's Algorithm for multiplication of signed 2's complement numbers (c) Write IEEE standard for floating point format [4+8+4]

38. (a) Define the following in respect to computer memory: (i) Read Access Time (ii) Band width and (iii) Latency time (b) Compare DRAM and SRAM (c) Define cache memory and what is its use? (d) Explain hit rate and miss rate. [6+4+4+2]

39. (a) Discuss on the relative merits and demerits of RISC and CISC processors (b) Write in detail about Micro program control unit. (c) Discuss briefly on the concept of hand shaking in I/O operation [5+7+4]

### Part 3, Paper-V, Computer Networks

- 1.(a)An analog signal is limited to 4 KHz. It is converted to a PCM signal using 8bit/sample. What is the bit rate on the transmission line? (b) If the signal to noise ratio is 7 dB and bandwidth is 10 KHz, find the capacity of channel (c) Draw the wave forms of (i)ASK (ii)FSK and (iii) PSK for the data 110101100 [2+3+6+5]
  
- 2.(a) What are various classes of IP addressing? Calculate the maximum number of class A,B and C network Ids (b) Explain the basic differences between IEEE 802.3 and switched Ethernet, as far as implementation is concerned. (C)Sketch a diagram showing each of the layers of TCP/IP model. Include the position of each protocol layer in the diagram. [(3+3)+5+5]
  
3. Write short notes on (i) DNS (ii)CRC (iii) ADSL (iv)Client-Server Model [4X4]
  
4. (a) Discuss the architecture of TCP/IP model (b) Explain CSMA/CD and its use [10+6]
  
- 5.(a) Describe the function of data link and Transport layer (b)What are the drawbacks of Mesh Topology? (c)Describe PAM and PCM with suitable diagram. (d)With suitable diagram explain the Manchester and Differential Manchester encoding techniques.[3+2+(3+3)+5]
  
- 6.(a)What do you mean by PSK? Explain with suitable example(b)Draw a constellation diagram for 8 PSK (c) Briefly explain the working of optical fiber with suitable diagram. (d)What is the difference between multimode and single mode optical fiber.[(2+2)+2+6+4]
  
7. (a)Explain Client-server model (b) Describe the purpose of DNS protocol in the internet. (c) Discuss the idea of web-based e-mail [5+5+6]
  
8. (a)Write short note on [4X4]  
(a)Web Server (b) Dynamic Host control protocol (c)Video Conferencing (d) Web Browser
  
- 9.(a)What are the functions of data link and presentation layer in the OSI model? (b)State the advantages and disadvantages of the MESH topology (c) What is a peer-to-peer process? Explain with necessary diagram [(3+3)+(2+2)+6]
  
- 10.(a) What are Cyclic redundancy code(CRC)? (b)How do the layers of TCP/IP protocol suite correlate to the layers of the OSI model? (c) Compare and contrast frequency modulation and amplitude modulation (d)How is baud rate related transmission bandwidth of FSK and PSK(e) If the bit rate of a signal is 10000bits/second, determine how many bits can be sent in 100 milliseconds?[3+3+4+4+2]

11.(a) Describe the component of a fiber-optic cable, Draw a picture(b) Comment of ‘Shanon Capacity’ in communication domain.(c)How does TDM combine multiple signals in to one, Briefly explain.(d) How does ADSL modulate a signal? (e)What is the relationship between the size of CRC remainder and the divisor [4+3+4+3+2]

12.(a)What do you understand by Domain Name Servers(DNS)? (b)What are TCP/IP and ADSL (c) Explain the function of the browser in World Wide Web (WWW) [4+6+6]

13. Write short notes on [4X4]

(a) Internet Service Provider (b)ISDN (c)IRC (d) SMTP.

14.(a) Clearly explain the main functions of the data link, network and transport layers of the OSI reference model (b)Show how the bit pattern 110100010 will get encoded using Manchester and Differential Manchester encoding techniques. (c)Explain the pulse code modulation technique with the help of a diagram (d)What is the differences between bit rate and baud rate? [3+5+6+2]

15.(a) Distinguish between Frequency and time division multiplexing technique for data communication. Which of these two techniques are typically used for communication over (i) Wireless medium (ii) Optical fiber. (b)Explain the concept of cyclic redundancy code (CRC) with the help of an example. How it can be used for error detection and recovery in data communication? (c)What are the basic functionalities of the TCP, UDP and IP protocols? [(4+2)+(4+3)+3]

16.(a)Explain the differences in the working of single mode and multi mode fibers. Which of two is preferred for high bandwidth communication? (b)With respect to the Ethernet protocol, answer the following: (i) How a collision is typically detected? (ii)What will the transmission station do upon detecting a collision? (iii)Why is there a minimum limit to the size of a frame? (c) What are the differences between a hub, a bridge and a router? [4+(3+3+3)+3]

17. (a) What is basic function of DNS server? What are the roles of primary and secondary DNS servers? (b)In client-server programming, what do port numbers signify? What is a socket? (c)In the SMTP protocol, what are the commands to specify the sender and receiver email addresses and to send the body of the mail? Why are protocols needed?[4+(2+2)+(6+2)]

18.(a) Write short note on [4X4]

(i)WAN (ii) INTEL 8251 (iii) Asynchronous transmission (d) Matrix keyboard interfacing

19.(a) List the layers of Internet Model ? (b) Describe the function of each layer with necessary diagram (c)What is peer-to-peer process? Explain with necessary diagram (d)How do the layer of Internet model correlate to the layers of the OSI model[2+4+6+4]

20(a) What is channel capacity ? How is it related to bandwidth ? Discuss the impairments that may occur during transmission. (b) “The prime goal of networking is resource sharing”- Comment on it emphasizing the various resources that one can share through networking.[(2+2+6)+6]

21.(a) What are the factors that determine whether a communication system is LAN,MAN or WAN? (b) Why are protocols needed? (c)What is the average size of an Ethernet frame? (d) An Ethernet MAC sub layer receives 1510 bytes of data from the LLC (Logical Link Control). Can the data be encapsulated in one frame? If not, how many frames need to be sent? (e) What is the size of the data in each frame? [4+4+2+4+2]

22.(a) With the help of example, explain how pulse code modulation can be used to convert an analog signal to a digital signal for communication over a channel.(b)In a pulse code modulation system, it is required to digitize voice data which are limited to frequencies below 4000Hz. Every sample value is quantized into one of 256 different levels, what will be the maximum data rate in bits per second? Use sampling theorem to do this. (c)With the help of a schematic diagram, explain the principle of operation of frequency division multiplexing, Why are guard bands used? [6+6+4]

23. Write short notes on [5X4]

(a)Challenges in Video conferencing (b) Internet and Extranet (c)Secure HTTP protocol (d)Mail access protocols (e)Advantages of ADSL modems over traditional modems.

