

- N.B. (1) Question no. 1 is compulsory.
 (2) Attempt any three from the remaining.
 (3) Figures to the right indicate full marks.

1. (a) Find the Laplace Transform of $\sin t \cos 2t \cos ht$. 5
 (b) Find the Fourier series expansion of $f(x) = x^2$ $(-\pi, \pi)$ 5
 (c) Find the z-transform of $\left(\frac{1}{3}\right)^{|n|}$ 5
 (d) Find the directional derivative of $4xz^2 + x^2yz$ at $(1, -2, -1)$ in the direction of $2\bar{i} - \bar{j} - 2\bar{k}$ 5
2. (a) Find an analytic function $f(z)$ whose real part is $e^x(x \cos y - y \sin y)$ 6
 (b) Find inverse Laplace Transform by using convolution theorem $\frac{1}{(s-3)(s+4)^2}$ 6
 (c) Prove that $\bar{F} = (6xy^2 - 2z^3)\bar{i} + (6x^2y + 2yz)\bar{j} + (y^2 - 6z^2x)\bar{k}$ is a conservative field. 8
 Find the scalar potential ϕ such that $\nabla \phi = \bar{F}$. Hence find the workdone by \bar{F} in displacing a particle from $A(1,0,2)$ to $B(0,1,1)$ along AB .
3. (a) Find the inverse z-transform of $F(z) = \frac{z^3}{(z-3)(z-2)^2}$ 6
 (i) $2 < |z| < 3$ (ii) $|z| > 3$
 (b) Find the image of the real axis under the transformation $w = \frac{2}{z+i}$ 6
 (c) Obtain the Fourier series expansion of 8
 $f(x) = \pi x$; $0 \leq x \leq 1$
 $= \pi(2-x)$; $1 \leq x \leq 2$
 Here deduce That $\frac{1}{1^2} + \frac{1}{3^2} + \dots = \frac{\pi^2}{8}$
4. (a) Find the Laplace Transform of 6
 $f(t) = E$; $0 \leq t \leq \frac{p}{2}$
 $= -E$; $\frac{p}{2} \leq t \leq p$, $f(t+p) = f(t)$

(b) Using Green's theorem evaluate $\int_c \frac{1}{y} dx + \frac{1}{x} dy$ where c is the boundary of the region bounded by $x=1$, $x=4$, $y=1$, $y=\sqrt{x}$ 6

(c) Find the Fourier integral for $f(x) = \begin{cases} 1-x^2, & 0 \leq x \leq 1 \\ 0 & x > 1 \end{cases}$ 8

Hence evaluate $\int_0^{\infty} \frac{\lambda \cos \lambda - \sin \lambda}{\lambda^3} \cos\left(\frac{\lambda}{2}\right) d\lambda$

5. (a) If $\vec{F} = x^2\vec{i} + (x-y)\vec{j} + (y+z)\vec{k}$ moves a particle from $A(1, 0, 1)$ to $B(2, 1, 2)$ along line AB . Find the workdone. 6

(b) Find the complex form of Fourier series $f(x) = \sinh ax$ $(-\ell, \ell)$ 6

(c) Solve the differential equation using Laplace Transform. 8
 $(D^2 + 2D + 5)y = e^t \sin t$ $y(0) = 0$ $y'(0) = 1$

6. (a) If $\int_0^{\infty} e^{-2t} \sin(t + \alpha) \cos(t - \alpha) dt = \frac{3}{8}$ find the value of α . 6

(b) Evaluate $\iiint (y^2z^2\vec{i} + z^2x^2\vec{j} + x^2y^2\vec{k}) \cdot \vec{n} ds$ where s is the hemisphere $x^2 + y^2 + z^2 = 1$ above xy -plane and bounded by this plane. 6

(c) Find Half range sine series for $f(x) = \ell x - x^2$ $(0, \ell)$ 8

Hence prove that $\frac{1}{1^6} + \frac{1}{3^6} + \dots = \frac{\pi^6}{960}$

GN-Con.:6452-14.

COMP

SE/III/COMP/Data Structure/02/12/14

QP Code :14605

(3 Hours)

[Total Marks : 80

- N.B : (1) Question no.1 is compulsory.
(2) Attempt any three questions out of the remaining five questions.
(3) Figures to the right indicate full marks.
(4) Make suitable assumptions wherever necessary with justification.

