MCQ- Graph Theory

1. Degree of any vertex of a graph is
    a. Number of vertices in a graph
    b. The number of edges incident with the vertex
    c. Number of edges in a graph
    d. Number of vertices adjacent to thatvertices
2. A graph with no edges is known as empty graph. Empty graph is also known as
    a. Trivial graph
    b. Regular Graph
    c. Bipartite Graph
    d. None of these
3. If the origin and terminus of a walk are same, the walk is known as..
    a. Open
    b. Closed
    c. Path
    d. None of these
4. A vertex of a graph is called even or odd depending upon
    a. Total number of edges in a graph is even or odd
    b. Total number of vertices in a graph is even or odd
    c. Its degree is even or odd
    d. None of these
5. The maximum degree of any vertex in a simple graph with n vertices is
    a. n-1
    b. n+1
    c. 2n +1
    d. n
6. Suppose v is an isolated vertex in a graph , then the degree of v is
    a. 0
    b. 1
    c. 2
    d. 3
7. The complete graph with 4 vertices has k edges where k is
    a. 3
    b. 4
    c. 5
    d. 6
8. Length of the walk of a graph is
    a. The number of vertices in walk W
    b. The number of edges in walk W
    c. Total number of edges in a graph
    d. Total number of vertices in a graph
9. A graph with one vertex and no edges is
    a. Multigraph

b. Digraph
c. Isolated graph
d. Trivial graph

10. In any undirected graph the sum of degrees of all the nodes
    a. Must be even
    b. Must be odd
    c. Need not be even
    d. None of these
11. A subgraph H of G is a spanning subgraph of G if
    a. V(H) = V(G)
    b. V(H) - V(G)
    c. V(H) < V(G)
    d. V(H) >V(G)
12. If the degree of vertex d(v)= k for every vertex v of the graph G, then G is called
    a. K-regular graph
    b. K graph
    c. Planar graph
    d. None of these
13. A simple graph is called self -complementary, then G
    a. Isomorphic to another graph
    b. Isomorphic to its complement graph
    c. Isomorphic to G
    d. None of these
14. A spanning 1-regular subgraph of G is called
    a. Spanning tree
    b. Clique
    c. Cubic graph
    d. 1-factor graph
15. Every Tournament contains a directed ……..
    a. Hamiltonian cycle
    b. Hamiltonian path
    c. Eulerian Tour
    d. Cycle
16. A digraph is a tournament , if its underlying graph is ……
    a. Spanning Graph
    b. Complete Graph
    c. Super Graph
    d. Hamiltonian Graph
17. A digraph is strict, if its underlying graph is
    a. Complete Graph
    b. Simple
    c. Connected
    d. Path

18. The number of vertices of $G_1 \square G_2$ is
    a. $n(G_1)\ n(G_2)$
    b. $n(G_1) + n(G_2)$
    c. $n(G_1)\ 2\ n(G_2)$
    d. $n(G_1)\ m(G_2)$
19. The number of edges of $G_1 \times G_2$ is
    a. $m(G_1)\ n(G_2)$
    b. $2m(G_1).m(G_2)$
    c. $m(G_1) + m(G_2)$
    d. $2n(G_1)\ m(G_2)$
20. The line graph of the simple graph is a path iff G is a
    a. Complete graph
    b. Trail
    c. Path
    d. Tour
21. The line graph of the star $K_{1,n}$ is the
    a. Path
    b. Tournament
    c. Walk
    d. Complete graph
22. A vertex v is reachable from a vertex u of D, if there is a
    a. Directed walk from v to u
    b. Directed path from u to v
    c. Directed path from u to v
    d. Directed edge from u to v

    Answer: Directed path from u to v
23. A vertex of D is pendant, if its degree is
    a. 0
    b. 1
    c. 2
    d. 3
24. An automorphism of a graph G is a
    a. Mapping from G onto itself
    b. homomorphism from G onto itself
    c. isomorphism from G onto itself
    d. bijection from G onto itself
25. If G is a self-complementary graph of order n, then
    a. $n \equiv 0 \bmod 4$
    b. $n \equiv 0 \bmod 5$
    c. $n \equiv 0 \bmod 8$
    d. $n \equiv 0 \bmod 3$
26. The minimum k for which there exists a k vertex cut is called
    a. Edge connectivity
    b. vertex connectivity

