Duration :- 2.30 Hrs | X321NDM19 | Maximum Marks : 75

Note : 1) All Questions are compulsory.
2) Make suitable assumptions wherever necessary.
3) Figures to right indicate full marks.
4) Use of Non-Programmable calculator is allowed.

Q.1. Attempt any three of following. **15 M**

a. If A = { 2, 4, 6 } and B = { 1,3, 5 }, Find A x B, A x A, B x B, B x A

b. Let D be the set of positive divisors of 15.
Define : a + b = L.C.M. {a, b} for all a, b ∈ D
a.b = GCD { a,b } for all a, b ∈ D
show that (D, +, · , ‘ , 1, 15) is Boolen Algebra.

c. Obtain the truth table for
i. $\sim p \rightarrow q$ ii. $(p \vee q) \rightarrow r$ iii. $(p \rightarrow r) \wedge (q \rightarrow r)$

d. Identify whether the following statements are valid or invalid.
i. This real number is rational or it its irrational
This real number is not rational
∴ Real number is irrational
ii. Murder is always wrong
Sometimes murder isn't wrong
∴ Death penalty should be illegal

e. Rewrite the following statements informally in at least two different ways without using variables or quantifiers.
i. ∀ rectangles x, x is a quadrilateral
ii. ∃ a set A, such tat A has 16 subsets.

f. State & prove De-Morgan's Law.

Q.2. Attempt any three of following. **15 M**

a. Prove that for all integers n, n^2-n+11 is a prime number.
b. Prove that two consecutive integers have opposite parity.
c. Prove that $\sqrt{2}$ is an irrational number.
d. Let a, b, c be integers, such that a/b an a/c then show that a| (b+c)
e. Prove that $\lfloor x + 3 \rfloor = \lfloor x \rfloor + 3$
f. The sum of any two even integers is even.

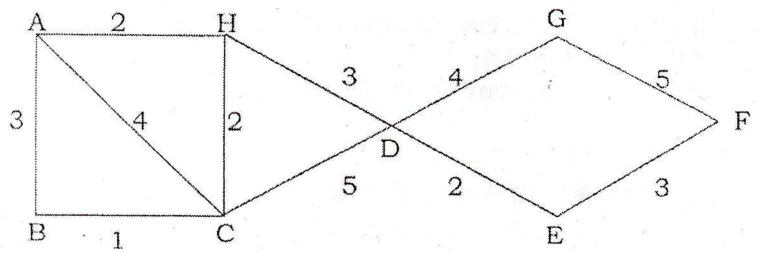
Q.3. Attempt any three of following. **15 M**

a. Using mathematical induction prove that for all integers $n \geq 0$, $2^{2n} - 1$ is divisible by 3.
b. Solve the following recurrence relation
$t_n = 5t_{n-1} - + 6t_{n-2}$ subjects to initial condition $t_0 = 7$, $t_1 = 16$
c. Define followings.
1. One-one function
2. Onto function
3. Bijective function
4. Inverse function
d. Given f(x) = 3x+2 and g(x) = x+5 find fog & gof, is fog = gof
e. Determine whether given function is bijective
f(x) = (x+1) / (x+2)
f. Let f:R→R be a function defined by f(x) = 6x+4, find f^{-1} if it exists.

Q.4. Attempt any three of the following. **15 M**

a. Define following terms.
1. Loops 2. Degree of vertex 3. Walk 4. trail

b. Using Kruskal's algorithm find minimum spanning tree.

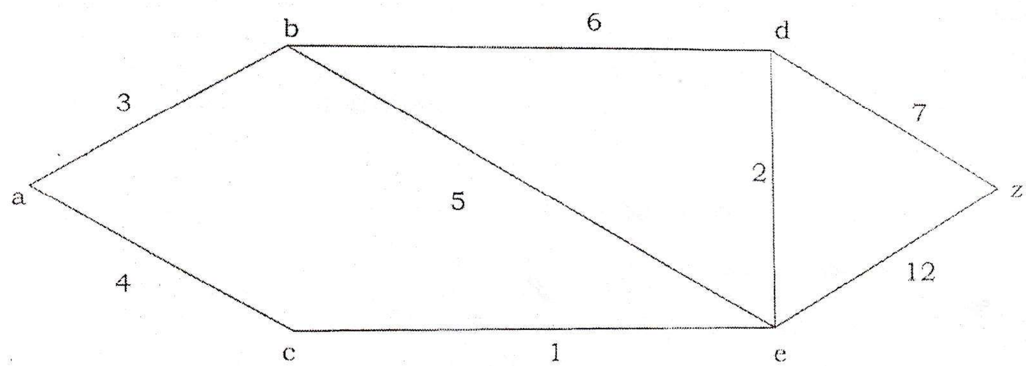


c. Let R be the relation defined on Set A = {1, 2, 3, 4} as
R= { (1, 1), (1,2), (3,1), (2,2), (3,2), (4,3), (4,4)}
Find i) R^{-1} ii) MR (Matrix Representation of Rel^{n}) iii) Diagraph of R

d. Give example of a relation on set A = {a, b, c, d} which satisfies
i) Reflexive, Symmetric but not transitive
ii) Reflexive, transitive but not symmetric
iii) Equivalence Relation

e. If A & B two events such that P(A) = 0.8; P(B) = 0.7, P (A∪B) = 0.6
Find P (A∩B), P (A/B), P (B/A)

f. Find the shortest path using Dijkstra's algorithm.



Q.5. Attempt any three of following. **15 M**

a. How many license plates can be made using either three digits followed by upper case English letter or three upper case English letters followed by three digits?

b. Show that whenever 25 Girls & 25 Boys are seated around circular table there is always person both of whose neighbours are boys.

c. Suppose the group of 12 consist of 5 men and 7 women.
a) How many 5-person team can be chosen that consist of 3 Men & 2 Women
b) How many 5-person team contain at most one man?

d. Two unbiased coins are tossed at a time. Find the probability of obtaining
i) Exactly one head
ii) No Head
iii) At least one head

e. If A & B are independent events such that
P(A) = 3/10, P(B) = 3/5 find P(A′), P(B′), P(A∩B)
P(A′∩B), P(A′∩B′), P(A∪B) and P (A′∪B)

f. An urn consist of 3 red & 4 green balls. Find expected value of red ball drawn.

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