24.(a)What are the main functions of the data link, network and transport layers? (b) Transport layer is sometime called host-to-host or end-to-end layer, while network layer is not. Justify the reason. (c) Explain the method of pulse code modulation with the help of a diagram. On what factors does the data rate of a pulse code modulated signal depend? (d) An analog signal is sampled at the rate of 10KHz each sample digitized into 1024 discrete levels, and then transmitted over a digital communication channel. What is the minimum required bandwidth of channel?[3+1+(6+2)+4]

25. (a) Clearly explain the differences between time division and frequency division multiplexing.(b) What do you mean by framing in the context of time division multiplexing?(c) Five signal sources are multiplexed using time division multiplexing. Each source produces 100 characters (8 bits each) per second. Assume that there is byte interleaving and that each frame required one bit for synchronization. What is the frame rate? What is the bit rate on the path

(d) Digital communication is considered to be better than analog communication in terms of the quality of signal being transmitted. Justify the statements. [3+(4+2)+4+3]

26.(a) With the help of diagrams, explain the differences between single-mode and multiple-mode optical fiber in terms of their principle of operation. For very high speed communication applications, which of the two would be preferred and why? (b) Why are the conduction wires in a twisted-pair cable twisted? (c) Explain the process of generating the CRC checksum with the help of an example. (d) Why is the method of CRC checksum considered to be better than parity checksum with respect to error detection probability? (e) Suppose that the frame size is 1024 bits and bit error rate is  $10^{-4}$ . A source transmits 10 frames to a destination. What is the probability that all the frames will reach the destination without errors? [4+2+4+2+4]

27.(a) What are the basic differences between a LAN and a WAN? Why cannot we use a LAN protocol like the Ethernet for use in a WAN? (b) It is required to set up a LAN connecting 12 PCs, Show a schematic diagram highlighting all the network component and accessories that are needed to complete the connection. What are the additional components and accessories that would be needed if the LAN is required to be connected through a dial-up connection to an ISP for WAN access? (c) A PC has been configured with an IP address 146.18.95.23 and a subnet mask of 255.255.192.0. What will be the corresponding subnet address? (d) The network routing protocols in use rely on distributed computing and not centralized computing. Justify or contradict. [(2+1)+(6+2)+2+3]

28. Write short notes on [5X4]

(a) Iterative versus concurrent servers (b) SMTP protocol (c) HTTP protocol (d) TCP/IP (e) Cable modem

29.(a) What do you mean by layered architecture? What is the advantage? (b) What are the functions of data link and presentation layer? (c) What are advantages and disadvantages of MESH topology? The disadvantage of MESH topology are overcome in STAR topology (d) Write advantage and disadvantage of digital transmission? [(1+1)+(2+2)+(2+2)+2+4]

30.(a) What are the two main forms of multiplexing? What are their requirements? (b) Describe with example, the advantage of using statistical TDM, synchronous TDM (c) We have four sources, each creating 250 characters per second. If the interleaved unit is a character and 1 synchronizing bit is added to each frame, find (i) data rate of each source (ii) the duration of each character in each source (iii) the frame rate (iv) duration of each frame (v) the number of bits in each frame (vi) the data rate of the link [(1+2)+7+6]

31.(a) Define carrier signal and its role in analog transmission. (b) What are the different techniques to convert digital data to analog. Which of these is most susceptible to noise? Defend

your answer. (c) Compare and Contrast: Pulse Code Modulation and Delta Modulation. (d) What is the number of bits per signal element for the following: (i) PSK with 8 different phases (ii) QAM with a constellation of 256 points (e) Draw constellation diagrams for QAM with (i) 2 different amplitudes and 8 phases separated by  $45^\circ$  (ii) 4 different amplitudes and 4 phases separated by  $90^\circ$ . Which is better and why? [(1+2)+(2+2)+5+2+(1+1)]

32.(a) Write down short notes on (i) DNS (ii) Browsers (iii) Voice and Video Conferencing (iv) IP-address (v) Dial-up connection

33.(a) Which reference model has been developed to device standards for global communication across heterogeneous computer platform? (b) What are the differences between connection-less and connection-oriented network layer? (c) What are the different techniques of error detection during data transmission? (d) What are the advantages and disadvantages of STRAR network topology [8+2+4+2]

34.(a) What is multiplexing in communication? Why is it needed? What are the two main forms of multiplexing? (b) Show diagrammatically and explain how channels are combined into groups, groups into super-groups and super groups into master-groups (c) Explain the principle of time-division multiplexing with a sketch to show how the interleaving of channels takes place. [(1+1+1)+6+7]

35.(a) What are the differences between synchronous and asynchronous data transmission? (b) What do you mean by parallel transmission and serial transmission (c) What is difference between bps and Baud? (d) Mention 6 different types of transmission media. What are the maximum data rates though each them? Which of those cannot carry analog signal? What are the advantages of optical fiber-cable over co-axial cable [3+2+2+(3+3+1+2)]

36.(a) What is communication protocol? What is a protocol converter? (b) What is MODEM? Name 3 types of MODEM and describe, in brief, each of them. What is a "smart" MODEM? What a "SMART" MODEM can do that a "dumb" MODEM cannot do? (c) What is multiplexer? How does it differ from a MODEM [(2+2)+(3+3+1+1)+2+2]

37.(a) What is MIME? (b) Mention four common top-level domain types those are non geographical and four top-level domain types which are geographically based (c) What are the differences between Dial-up and Dedicated Internet service (d) What are TCP/IP, ISDN and ADSL [4+3+3+6]

### **Part 3, Paper-VI, Object Oriented Programming**

1.(a) Make proper distinction between procedure and object oriented programming approach.(b)What is data abstraction and encapsulation? What are class, object?© Explain generic pointer with example.(d) What are manipulators in C++? Explain with example.(e) Mention the properties of static data member.[4+(2+2)+2+3+3]

2.(a)Explain multiple inheritance with proper example.(b)What is virtual function? Explain with example. ©Overload '+' operator for matrix addition applying 'template' concept.(d)What is the difference between public & private derivation of base class.(e)Explain try and catch block with example. [3+3+4+2+4]

3.(a) what is the utility of a virtual functions ?Explain with a example.(b) What is an exception? How can an exceptions be handled in C++? Explain by writing suitable functions.© What is the role of a constructor? Explain the purpose of overloading constructor. What is destructor?[4+(1+5)+6]