c. Edge cut
d. vertex cut

27. For a complete graph $K_n, \kappa(G) =$

(a) 1 (b) 0 (c) n-1 (d) none

28. The smallest k for which there exists k- edge cut in a graph G is called

(a) Vertex connectivity (b) vertex cut (c)Edge connectivity (d) none

29. A graph is r-regular if

(a) $\kappa(G) \geq r$ (b) $\kappa(G) < r(c)\ \kappa(G) = r$ (d) $\kappa(G) = 0$

30. For a loopless connected graph which one is true

(a) $\kappa(G) \leq \lambda(G)$ (b) $\kappa(G) \geq \lambda(G)$

(c) $\kappa(G) \leq \delta(G)$ (d) $\kappa(G) \geq \delta(G)$

31. A non- trivial connected graph that has no cut vertices is

(a) Separable (b) non- separable

(c) disjoint (d) none

32. A maximal non- separable subgraph of a graph is

(a) Block (b) separable

(c) non- separable (d) none

33. How many vertices are common for any two blocks?

(a) 2 (b) 1 (c) at most 1 (d) at least 1

34. A connected graph without cycles is called

(a) Tree (b) bipartite graph

(c) component (d) complete graph

35. The number of vertices of odd degree in a graph is always……..

(a) Odd (b) even (c) 1 (d) 0

36. Every connected graph contains

(a) Cycle (b) block (c) spanning tree (d) none

37. The number of edges in a tree on n vertices is

(a) n (b) 1 (c) n-1 (d) n-2

38. $\tau(K_n) =$

(a) n^n (b) n^{n-1} c) n^{n-2} (d) n^{n+1}

39. A connected graph on n vertices and $n-1$ edges is a

(a) Block (b) forest (c) tree (d) none

40. The diameter of a graph G is defined as

(a) $Max\{d(v) : v\ belongs\ to\ V(G)\}$
(b) $Max\{d(u,v) : u,v\ belongs\ to\ V(G)\}$
(c) $Min\{d(u,v) : u,v\ belongs\ to\ V(G)\}$
(d) $Min\{d(v) : v\ belongs\ to\ V(G)\}$

41. If v is a vertex of G, the eccentricity e (v) is defined by

(a) $Max\{d(u,v) : u,v\ belongs\ to\ V(G)\}$
(b) $Max\{d(u,v) : u\ belongs\ to\ V(G)\}$
(c) $Min\{d(u,v) : u,v\ belongs\ to\ V(G)\}$
(d) $Min\{d(u,v) : u\ belongs\ to\ V(G)\}$

42. The radius $r(G)\ of\ G$ is the minimum

(a) Eccentricity of G (b) diameter of G

(c) distance of G (d) degree of G

43. The set of central vertices of G is called

(a) radius (b) diameter (c) center (d) pendant vertex

44. A graph containing only one cycle is called

(a) unicyclic (b) polycyclic (c) cyclic (d) none

45. A tree with at least two vertices contain

(a) at most two pendant vertices

(b) at least two pendant vertices

(c) exactly one pendant vertices

(d) more than one pendant vertices

46. Every tree is a

(a) cubic graph (b) bipartite graph

(c) unicyclic graph (d) polycyclic

47. Trees are connected graphs in which every pair of distinct vertices are joined by

(a) two disjoint paths (b) a unique path

(c) more than two paths (d) none

48. Cayley's formula determines

(a) the number of edges of a tree

(b) the number of spanning trees in a graph

(c) the number of cycles in a graph

(d) the number of paths in a graph

49.For a disconnected graph, $\kappa(G) =$

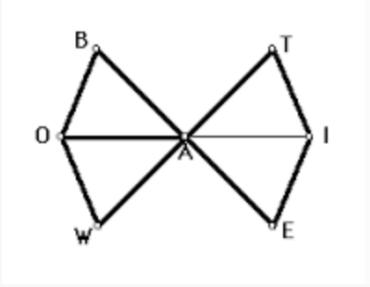
(a) 1 (b) 0 (c) n-1 (d) n+1

50. A vertex v of G is called a central vertex if $e(G) =$

(a) $d(v)$ (b) $r(G)$ (c) $diam\ (G)$ (d) $none$

51. A graph is Eulerian if it contains …… .
    a) Euler trail
    b) Euler tour
    c) Hamiltonian path
    d) Hamiltonian cycle
52. Tracing all edges on a graph without picking up your pencil or repeating and starting and stopping at different vertices is called …….. .
    a) Euler tour
    b) Euler trail
    c) Hamiltonian path
    d) Hamiltonian cycle
53. Euler paths must touch …… .
    a) All edges
    b) All vertices
    c) Both a and b
    d) Neither a nor b
54. A given graph G is a Euler graph if and only if all vertices of G are of …….. .
    a) Same degree
    b) Even degree
    c) Odd degree
    d) Different degree

55. For which of the following, Euler tour is never possible if number of vertices is greater 2.
    a) K_n
    b) Q_n
    c) W_n
    d) C_n
56. Refer to the graph below and choose the best answer:



a) Euler path and Euler tour
b) Euler path only
c) Euler tour only
d) Neither an Euler path nor an Euler tour

