

- Q.1. By PMI Prove that
- $$1^3 + 2^3 + 3^3 + \dots + n^3 = \frac{1}{4} n^2 (n+1)^2$$
- Q.2. How many Integers are there between 1 and 1000 which are not divisible by 2, 3, 5 or 7?
- Q.3. Prove that dual of a lattice is also a lattice
- Q.4. If  $f(x) = ax + b$  &  $g(x) = cx + d$  where  $a, b, c, d$  are constants, are any two functions on the set  $\mathbb{R}$  then for what values of  $a, b, c, d$  the  $g \circ f$  and  $f \circ g$  are equal?
- Q.5. In a group of six people, at least three must be mutual friends or at least three must be mutual strangers Prove it by PHP.
- Q.6. Prove that number of vertices of odd degrees in a graph  $G$  is always even.
- Q.7. Prove that sum of degrees of all vertices in a graph is equal to twice the number of edges in the graph.
- Q.8. If  $G(V, E)$  is a connected graph then  $G$  is bipartite iff  $G$  contains no odd cycle.

Q.9. Prove that no. of edges in a simple graph with  $n$  vertices and  $k$  connected components ( $k \geq 1$ ) can not exceed

$$\frac{(n-k)(n-k+1)}{2}$$

Q.10. How many vertices and edges are there in  $K_n$ ,  $C_n$  &  $W_n$ .

Q.11. Prove that a tree with  $n$  vertices has exactly  $(n-1)$  edges.

Q.12. Prove that a graph is connected iff it has a spanning tree.

Q.13. Prove that  $[(p \rightarrow q) \wedge (q \rightarrow r)] \rightarrow (p \rightarrow r)$  is tautology.

Q.14. Test the validity of following arguments:-

$$\begin{array}{l} \sim c \rightarrow \sim a \\ \sim b \\ c \rightarrow d \\ a \vee b \\ \hline \therefore d \end{array}$$

Q.15. Express following Boolean function in CNF  
 $(x_1 + x_2) \cdot (x_1 + x_3) + x_1 \cdot x_2 \cdot x_3$

Q.16. Prove that every complimented distributive Lattice  $(L, \leq)$  with  $0 \neq 1$ , determines a boolean algebra  $\langle L, \vee, \wedge, ', 0, 1 \rangle$

Q.17. Find coefficient of  $x^{50}$  in expansion of  
 $(x^{10} + x^{11} + \dots + x^{25}) (x + x^2 + x^3 + \dots + x^{15})$   
 $(x^{20} + x^{21} + \dots + x^{45})$

Q.18. Find generating function of numeric  
 $f^n$   $a_n = (n+1)(n+2)5^n$

Q.19. Find numeric  $f^n$  of following generating  
 function  $\frac{9}{4(2+x)} - \frac{13}{12(2-x)} - \frac{4}{3(1+x)} - \frac{1}{x-1}$

Q.20. By method of generating functions  
 solve  $a_n - 2a_{n-1} + a_{n-2} = 2^{n-2}$

Q.21. Solve  $a_n - 6a_{n-1} + 8a_{n-2} = n \cdot 4^n$

Q.22. In how many ways  $2n+1$  marbles can  
 be distributed among 3 boxes so  
 no box contains more than  $n$  marbles?

Q.23. Show that following graph is not  
 bipartite