4.(a)Explain compile time and run time polymorphism with example.(b) What is meant by function prototype? ©Explain whether following statements are valid or not:(i)int mul(int i,int j=5,int k=10);(ii)int mul(int i=5,int j);(iii)int mul(int i=0,int j,int k=10);(iv) int mul(int i=2,int j=5,int k=10);(d)How do the properties of following two derived classes differ?(i) Class D1: private B(ii)Class D2:public B; where D1,D2 and B are some classes.(e)Differentiate const pointer and pointer to a constant. [(2+2)+2+(1X4)+(2+2)+2]

5.(a)Why would you declare a class's member variable private? (b) What is default constructor. State the role of destructor too.© What is the utility of namespace?(d)How does protected member differs from private data member in C++?(e) What is abstract class? [3+3+3+4+3]

6. (a)What is generic pointer? (b) Distinguish between the following two statements considering T1 and T2 are objects of class 'Time' (i)Time T2(T1); (ii) Time T2=T1;© What is generic programming? Explain with example.(d)What is dynamic instantiation of objects? How it can be achieved?(e)Define a class named "circle" having radius as private data member. Write set and get function to access the radius. Write a function to return area of circle. Also use default constructor.[(2+2+4+(2+2)+4]

7. (a)what is object oriented programming? How it is different from procedure oriented programming? (b) What do you mean by virtual function? Distinguish between virtual and overloaded function.(c)Create a class MAT of size mXn. Define all possible matrix operations for MAT type objects[5+5+6]

8.(a) How does the use of template ensure better program design in C++? Explain with suitable example.(b)Why cannot we overload : operator in C++? (c) What are the disadvantages of inheritance? (d) Why do array index start from zero(0) in C++?[6+3+4+3]

9.(a) What is a class? How does it accomplish data hiding? (b)How is member function of a class defined? Can we use the same function name for a member function of a class and an outside function in the same program file? If yes, how are they distinguished? If no, give reasons.(c)What does polymorphism mean in C++?How does polymorphism achieved at (i) compile time and (ii) run time?(d)We know that a private member of a base class is not inheritable. Is it any way possible for the objects of a derived class to access the private members of the base class? If yes how? Note that the base class cannot be modified.[3+(2+3)+(1+4)+3]

10. (a) What is friend function? What are merits and demerits of using friend function? (What is operator overloading? Why it is necessary to overload an operator?(c) A friend function cannot be used to overload the assignment operator-Explain why?(d)What is dynamic instantiation of objects? Why is it required? How is dynamic initialization of objects achieved?[4+3+3+6]

11.(a) Explain what is meant by information hiding? Define instance variable and Member function. Give example (b) Explain what are meant by multiple constructors and default constructor. (c) What is copy constructor? What is its utility? Explain what is default copy constructors [(3+4)+4+5]

12(a) What is meant by inheritance? Explain simple and multiple inheritances. Discuss inherited access restriction for Base Class member with derived class.(b) Explain the following: (i) Dynamic binding (ii) Function overloading(iii) Encapsulation.[(2+2+3)+(3\*3)]

13.(a)Explain with suitable example the difference between static and dynamic binding.(b)What is meant by Function overloading? Illustrate. (c) Explain the following access specifications: public, private, protected[6+4+6]

14. (a)What is the role of a constructor? Explain the purpose of overloaded constructors. What is destructor?(b)Explain the role of virtual base class in inheritance ambiguity.(c) What are generic classes? Illustrate [6+6+4]

15.(a)What are constructors? Why do we need them?(b)Explain copy constructor with an example. (d)What are multiple inheritances? What problem can arise if multiple inheritances is combined with multilevel inheritance? How is this problem solved? [5+5+6]

16.(a)Explain constructors and destructor? Explain their use with the help of suitable examples.(b)Illustrate the concept of polymorphism with at least two examples. (c)Write a C++ program that to determine whether entered number is prime or not.[(3+3)+5+5]

17.(a)What is inline function? When do we use inline functions and why Differentiate between function and inline functions.(b)Show with a program how constructor are called in derived



classes.(How is polymorphism achieved at (i)compile time (ii)run time?(c)When is the 'this' keyword used and why ?Illustrate [1+(1+1)+2+4+4+3]

18.(a) Why is it necessary to overload an operator? When is a friend function required to overload an operator? Give an example.(b)What is generic program? How it is implemented in C++?(c) What is a virtual function? Write a program in C++ to create a class Doctor with a virtual function 'salary'. Derive class visiting-Doctor and implement function 'salary' in it.[(2+2)+(2+2)+8]

19. (a)Why would you declare a class's member variables private? (b)What is default constructor? State the role of destructor also. (c)Write a class declaration named Circle with a private member variable named radius. Write set and get functions to access the radius variables and a function named Getarea that returns the area of the circle. Add a default constructor to the circle class where the constructor should initialize the radius member to zero. (d) Describe the objective of declaring a Friend class through an example. [3+3+5+5]

20. (a)State the difference between private and protected members. Briefly discuss the importance of operator overloading with an example. (b) Design a class named Employee having members Employee name, Employee number and Hire date. Write necessary constructors Also write a class named Production worker that is derived from the Employee class. This class should have the information about shift and hourly pay rate. The workday is divided into two shifts: day and night. Write one or more constructor and the appropriate functions for the class. Demonstrate the classes by writing a program that uses a Production worker object.[3+5+8]

21.(a)What is the utility of a virtual function? Explain with a suitable example. (b) What is an exception? How can an exception be handled in C++? Explain by writing suitable functions. (c) What is the role of a constructor? Explain the purpose of overloading constructor. What is destructor? [4+(1+5)+6]

22.(a)How does a protected variable differ from a private variable in C++.(b) What is abstract class.(c) What is the utility of namespace? (d) What is meant by inheritance? Distinguish between multiple and multilevel inheritance..What is friend function? [4+4+3+5]

23.(a) Explain the difference between a pointer and a reference variable.(b)What do you mean by access modifiers of visibility levels? What are the different access modifiers? Explain each[4+6]

24.(a) How can we distinguish between prefix and postfix nature while overloading the unary ++ operator? (b) What is default arguments? Write a program to illustrate default argument .(c)Does it provide polymorphism?[2+7+1]

25.(a)State whether each of the following are valid or invalid act of C++ statements  
(i) $C=C++$ (ii) $\text{int } **c=\text{new};$ (iii)  $\text{char } c=256;\text{cout}<<c;$ (iv) $\text{char } *c;c='\0'$ (v) $\text{int } \&c=10;$ (b)What is late binding?(c)What is macro? Give example  $[(5*1)+2+3]$

26.(a)What is a static member of a class? (b)What is copy constructor? (c) What is generic class? (d)what is manipulator in C++?(e) What are the differences between inline and non-inline functions?[2\*5]