57. Which of the following statements are true:
    I. A graph is Eulerian if and only if each edge e of G belongs to an even number of cycles
    II. A graph is Eulerian if and only if each edge e of G belongs to an odd number of cycles
    III. A graph G is Eulerian if and only if it has an even number of cycle decompositions
    IV. A graph G is Eulerian if and only if it has an odd number of cycle decompositions
    a) I and III
    b) I and IV
    c) II and III
    d) II and IV
58. A graph G is called traceable if it has a/an …….. .
    a) Hamiltonian path
    b) Hamiltonian cycle
    c) Euler trail
    d) Euler tour
59. The Herschel graph is ……..
    a) Hamiltonian and bipartite
    b) Non-Hamiltonian and bipartite
    c) Hamiltonian but not bipartite
    d) Non-Hamiltonian and not bipartite
60. Let G be an undirected complete graph on n vertices, where n>2. Then the number of different Hamiltonian cycles in G is equal to …… .
    a) $n!$
    b) $(n-1)!$
    c) 1
    d) $\frac{(n-1)!}{2}$
61. If a graph G has no loops or parallel edges and if the number of vertices in the graph is $n \geq 3$, then the graph G is Hamiltonian if
    I. deg(v) ≥ n/3 for each vertex v
    II. deg(v) + deg(w) ≥ n whenever v and w are not connected by an edge.
    III. E(G) ≥ 1/3 (n-1)(n-2)+2

a) (i) and (iii) only
b) (ii) and (iii) anly
c) (iii) only
d) (ii) only

62. For which value of m and n does the complete bipartite graph $K_{m,n}$ have a Hamiltonian cycle
    a) m≠n, m,n ≥ 2
    b) m≠n, m,n ≥ 3
    c) m=n, m,n ≥ 2
    d) m=n, m,n ≥ 3
63. Identify true statements:
    I. Every complete graph is Hamiltonian
    II. Every wheel graph is Hamiltonian
    III. Every complete bipartite graph is Hamiltonian

    a) I only
    b) I and II only
    c) I, II and III
64. Identify true statements:
    I. If cl(G) is Hamiltonian, then G is Hamiltonian
    II. If cl(G) is complete, then G is Hamiltonian

    a) I only
    b) II only
    c) Both I and II
    d) Neither I nor II
65. The minimum number of colours needed for a proper vertex colouring of planar graph is ……. .
    a) 2
    b) 3
    c) 4
    d) 5
66. What will be the chromatic number of a tree having more than 1 vertex ?
    a) 0
    b) 1
    c) 2
    d) Varies with the structure and number of vertices of the tree
67. What will be the chromatic number for a line graph having n vertices ?
    a) 0
    b) 1
    c) 2
    d) n
68. A graph with chromatic number less than or equal to k is called …… .
    a) k chromatic
    b) k colourable

c) k chromatic colourable
d) k colourable chromatic

69. The chromatic number of the Peterson graph is …… .
    a) 3
    b) 4
    c) 5
    d) None of the above
70. How many unique colours will be required for a proper vertex colouring of an empty graph having n vertices?
    a) 0
    b) 1
    c) 2
    d) n
71. For any simple graph G with n vertices and chromatic number χ, then which if the following statements are true:
    I. $2\sqrt{n} \leq \chi + \chi^c \leq n + 1$
    II. $n^2 \leq \chi\chi^c \leq \left(\frac{n+1}{2}\right)^2$
    III. $2n \leq \chi + \chi^c \leq \sqrt{n+1}$
    IV. $n \leq \chi\chi^c \leq \left(\frac{n+1}{2}\right)^2$
    a) I and II
    b) I and IV
    c) II and III
    d) III and IV
72. A graph is called critical if for every proper subgraph H of G,
    a) $\chi(H) = \chi(G)$
    b) $\chi(H) \leq \chi(G)$
    c) $\chi(H) < \chi(G)$
    d) $\chi(H) \geq \chi(G)$
73. If G is k-critical then which of the following is true.
    a) $\delta(G) \geq k - 1$
    b) $\delta(G) < k - 1$
    c) $\delta(G) < k$
    d) $\delta(G) \leq k$
74. Which of the following is the correct statement of Brooks' theorem:
    a) If a connected graph G is neither an odd cycle nor a complete graph, then $\chi(G) \leq 1 + \Delta(G)$
    b) If a connected graph G is neither an odd cycle nor a complete graph, then $\chi(G) \leq \Delta(G)$
    c) If a connected graph G is neither an odd cycle nor a complete graph, then $\chi(G) \geq 1 + \Delta(G)$
    d) If a connected graph G is neither an odd cycle nor a complete graph, then $\chi(G) \geq \Delta(G)$
75. What is the independence number of a wheel graph with n+1 vertices (n≥3) ?
    a) n

b) $\left[\frac{n}{2}\right]$
c) 1
d) None

76. Which of the following is not a planar graph?
    a) Trees
    b) Cycles
    c) Wheels
    d) Petersen graph

77. Number of unbounded faces of a plane graph is
    a) Zero
    b) One
    c) Two
    d) Infinite

78. In a planar graph, the …. are not allowed to intersect.
    a) Edges
    b) Vertices
    c) Faces
    d) Corners

79. A cut edge of a connected plane graph G belongs to …. faces of G.
    a) One
    b) Two
    c) One or Two
    d) Three

