

2015

Time: 3 hours

Full Marks: 70

Candidates are required to give their answers in their own words as far as practicable.

The figures in the margin indicate full marks.

Answer from **all** the Groups as directed.

Group – A

1. Choose the correct answer of the following: 1x15=15

a) The number of elements in the power set $P(S)$ where $S =$

$\{\{\emptyset, 1, \{2, 3\}\}$ is:

- i. 2
- ii. 4
- iii. 8
- iv. 3

b) The set $A = \{1, 2, 3, 4, 12\}$ with a divide by relation forms:

- i. Equivalence relation
- ii. Partial ordered set
- iii. Totally ordered set
- iv. Binary relation

c) The number of relation on the set $A = \{1, 2, 3, 4\}$ is:

- i. 8

- ii. 16
- iii. 24
- iv. None of the above

d) The height of the binary tree of 15 node is:

- i. 2
- ii. 3
- iii. 4
- iv. 8

e) The number of different words formed from the letter PASCAL is:

- i. 300
- ii. 360
- iii. 720
- iv. 100

f) The value of a_3 where $a_n = 2.5 a_{n-1}$ and $a_1 = 4$ is:

- i. 40
- ii. 10
- iii. 400
- iv. None of the above

g) $(p \Rightarrow q) \wedge (q \Rightarrow r) \Rightarrow (p \Rightarrow r)$ is a:

- i. Contradiction
- ii. Tautology
- iii. Modus ponens
- iv. Indirect Method

h) The value of $(g \circ f)(-2)$ where $f: A \rightarrow B$, $g: B \rightarrow C$ defined by

$f(a) = a + 1$ and $f(b) = b^2 + 2$ is:

- i. 3
- ii. 4

iii. 5

iv. 6

i) The number of edges of a complete graph having n vertices is:

i. $n + 1$

ii. $n(n+1)/2$

iii. $n(n-1)/2$

iv. None of the above

j) Chromatic number of a complete graph with n vertices is:

i. n

ii. $n - 1$

iii. $2n$

iv. None of the above

k) Degree of each node of binary tree is at most:

i. 1

ii. 2

iii. 3

iv. None of the above

l) If 30 people are selected then how many of them are born on the same day of the week?

i. 5

ii. 6

iii. 7

iv. 8

m) What is the value of $\theta(g)$ where $g(n) = n^2 + n/g(n)$?

i. $\lg(n)$

ii. $n \lg(n)$

iii. n^2

- iv. n
- n) A Hamiltonian path is path that contains:
 - i. Each vertex exactly once except first vertex
 - ii. Each edge exactly once except first edge
 - iii. Contain even number of vertex
 - iv. Contain odd number of edge
- o) Which one of the following is shortest path algorithm?
 - i. Prim's algorithm
 - ii. Dijkstra's algorithm
 - iii. Fleury's algorithm
 - iv. Kruskal's algorithm

Group – B

Answer any **five** questions of the following: 4x5=20

2. Compute truth table for the following:

$$\sim (p \wedge q) \equiv (\sim p) \vee (\sim q)$$

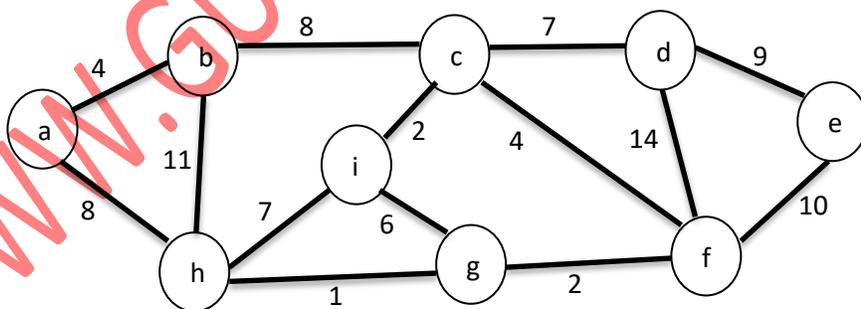
- 3. Using mathematical induction prove that $2^n > n$ for $n > 1$.
- 4. Let $A = \{a, b, c, d, e\}$ and $R = \{(a, a), (a, b), (b, c), (c, e), (c, d), (d, e)\}$, compute (i) R^2 (ii) R^∞ .
- 5. Let $A = \{1, 2, 3, 4, 5, 6\}$. Compute $(4, 1, 3, 5) \circ (5, 6, 3)$ and $(5, 6, 3) \circ (4, 1, 3, 5)$. Prove that $(4, 1, 3, 5) \circ (5, 6, 3) \neq (5, 6, 3) \circ (4, 1, 3, 5)$.
- 6. Draw Hasse diagram of the set $D_{20} = \{1, 2, 4, 5, 10, 20\}$ under divisibility relation. Prove that the set form a lattice under divisibility relation.

7. Write notes on any two of the following:
 - a) Partially ordered set
 - b) Equivalence relation
 - c) Permutation function
8. Explain preorder traversal with an example.
9. Write Kruskal's algorithm.

Group – C

Answer any **five** questions of the following: 7x5=35

10. Find an explicit formula for the sequence defined by $C_n = 3C_{n-1} - 2C_{n-2}$ with initial conditions $C_1 = 5$ and $C_2 = 3$.
11. Let $A = \{1, 2, 3\}$ and let $R = \{(1, 1), (1, 2), (2, 3), (1, 3), (3, 1), (3, 2)\}$. Find transitive closure using Warshall's algorithm.
12. Prove that cube root of unity forms an Abelian group under multiplication.
13. Explain Dijkstra's algorithm.
14. Using Prim's Algorithm find the minimum spanning tree of the following graph:



15. Draw the binary tree using the following tree traversal (Write each steps)

Preorder: ABCEIFJDGHKL

Inorder: EICFJBGDKHLA

Find postorder traversal from the binary tree.

16. Write short notes on the following:

- a) Depth First Search
- b) Euler's Circuit
- c) Homomorphism

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