27.(a)What are virtual class and virtual destructor? (b)What is friend function? Why it is used? (c)What is function overloading? Illustrate with example.[2+2+6]

28.(a)Why operators are needed to be overloaded? (b) Write a program to overload the new operator(c)What is function overriding?[2+6+2]

29.(a)What is specialty of template function? Give example.(b) Design a template class to implement a queue.[4+6]

30. Write short notes on (a) Abstract class & Abstract base class(b)Default constructor[5+5]

31.(a)What is static function?(b) What is the advantage of using new operator as compare to the function malloc()?(c)What is the function of CONST keyword?(d)State the basic differences between structures and class(e)What is “this” pointer?(f)How many arguments are required in the definition of an overloaded unary operator?(g)What is virtual function?(h)What is the importance of destructor?(i)What is seekg() and seekp() functions?(j)What is abstract class?(k)What is constructor? How is it invoked? [2\*11]

32.(a)What is difference between procedure-oriented programming and object-oriented programming? Explain with example. (b)Briefly explain the concept of data abstraction and encapsulation in C++. [8+6]

33.(a)Explain the different user defined data types in C++ with example.(b)What is main advantage of passing arguments by reference compared to by value? Write a function using reference variables as arguments to swap the values of a pair of integers.[6+8]

34.(a)Briefly explain the terms : private, public and protected access specifiers (b) Write a class to represent a vector(a series of float values) Include member function to perform the following tasks(i) to create vector(ii)to modify the value of a given element.(iii)to multiply by a scalar value(iv) to display the vector[6+8]

35. (a) Is it mandatory to use constructors in class? What are the different characteristics of a constructor? (b) A book shop maintains the inventory of books that are being sold at the shop. The list includes details such as authors, title, price, publisher and stock position. Whenever a customer wants a book, the sales person inputs the title and author and the systems searches the list whether it is available or not. If it is not available, an appropriate message is displayed. If it is available then the system displays the book details and request for the numbers of copies required. If the requested copies are available, the total cost of the requested copied is displayed: Otherwise the message '**required copies not in stock**' is displayed. Design a system using a class called **books** with suitable number of member functions and constructors, Use new operator to allocate memory spaces required.[4+10]

36. (a)What does inheritance mean in C++? What is virtual base class? When do we need to make a class virtual? Give example. (b) What is file mode? Describe the various file mode options available. Both ios::ate and ios::app place the file pointer at the end of file, what is the difference between them?[8+6]

37. (a)What is inline function? How is it different from macro?(b)What do you understand by 'default argument' When is it used?(c)Define 'friend' function, What are the merits and demerits of friend functions? (d) How structures in C++ is different from structures in 'C'? (e)what are the differences between class and structures in C++[(1+2)+(1+2)+(1+3)+2+2]

38.(a)How static method of class is different from a non-static method of a class?(b)What is 'call by reference'? Can you create an array of reference?(c)what is name space? What is the difference between visibility and scope of a variable? (d)What is function overloading? How is it different from function overriding? (e) State the restriction to use overloaded function and inline function.[2+(2+1)+(1+2)+(2+1)+3]

### **Part 3, Paper-VI, Software Engineering**

1. Draw a schematic diagram to represent Waterfall model of software development. Represent the deliverables that need to be produced at the end of each phase. Give brief explanatory remarks. (5)
2. Explain the features of prototyping model. What are its advantages and limitations. (3+2)
3. Distinguish between a physical and logical DFD. Discuss how a physical DFD can be transformed into logical DFD.(2+3)
4. What is software testing. Distinguish between White Box and Black Box testing. Write a program to add two digit integers. Find how many test cases are required to test the programs completely. (2+2+2+3)
5. What is Quality Software ? State attributes of a "Quality Software". (3+5)
6. Describe an application where prototype model for software development life cycle is used. (5)
7. Discuss the spiral model for SDLC and mention the utility of it over waterfall model. (5)
8. Explain the role of "Data Dictionary" in system design. (5)
9. State the advantages of developing the Context diagram and system flowchart diagram in SSA through an example. (5)
10. In a Hospital Management System develop a DFD for a "Ward Service Management System". State all your assumptions. (8)
11. In a Library Management System develop a DFD for a "Lending Service Management System". State all your assumptions. (8)
12. What are software project and process matrices. (5)
13. Write a short note on a) coupling and cohesion b)Data dictionary c) Software reliability (5+5+5)
14. What is meant by Software Design Life Cycle (SDLC)? Explain with one example of model.(3+5)
15. Distinguish between software verification and validation.(5)
16. What do you mean by non-functional requirement? Give an example.
17. Write limitations of waterfall model.
18. What is black box testing?
19. State attributes of "Quality Software".
20. Describe Prototype Model.

21. Explain an application where prototype model for software development life cycle is used.
22. Discuss spiral model for SDLC and mention the utility of it over Waterfall Model.
23. Distinguish between black box and White box testing.
24. What is white box testing?
25. Explain the role of “Data Dictionary” in system design.
26. State the advantages of developing the Context diagram and system flowchart diagram in SSA through an example.
27. What is DFD?
28. Differentiate between alpha and beta testing.
29. Define cyclomatic complexity.
30. What are software project and process metrics?
31. Design a DFD and ERD of Library management system.
32. Design a DFD and ERD of College management system.
33. Design a DFD and ERD of Hospital management system.
34. Discuss Coupling and Cohesion.
35. What is Data Dictionary?
36. What do you mean by metadata?
37. What is Software reliability and availability?
38. What is structure Charts?
24. What is context diagram?
25. Why is low coupling desirable?
26. Discuss the importance of analysis and design in software life cycle.
27. Discuss spiral model and explain the characteristics.
28. Why spiral model difficult to implement?
29. Discuss the advantages and disadvantages of the waterfall model.

30. What do you mean by SDLC?
31. What do you mean by V-model in SDLC?
32. Why spiral model called Meta data?
33. What is the purpose of DFD?
34. Distinguish between software verification and software validation.
35. What are the differences between logical and physical DFD?
36. Discuss iterative waterfall model. Mention advantages and disadvantages.
37. Compare the relative advantages of using the iterative waterfall model and the spiral model of software development.
38. How are the risks associated with a project handled in the spiral model of software development?
39. Explain why it is not prudent to use the iterative waterfall model for developing very large software products.
40. List four desirable characteristics of a good software requirement specification (srs) document.
41. What do you mean by balancing a DFD?
42. What is the main shortcoming of DFD as a tool for performing structured analysis?
43. What is control flow graph?
44. Draw the control flow graph of the following code for gcd computation. Then use it to find optimal test cases with the help of Path Coverage Criteria during white box testing.

```
int gcd(int x, int y){  
    while(x!=y){  
        if(x>y) then  
            x=x-y;  
        else y=y-x;  
    }  
    Return x;
```

45. What is coupling and cohesion?
46. Discuss Equivalence class partitioning and Boundary value analysis approaches for designing black box test cases.
47. Differentiate between a structure chart and a flow chart.
48. Write down the importance of data dictionary in the context of good software design.
49. What is meant by software testing?
50. Discuss how a physical DFD can be transformed into a logical DFD.
51. What is meant by Rhametive testing?
52. Write a program to add two digit integers. Find how many test cases are required to test the program completely.
53. Make suitable assumptions for automation of a manual system of your choice. Write Input/output, functional and performance requirements for the automated system.