1. (a) What is recursion? Write a 'C' program to calculate sum of 'n' natural numbers using recursion. 5
(b) What is a Mutiway Search Tree. Explain with an example. 5
(c) Give ADT for the queue data structure. Discuss in brief any two applications of the queue data structure. 5
(d) Compare and contrast Quicksort and Radix sort on basis of their advantages and disadvantages. 5
2. (a) Write a 'C' program to implement a priority queue. 8
(b) What are different types of files? Explain various file handling operations in 'C'. 7
(c) Explain with examples different techniques to represent the graph data structure on a computer. Give 'C' language representations for the same. 5
3. (a) Consider the following list of numbers :— 10
67, 12, 89, 26, 38, 45, 22, 79, 53, 9, 61.
Sort these numbers using Heap Sort.
(b) Write a 'C' program to implement a singly Linked List which supports the following operations : 10
(i) Insert a node in the beginning
(ii) Insert a node in the end
(iii) Insert a node after a specific node
(iv) Deleting a specific node
(v) Displaying the list.
4. (a) Write a 'C' program to convert a polish notation to reverse polish notation. 10
(b) Consider the following list of numbers : 10
18, 25, 16, 36, 08, 29, 45, 12, 32, 19.
Create a binary search tree using these numbers and display them in a nondecreasing order. Write a 'C' program for the same.
5. (a) Discuss how memory allocation for a sparse matrix can be optimized using a linked list. Write a C-program for the same. 15
(b) Write a function for DFS traversal of graph. Explain its working with an example. 5
6. (a) Insert the following elements in AVL tree : 10
44, 17, 32, 78, 50, 88, 48, 62, 54.
Explain the different rotations that will be used.
(b) Write a 'C' program to search a list using Indexed Sequential Search. What are the advantages of using Indexed Sequential Search over Sequential Search? 10

GN-Con.:9120-14. -----

Sem-III / object oriented / Prog. methodology / Comp & IT (CBGS)

18-12-14

QP Code :14704

(3 Hours)

[Total Marks :80

- N.B. : (1) Question No.1 is compulsory.
(2) Attempt any three from remaining.

1. (a) Write a program that queries a user for the no.: of rows and columns representing students and their marks. 10

Reads data row by row and displays the data in tabular form along with the row totals, column totals and grand total

Hint : For the data 1, 3, 6, 7, 9, 8 the output is

1	3	6		10
7	9	8		24
8	12	14		34

- (b) Explain System.arraycopy () 5
(c) Explain multiple inheritance in java with suitable example. 5

2. (a) Identify classes and their attributes and draw the relationships that are described by the following business rules. Include the multiplicities for each relationship. 12

- (i) A patient must be assigned to only one doctor and a doctor can have one or many patients.
(ii) An employee has one phone extension and unique phone extension is assigned to an employee.
(iii) A movie theatre shows atleast one movie and a movie can be shown at upto 4 other movie theatres around town.
(iv) A movie either has one star, 2 co-stars or more than 10 people starring together. A star must be in atleast one movie.

- (b) Explain coupling and cohesion with suitable example. 8

3. (a) Each year, sleepy Hollow Elementary school holds a "Principal for a Day" lottery. 10
A student can participate by entering his/her name and ID into a pool of candidates. The winner is selected randomly from all entries. Each student is allowed one entry. Implement a student class that encapsulates a student. Implement StudentLottery class with methods addStudents () and pickwinner () and main ()
Hint : Use Random class to pick winner.

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TURN OVER

- (b) With suitable example ,explain creation and use of user defined packages. 10
- 4.(a) Write detailed note on following exception handling terms. 10
(i) try-catch (ii) finally
(iii) Catch multiple exception
(iv) Throwing exception.
- (b) Write a program that computes the sum of a list of integers that is supplied by a user. The end of data signalled by the value - 999. This value is used only as a flag and not used in sum. 10
5. (a) Create Rectangle and Cube class that encapsulates the properties of a rectangle and cube i.e. Rectangle has default and parameterised constructor and area () method. Cube has default and parameterised constructor and volume () method. They share no ancestor other than Object. Implement a class Size with size() method. This method accepts a single reference argument z. If z refers to a Rectangle then size (z) returns its area and if z is a reference to a Cube, then size (z) returns its volume. If z refers to an object of any other class, then size (z) returns - 1. Use main () method in Size class to call size (..) method. 15
- (b) Differentiate between Interface and abstract class. 5
6. Write short notes on any four :- 20
(a) JVM (b) Package
(c) Polymorphism (d) Wrapper class
(e) ArrayList and LinkedList
(f) Vector.

(3 Hours)

[Total Marks : 80

- N.B : (1) Question No. 1 is compulsory.
 (2) Solve any three questions out of remaining three questions.
 (3) All questions carry equal marks as indicated by figures to the right.
 (4) Assume appropriate data whenever required. State all assumptions clearly.