### Part 3, Paper-VI, Computer Graphics

1. Describe Bresenham line drawing algorithm and compare its performance with DDA algorithm. (8+3)
2. Prove that multiplication of transformation matrices for two successive rotations is commutative. (5)
3. State an algorithm for drawing an ellipse. (10)
4. How can the scaling transformation of an object be done. (5)
5. Use DDA algorithm to draw a line from (2,2) to (8,6). (6)
6. Derive a general transformation matrix for 3D rotation about x-axis. (5)
7. Perform a  $45^\circ$  rotation of a triangle A(1,1), B(5,1), C(3,5) about an arbitrary point (3,3). (6)
8. Define Projection and mention its importance. Differentiate between Parallel and Perspective projection. (5+5)
9. Discuss Cohen Sutherland polygon clipping algorithm. (8)
10. Explain the importance of Homogeneous Coordinate system. Show that composition of two rotations is additive. (4+6)
11. Describe the transformation matrix M which reflects an object about a line L whose y-intercept is (0,b) and an angle of inclination  $k^\circ$  with respect to x-axis. (6)
12. Given a triangle with vertices A(0,0), B(1,1), C(5,2). The problem is to scale the triangle to twice its size while keeping the point C(5,2) fixed. Write down the steps to find out the composite matrix and compute the resultant magnified triangle. (6)
13. How is a polygon represented in a computer graphics system? State the conditions for which a line will be completely clipped. (2+3)
14. What is Bezier Curve? (5)
15. Clip a line A(3,20) B(13,3) against a rectangular window whose left-bottom and top corner are at the points (5,5) and (25,15) respectively. (5)
16. What do you mean by scaling?
17. What do you mean by raster scan display?
18. What is aspect ratio?



19. Describe Bresenham's line algorithm and compare its performance with DDA algorithm also.
20. Prove that the multiplication of Transformation matrices for two successive rotations is commutative.
21. State an algorithm for drawing an ellipse.
22. How can the scaling transformation of an object be done?
23. Write down the transformation matrix of the reflection about the diagonal line  $y=x$  and find out the reflection of the point  $P(-5,-6)$ .
24. Differentiate between raster and vector graphics.
25. Distinguish between CGA, VGA and EGA.
26. Explain the importance of homogeneous coordinate system.
27. Show that the composition of two rotations is additive.
28. Describe the transformation matrix  $M$  which reflects an object about a line  $L$  whose  $y$ -intercept is  $(0,b)$  and angle of inclination  $\theta^\circ$  with respect to  $x$ -axis.
29. Write down the steps to find out the composite transformation matrix and compute the resultant magnified triangle.
30. How is polygon represented in a computer graphics system?
31. State the conditions for which a line will be completely clipped.
32. Clip a line against a rectangular window whose left-bottom and top-corner are at a specified point.
33. Write short note on Bezier Curves.
34. What is morphing?
35. What are the principal vanishing points for a standard perspective projection?
36. "Rotation and Translation operations are not commutative" – Justify.
37. "The eight-way symmetry of a circle can be used to devise an efficient circle drawing algorithm"- Justify the statement with a suitable algorithm.
38. What is the significance of the region codes in the context of Cohen-Sutherland line clipping algorithm?
39. What are meant by interior and exterior clipping?

40. What is view-port?
41. Distinguish between Raster Scan Display and Random Scan Display?
42. Explain Brasenham's Circle Drawing algorithm.
43. What conventions are used in graphics monitor in defining the origin for X (horizontal) and Y (vertical) coordinates? Explain.
44. Discuss two applications of computer graphics.
45. What is projection?
- 46 Differentiate between parallel and perspective projections.
47. Briefly explain the steps required for designing an animation sequence.
48. Explain the midpoint line scan-conversion algorithm.
49. Explain why a circle appears to be elliptical on screen?
50. Explain and Use DDA line generation algorithm to draw a line.
51. Derive a general transformation matrix for 3D rotation about x-axis.
52. Perform a  $45^\circ$  rotation of a triangle A(1,1), B(5,1), C(3,5) about an arbitrary point (3,3).
53. Show that in 2D, reflection about the X-axis followed by a reflection through the line  $y=-x$  is equivalent to a rotation about the origin.
54. Define projection and mention its importance.
55. Discuss Cohen-Sutherland polygon clipping algorithm.
56. Differentiate between interlaced and non-interlaced raster scanning methods.
57. The reflection along the line  $y=x$  is equivalent to the reflection along the X axis followed by anticlockwise rotation by  $\alpha$  degrees. Find the value of  $\alpha$ .
58. Write short note on 3D shearing.
59. Discuss briefly about the different types of parallel projection.
60. Discuss commutative property of scaling and rotation in 2D.
61. Explain the working principle of Midpoint circle algorithm.
62. Discuss Cohen-Sutherland polygon line clipping algorithm with example.

### **Part 3, Paper-VI, Data Base Management System**

1. What kinds of responsibilities does a DBA have in a database environment?
2. What does the Cardinality ratio specify?
3. Why is BCNF considered better than 3NF?
4. How is relational Calculus different from Relational Algebra?
5. What is weak entity? When this concept is used?
6. Give an example of a relationship with attributes.
7. Describe how strong and weak entities differ and provide an example of each.
8. What is a “functional dependency” and “full functional dependency”?
9. Discuss insertion, deletion and updating anomalies that arises in different stages of normalization process.
10. “The ER-approach and Normalization approach to database design leads to more or less the same relational schema” – Do you agree with this comment? Justify your answer.
11. Explain the Join operation of relational algebra.
12. Draw the ER diagram of a University management System.
13. What are the basic relational operators? How the intersection operation can be expressed through basic operators?
14. Explain the utility of division operation through an example.
15. What do you mean by domain integrity for a relational data model?
16. State the disadvantages of using network data model.
17. Define Union operator for relational algebra.
18. Give an example of specialization abstraction as used in ER data model.
19. What is metadata?
20. Explain why duplicate tables are not allowed in RDBMS.
21. Explain DDL, DML, DCL
22. What do you mean by ANSI SPAARC Architecture?
23. What is data independence?
24. Distinguish between traditional file system and DBMS.
25. Explain 3-tier and 2-tier architectures.
26. Define 3NF and BCNF with examples.
27. Write the merit and demerits of indexed sequential file over sequential file.
28. Compute the closure of the following set F of functional dependencies for relational schema R – (A,B,C,D,E).  $A \rightarrow BC$ ,  $CD \rightarrow E$ ,  $B \rightarrow D$ ,  $E \rightarrow A$ .
29. Define the concept of aggregation with examples.
30. What are the mapping constraints?
31. Explain referential integrity.
32. What do you mean by Data Models.
33. Define Functional Dependencies.
34. Distinguish between Network and Hierarchical data Model.
35. Explain view level of data model.