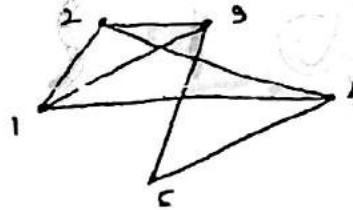
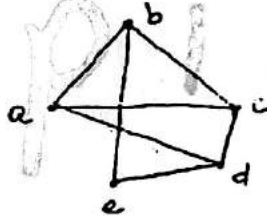
1. (a) Prove by mathematical induction $x^n - y^n$ is divisible by $x - y$. 5
 (b) How many vertices are necessary to construct a graph with exactly 6 edges in which each vertex is of degree 2. 5
 (c) Show that a relation is reflexive and circular if and only if it is an equivalence relation. 5
 (d) Prove that the set $G = \{1, 2, 3, 4, 5, 6\}$ is an abelian group under multiplication modulo 7. 5
2. (a) Is it possible to draw a tree with five vertices having degrees 1, 1, 2, 2, 4? 4
 (b) Find how many integers between 1 and 60 are 8
 (i) not divisible by 2 nor by 3 and nor by 5.
 (ii) Divisible by 2 but not by 3 and nor by 5.
 (c) Solve the recurrence relation $a_{n+2} - a_{n+1} - 6a_n = 4$ 8
3. (a) Show that $A \cap (B \oplus C) = (A \cap B) \oplus (A \cap C)$ 4
 (b) State and explain Pigeonhole principle, extended Pigeonhole principle. 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? 8
 (c) Let R be a relation on set $A = \{1, 2, 3, 4\}$, given as 8
 $R = \{(1, 1), (1, 4), (2, 2), (2, 3), (3, 2), (3, 3), (4, 1), (4, 4)\}$.
 Find transitive closure using Warshall's Algorithm.
4. (a) Find the generating function for the following sequence 4
 (i) 1, 2, 3, 4, 5, 6,
 (ii) 3, 3, 3, 3, 3, 8
 (b) Show that the (2, 5) encoding function $e: B^2 \rightarrow B^5$ defined by 8
 $e(00) = 00000$ $e(01) = 01110$
 $e(10) = 10101$ $e(11) = 11011$ is a group code.
 How many errors will it detect and correct.
 (c) Draw Hasse Diagram of D_{42} . Find the complement of each element in D_{42} . 8

5. (a) Define Distributive Lattice along with one appropriate example. 4
 (b) Let the functions $f, g,$ and h defined as follows : 3
 $f: \mathbb{R} \rightarrow \mathbb{R}, f(x) = 2x + 3$
 $g: \mathbb{R} \rightarrow \mathbb{R}, g(x) = 3x + 4$
 $h: \mathbb{R} \rightarrow \mathbb{R}, h(x) = 4x$
 Find $\text{gof}, \text{fog}, \text{foh}, \text{hof}, \text{gofoh}$

(c) let $H = \begin{vmatrix} 1 & 0 & 0 \\ 0 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{vmatrix}$ 8

Be a parity check matrix. Determine the group code $c_H: B^3 \rightarrow B^6$

6. (a) Determine if $[(p \Rightarrow q) \wedge \neg q] \Rightarrow \neg p$ is a tautology. 4
 (b) Define isomorphic graphs. Show that following graphs are isomorphic. 8



- (c) R be a relation on set of integers Z defined by 8
 $R = \{(x, y) \mid x - y \text{ is divisible by } 3\}$
 Show that R is an equivalence relation and describe the equivalence classes.
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GN-Con.:11265-14.

QP Code : 14644

(3 Hours)

[Total Marks : 80

- N.B. (1) Question No. 1 is compulsory.
 (2) Assume suitable data if necessary.
 (3) Attempts any three questions from remaining questions.

1. (a) Represent $(29)_{10}$ into Excess-3 code and Gray code. 2
 (b) Convert the following hex no. $(67.4A)_{16}$ into equivalent Octal no. 2
 (c) Convert decimal (215.32) into base '7'. 4
 (d) Convert $(670.17)_8$ into binary and hex. 4
 (e) Add $(57)_{10}$ and $(26)_{10}$ in BCD. 2
 (f) Explain uses of Gray code. 4
 (g) Add $(DDCC)_{16}$ and $(BBAA)_{16}$. 2
2. (a) (i) State the boolean algebra laws used in k-map simplification. 5
 (ii) Simplify $Y = ABC(\overline{CD}) + \overline{BCD} + (\overline{A}\overline{C})(B+D)$. 5
 (b) A misguided mathematician would like to subtract term $A\overline{C}$ from both sides of 10
 equality.
 $BC + ABD + A\overline{C} = BC + A\overline{C}$
 Would they still be equal if he did so. Justify and simplify the expression.
 $F = \underbrace{(x + \overline{z})}_{X + \overline{Z}} \underbrace{(\overline{z} + \overline{w}y)}_{\overline{W}X} + \underbrace{(vz + wx)}_?$
3. (a) Simplify using boolean theorems and implement using AOI gate only.
 (i) $\overline{AB + \overline{A}\overline{B} + (A+B) \cdot (\overline{A} + \overline{B})}$ 5
 (ii) Implement the following expression using NAND-NAND logic $y = \Sigma m(0, 1, 5)$ 5
 (b) Simplify using k-map obtain SOP equation and realize using NAND gate. 10
 $f(A, B, C, D) = \Pi M(i, 2, 3, 8, 9, 10, 11, 14) + d(7, 15)$.
4. (a) Implement the following expression using 8 : 1 mux 4
 $f(A, B, C, D) = \Sigma m(0, 1, 3, 5, 7, 10, 11, 13, 14, 15)$.
 (b) Explain with example 4 bit BCD adder using IC-7483. 8
 (c) Compare the performance of TTL, CMOS and ECL logic. 8
5. (a) What is shift register? Explain 4 bit bi-directional shift register. 10
 (b) Convert JK FF to SR and DFF. 10
6. Write short note on (any three) :— 20
 (a) State table
 (b) VHDL
 (c) Difference between CPLD and FPGA
 (d) Decade counters.

GN-Con. : 10397-14.