36. What is data dictionary?
37. How is multi-valued attribute represented in relational model?
38. What the role of DBA?
39. Write the steps/algorithm of inserting a value in dense index.
40. Compare and contrast indexing and hashing scheme.
41. What are the problems of sequential file organization?
42. Explain left and right outer join with example.
43. Consider the relational schemas  $R(P,Q,R,S,T,U,V)$  with the following functional dependency:  $P \rightarrow S, Q \rightarrow \{T,U\}, S \rightarrow U, \{P,Q\} \rightarrow R$ . What are the candidate keys of this relation?
44. Distinguish between procedural and non-procedural query language.
45. Reduce the following relation to 3NF.  $F(R,E,D1,D2,D3,A1,A2,A3)$ . Following functional dependencies hold in this relation:  $R \rightarrow E, E \rightarrow D1, D1 \rightarrow D2, D1 \rightarrow D3, A1 \rightarrow A2, A1 \rightarrow A3$ .
46. Explain with the help of ER diagram the process of a Banking System.
47. Why do we need to normalize a database?
48. What is lossy decomposition?
49. Explain decomposition.
50. What is dependency preservation?
51. Give an example of a relational schema that is in 3NF but not in BCNF.
52. "SQL is a relationally complete Language" - Justify the statement.
53. Define data abstraction.
54. Illustrate with suitable example how insertion and deletion are done in hashed file organization.
55. What are the advantages of secondary index?
56. Write short note on query processing language.
57. Explain ODBC and JDBC.
58. What do you mean by 2NF? Explain with example.
59. Explain lossless join decomposition with example.
60. What is sparse Index and Dense index?
61. Define B+ Tree and B- Tree.
62. What do you mean by Object relational Model?
63. Distinguish between primary and secondary index.
64. Differentiate between centralized and distributed system.
65. What is projection and selection operator?
66. Explain Cartesian product.
67. What is natural join?
68. Explain Tuple relational and domain relational calculus.
69. Consider the following relational schema and write the relational algebra expression for the following queries: Hotel (hotel#, hotelname, city), Room (room#, hotel#, type, price),

Booking (hotel#, Guest, datefrom, dateto, room#), Guest (guest#, guestname, guestaddress). i) Produce a relation containing all the details of all hotels with a room price above RS. 1500. (Also design domain relational Calculus), ii) Produce a relation containing the names of all guest who have booked all hotels in Kolkata, iii) List the price and type of all rooms at the Park Hotel, iv) Produce a relation containing the names of all hotels that have a booking for a guest called Ram Sharma (also design it for Tuple relational calculus).

70. Consider the following relational schema and write the SQL expression for the following queries: Customers (cid, cname, city, discount), Agents (aid, aname, city, percent), Products (pid, pname, city, quantity, price), Orders (ordno, month, cid, aid, pid, qty, rupees). Write the SQL expressions for each of the following queries: i) Get the aid's and anames of agents with aname beginning with the letter N who do not place orders for any product in Patna, ii) Get names of agents who place orders for all products ordered by customer C003, iii) Get product names ordered by at least one customer based in Bangalore through an agent a0004, iv) Give all (cname, aname ,price) where the customer places an order through the agent a004.
-

### Part 3, Paper-VIII, C++ Practical Questions

1. Design a class called “misc” that will do the following:(a) Check whether the entered number is prime or not(b) Check whether the entered number is perfect or not (c) Check whether the entered number is Armstrong or not.
2. Create two classes ‘DM’ and ‘DB’ which stores the values of distances. ‘DM’ stores meter and centimeter & DB stores foot and inches. Write a program to read values for class objects and add one DM object with another DB object. Perform this addition using friend function. Display should be in format of feet and inches or meter and centimeter.
3. Design a class called “mytime”. It has member as hour, minute and seconds. Use appropriate constructors and overload + and – operators to perform addition and subtraction of two entered time.
4. Create a class called “matrix” and perform multiplication and addition applying the concept of operator overloading and template with proper checking for performing addition and multiplication.
5. Design a class called “string” which has one string and length of that string as data members. Overload following operators (i) ‘=’ for string copy (ii) ‘==’ for string comparison (iii) ‘+’ for string concatenation. (iv) ‘<<’ operator (v) ‘>>’ operator
6. Write a base class Worker and derived classes HourlyWorker and SalariedWorker. Every worker has a name and a salary rate. An hourly worker gets paid hourly wage for the actual number of hours worked, if the hour is at most 40 per week. If it is greater than 40, then worker gets 1 1/2 times of the hourly rate for the excess hour. The salaried worker gets paid hourly wage for 40 hours, no matter what the actual number of hours is.
7. Write a program to carry out polynomial multiplication using linked lists. The linked list class should be of template type.
8. Develop a C++ program to prepare the mark sheet of students of a university examination, assuming that the following data can read from keyboard: Name of student, Roll number, subject code, subject name, Internal marks and External marks. Design a bases class consisting of first three data items. The derived class consists of the rest of the data items. The program should have facilities to carry out the following methods: build a master table, list the entries of the table, insert a new entry, display a particular entry on the basis of roll number [using file]
9. Create a class Intarray which creates an array of integer data elements of different sizes, dynamically. Include suitable constructors and destructors in that class. Design a class stack which derives from the class Intarray. Include member functions PUSH, POP and display with the exception-Stack overflow and Stack underflow.

10. Define a class named "Sequence" for storing sorted strings. Define constructor, a destructor, and the following member functions for sequence: (a) Insert() which inserts a new string into its sort position.(b) Delete() which deletes an existing string. (c) Find() which searches the sequence for a given string and returns true if it finds it. And false otherwise.(d) Print() which prints the sequence strings.
11. Write two class AC and Remote as per following constraints: a) Make them mutual friends b) Add a state variable member to the Remote class that describes whether the remote control is in normal or interactive mode. c) Add a Remote method to display the mode d) Provide the AC class with a member for toggling the new Remote member. This methods works only if the AC is the "ON" state. Write a C++ program to implement it.
12. Create a class DLinkedList using template to contain a doubly-linked list. Provide a method revlist() that will contain the nodes of the doubly linked list but in reverse order. Run the program on integer and float type elements for the linked list. Write other auxiliary functions like display() etc. use suitable signatures for the functions. This program should also find numbers of nodes and checks whether a number is present in the list or not
13. Design a class called "triangle" and then check triangle types like isosceles, equilateral and scalene. Design the appropriate methods for calculating area, perimeter. Use inheritance appropriately.
14. Overload the two operators for the "binary "class: (a)operator – which gives the difference of two binary values, assume that the first operand is always greater than the second operand. (b) operator [] which indexes a bit by its position and returns its value as 0 or 1 integer
15. Write a C++ program to carry out quicksort on an array of integers.
16. Write a C++ program that accepts a date as inputs and display the dates of all Saturdays and Sundays of the month.
17. Write a string class to do the following:(a) to count the number of words.(b)write a toggle()that converts all alphabetic characters present in an input string to lowercase if it is uppercase and vice versa.
18. Write a C++ program to generate postfix expression from the infix form. The infix form is to be passed as the input to the constructor of a class. The class should have one method in2post() to perform it.
19. Write a C++ program to read an integer from keyboard and print each digit using inline member function. Eg. Input: 1234 , output :one two three four.

20. Write a C++ program to create Binary Search Tree. The program should support insertion and deletion of a node. The binary search tree class must of template type.

21 Write a C++ program for overloading to add .polynomials of the form:

$$a^n x^n y^n z^n + a^{n-1} x^{n-1} y^{n-1} z^{n-1} + \dots + a^0$$

22. Write a C++ program to inverse a square matrix of order n. The class matrix is having dynamic allocation of its data members. Catch exception raised by the 'new' operator and take corrective actions.

23. Write a C++ program that instantiates a function template that implements the shell sort on an array of objects.

24. Write a C++ program to implement the template class B tree. You need to perform the following operations: Insertions and deletion of a node.

24. Write a C++ program to create a linear linked list. The linear linked list class must be of template type. The program must support the following operations:

(i)Count the number of nodes. (ii)Delete all the nodes having 'k' in their information field.(iii)Add a node after a node whose information field contains 'D'.

25. Write a C++ program to create a linear linked list. The linear linked list must be of type template type. The program supports the following operations:

(i) deletion of even numbered nodes (ii) Reversal of the list. (iii) Addition of a node after the i<sup>th</sup> node.

26. Write a C++ program to create the template class convert that accepts an integer in any base and converts it to another base. The base values are user specified.

27. Write a C++ program to have employee as an abstract class and create many derived classes such as manager, supervisor and project leader from the employee class. Create their objects and process them.

28. Write a C++ program to create template class min-heap. You need to perform operations such as insertion, deletion and re-heapification. Finally using the template class min-heap write the program for heap sort.

29. Write a C++ program to implement the template class AVL. You need to perform operations such as insertion, deletions and traversal.

30. Write a C++ program to add/subtract two complex numbers. Each complex number object, an instance of class complex is having dynamic allocation of its data members. Catch exception raised by 'new' operator and take corrective actions.



31. Consider that the base class queue is available. Overflow and underflow situations are not taken care by base class. Write a C++ program to enhance this class to MyQueue, which raises an exception whenever overflow or underflow error occurs.

32. Write a C++ program to implement class BST. You need to perform traversal operations.

33. Design template classes such that they support the following statements:

```
Rupee<float> r1,r2;
```

```
Dollar<float> d1,d2;
```

```
d1=r2;//Rupee to dollar
```

```
r2=d2//dollar to rupee
```

Write a program that does such conversion according to current market value.

34. Write a program for manipulating linked list supporting node operations as follows:

```
Node=node+2;node=node-3;
```

```
Node <int> *n node1+node2;
```

The first statement creates a new node with node information 2 and the second statement deletes a node with node information 3. The Node class must be of type template.

35. Write a program having Student as abstract class and create many derive classes such as Engg ,Sc, Med etc. form the Student class. Create their object and process them.

36. Write an interactive operator overloaded programs for manipulating matrices Overload objects such <<,>>,+,-,\*,=.

37. Write a program to create a graphic class hierarchy, Create an abstract base class called Figure and derive two classes Close and Open from that. Declare two more classes called Polygon and Ellipse using Close class. Create derive class Line and Polyline from the Open class. Define three objects triangle, rectangle, pentagon of the class Polygon.

38. Write a program to generate fully parenthesized infix expression form their postfix form.

39. Write a program to implement the template class for representing the BST (height at least 5) and perform the following operations

(a) Insert an element X, (b) Delete an element X (c) Calculate the quantity BF, after each of the above operations, where  $BF = h_L - h_R$ , where 'h' denotes the height of the respective subtrees.

40. Write a program to implement template class for representing a circular linked list. You will need to define three template classes, ListNode, CircList, CirIterator. Assume that class CircList contains a single private data member last that points to the last element of the circular linked list. Implement the iterator member function First(), Next(), NotNull() and NextNotNull().

41. Write a program to delete an element from a max-heap. The class MaxHeap must include public members IsEmpty() and IsFull(). The first returns true iff the Maxheap is empty and the second returns true iff it is false.

42. Write a program to implement dictionary class using ideal hashing. Assume that element keys are integers in the range 0 through MaxKey, where MaxKey is specified by the user at the time the dictionary is created.

43. Create a class HugeInteger which uses 40 elements array of digits to store integer as large as 20 digits. Provide methods InputHugeInteger, OutputHugeInteger and AddHugeInteger

44. Implement a FRACTION CLASS that can store numerator and denominator. The class contains constructor with default argument taken as numerator=0 and denominator=1, copy constructor and destructor. Overload operators = and +.

45. Design classes to do the following data conversions:

Degree d1,d2;     Radian r1,r2; d1=r1; r2=d2;

46. Write a program to implement template class Myclass, which stores a set of data elements. Implement Binary search method in the class Myclass (Non recursive way). You should implement boundary conditions (successful or non successful) using exception handling.

47. Design a class 'fraction' which contains data members numerator and denominator. Include default constructor with default arguments taken as numerator=0 and denominator=1. Overload the operator +(addition), \*(multiplication) and -(unary minus). Test your program with arithmetic expression  $(-x - y) * z + t$ , where x, y, z and t are objects of fraction class.

48. Design a class Intarray which creates an array of integers data elements of different sizes dynamically. Include suitable constructor and destructor in that class. Design a class heap which derives from the class Intarray. Include member functions sort and display. You should include suitable constructors and destructor in the class heap.

49. Design a class node to implement Singly Linked List. Use suitable constructors and destructors. Include member functions insertafternode(), split()[split list after a given node into two list] and display

50. Design a classes to do: Centigrade c1,c2; Fahrenheit f1,f2; c1=f1; f2=c2;

### **Part 3, Paper-VIII, Shell Script Practical Questions**

1. Write a shell script to arrange a set of integer data values either in increasing or decreasing order.
2. Write a shell-script to convert the base of a number.
3. Write a shell-script to find the primes between a given range using 'factor' command.
4. Write a shell-script to implement merge sort.
5. Write a shell script to implement a recursive shell function to find out the factorial of a given number and recursively and use it to check if a number is Peterson or not.
6. Write a shell-script to convert the file format from unix to dos.
7. Write a shell-script to find the word frequency of each word in a file.
8. Write a shell-script program to generate the non-Fibonacci primes between a given range.
9. Write a shell-script to calculate the roots of a quadratic equation.
10. Write a shell-script to determine the type of triangle formed based on the user input.
11. Write a shell-script to simulate 'wc' command.
12. Write a shell script to show the subdirectories and the files in the subdirectories of the current directory.
13. Write a shell script to delete all lines containing the word "unix" in the file supplied as argument to the script.
14. Write a shell script to reverse the content of a file.
15. Write a shell script to add blank lines to the end of every line
16. Write a shell script to test whether one string is substring of another string or not. Both strings are command line arguments.
17. Write a shell script to display the last line of a file without using the tail command.

18. Write a shell script to find the largest no. of three numbers. Which are passed as command line arguments.

19. Write a shell script to calculate GCD and LCM of integers supplied as command line arguments.

20. Write a shell script which reports names and sizes of all files in a directory whose size is exceeding 100 bytes. The filenames should be printed in descending order of their sizes, The total number of all files should be printed.

21. Write a shell script to append a line to a file. Both the filename and line have to be specified to a script at the command line. Ensure that in the shell script. Print the numbers of lines in the file after you are done.

22. Write a shell script which get executed at the moment when user login. It should display the message “good morning”, “good evening”, “good afternoon”, “good night” depending on logon time.

23. Write a shell script to determine the PERFECT NUMBERS within a range. [Perfect number eg:  $28=1+2+4+7+14$  ]

24. Write a shell script to change “DOS” to “WINDOWS” in a text file.

25. Write a shell script to find all Armstrong numbers between 100 and 999.

26. Write a shell script to sort numbers of array using selection sort.

27. Write a shell script to perform Hex addition and subtraction.

28. Write a shell script that accepts one or more filenames as arguments and converts all uppercase letters and also encrypts them using mono alphabetic substitution..

29. Write a shell script to change file name extension for .txt to .doc

30. Write a shell script to evaluate a valid infix expression with operators +, -, \*, /, \$(exponentiation) and also containing parenthesis types (), {}, [].

31. Write a shell script to count the number of words, spaces, characters and vowels in a body of text. Also indicate repeated words if any in the text.

32. Write a shell script to multiply two  $n \times n$  matrices where  $n$  is user specified.

33. Write a shell script that will be able to take any number of file name as arguments and checks whether a file exists and has size greater than zero, if such file exists the script checks whether it is a file or a directory. The script should respond using appropriate message.

34. Write a shell script that accepts a file name, starting and ending line numbers as arguments and displays all the lines between the given line numbers.

35. Write a shell script that would change the \$ prompt to the current directory name in which you are working.

36. Write a shell script that will display command line arguments in reverse order.

37. Write a shell script that will generate all combination of 1,2 and 3.

38. Write a shell script to append a front slash(/) to a directory name, a star(\*) to executable file name of the directory. The directory name should be supplied as command line argument. If the directory name is not supplied as command line argument, current directory will be assumed.

39. Write a shell script to simulate 'TYPE' command of LINUX.

40. Write a shell script to determine whether entered year is leap year or not.

41. Write a shell script to modify cal command of LINUX to include the following:

(i) Print current month and current year when called without parameter

(ii) Print calendar of the month of the current year only one argument between 1 & 12

42. Write a shell script to modify cal command so that it prints the calendar of the corresponding month and current year when the month is given in roman for like I, II, III...XII. You may assume I for April, II for May.....XII for March.

43. A student examination file contains records in the following format:

Name	Subject1	Subject2	Subject 3	Subject4
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The student is awarded division as per the following rules:

Percentage above or equal to 60-First division

Percentage between 50 and 59-Second division

Percentage between 40 and 49-Third division

Percentage less than 40- Fail

Write a shell script to calculate the division awarded to each student.

44. Write a shell script to find second largest and smallest numbers from a list of n numbers.

45. Write a shell script to compute the the given range:

$1/1^1 - 2/2^2 + 3/3^3 - 4/4^4 + 5/5^5 + \dots$  Accept the range as command line argument. If the range is negative or 0 then give appropriate message.

46. Write a shell script to implement a background process that will continuously print current time in upper right corner of the screen, while use can do his/her normal job at \$ prompt.

47. Write a shell script that copy one file to another file, for example, if the program name copy1, then it can copy f1 to f2(if f2 exists then it will be overwritten without any message), or by copy1 -l f1 f2, where due to -l option, it will ask user to overwrite f2, or not if f2 already exists.

48. Write a shell script to take four points A, B, C and D. Check whether the line segments AB and CD are parallel or intersecting.

49. Write a shell script to generate Lucas series which is given as 0,1,2,3,6,11,20.....

50. Write a shell script to compute average of n numbers. Accept these numbers at runtime(not though command line) The numbers must be supplied in sorted order. If the numbers are not supplied in sorted order then show an error message.

51. Write shell scripts to print following structure. Number of rows to be supplied as command line argument.

(i) * * * * *	(ii) *	(iii) *
* * * * *	* *	* *
* * *	* * *	* * *
* *	* * * *	* *
*	* * * * *	*

52. Write a shell script to check whether a given point P(x,y) lies on the circle, inside the circle or outside the circle  $x^2 + y^2 = R^2$ , where x, y and radius R will be supplied as command line arguments.

53. Write a shell script to use 'expr' command and to read a string and print a suitable message if it does not have atleast 10 characters.

54. Write a shell script to display in different format the command line arguments, which can be 'ONE', 'TWO' or 'THREE'. If the argument supplied as 'ONE' DISPLAY IT IN BOLD. If it is 'TWO' display it in reverse video and if it is 'THREE' make it blink on the screen If a wrong argument is there, print error.