80. An edge of a connected plane graph G belongs to …. faces of G.
    a) One
    b) Two
    c) One or Two
    d) Three

81. For the cycle graph C_4, the degree of the bounded face is
    a) Zero
    b) One
    c) Two
    d) Four

82. If G is a planar graph, which of the following is not true?
    a) G is embeddable on a sphere
    b) Each block of G is planar
    c) Number of faces in all plane embeddings of G are the same.
    d) Complement of G is a planar graph
83. The number of edges of a connected plane graph with 8 vertices and 5 faces is
    a) 5
    b) 11
    c) 15
    d) 13
84. The maximum number of edges of a simple planar graph with 5 vertices is
    a) 9
    b) 15
    c) 21
    d) 11
85. The girth of a graph is
    a) Length of a shortest path in G
    b) Length of a shortest cycle in G
    c) Number of faces of G
    d) Number of bounded faces of G
86. Which of the following graphs is planar?
    a) K_5
    b) $K_{3,3}$
    c) $K_{4,2}$
    d) K_6
87. Which of the following statements about $K_{3,3}$ is not true?
    a) Removal of a vertex results in a planar graph
    b) It is a nonplanar graph with the smallest number of vertices
    c) It is a nonplanar graph with the smallest number of edges
    d) Contraction of an edge results in a planar graph

88. The number of vertices of the dual graph of the complete graph K_4 is

    a) 3

    b) 4

    c) 6

    d) 8

    Answer: b) 4

89. Which of the following is true, if n is the number of vertices , m is the number of edges and f is the number of faces of a connected plane graph.

    a) $n + m + f = 2$

    b) $n - m + f = 2$

    c) $n - m - f = 2$

    d) $n + m - f = 2$

90. Let G be a graph with 10 edges. The number of edges of its dual graph is

    a) 2

    b) 8

    c) 6

    d) 10

91. All wheels are:

    i) Self dual

    ii) Planar

    iii) Non-Planar

    iv) Disconnected

    a) (i) All statements are true

    b) (i) and (iii) are true

    c) (i) and (ii) are true

    d) (ii) and (iii) are true

92. Euler Formula applies to

    a) All graphs

    b) All complete graphs

    c) All bipartite graphs

    d) All connected planar graphs

93. Let G be a simple planar graph on 10 vertices with 15 edges. If G is a connected graph, then the bounded faces in any embedding of G on the plane is
    a) 6
    b) 7
    c) 23
    d) 8
94. The set of eigen values of a graph G is called
    a) Energy of G
    b) Spectrum of G
    c) Trace of G
    d) Center of G
95. Eigen values of a real symmetric matrix are always
    a) Positive
    b) Negative
    c) Real
    d) Complex
96. The spectrum of the complete graph K_6 is
    a) $\begin{pmatrix} 6 & -1 \\ 1 & 5 \end{pmatrix}$
    b) $\begin{pmatrix} 5 & -1 \\ 1 & 5 \end{pmatrix}$
    c) $\begin{pmatrix} 6 & 1 \\ 1 & 5 \end{pmatrix}$
    d) $\begin{pmatrix} 5 & 1 \\ 1 & 5 \end{pmatrix}$
97. The spectrum of the cycle graph C_4 is
    a) $\begin{pmatrix} 2 & -1 \\ 1 & 3 \end{pmatrix}$
    b) $\begin{pmatrix} 2 & -1 \\ 2 & 2 \end{pmatrix}$
    c) $\begin{pmatrix} 2 & 0 & -2 \\ 1 & 2 & 1 \end{pmatrix}$
    d) $\begin{pmatrix} 2 & -1 & -2 \\ 2 & 1 & 1 \end{pmatrix}$
98. The adjacency matrix of the complete graph K_4 is

a) $\begin{pmatrix} 1 & 0 & 1 & 1 \\ 0 & 1 & 1 & 1 \\ 1 & 1 & 0 & 1 \\ 1 & 1 & 1 & 0 \end{pmatrix}$

b) $\begin{pmatrix} 0 & 1 & 1 & 1 \\ 1 & 0 & 1 & 1 \\ 1 & 1 & 0 & 1 \\ 1 & 1 & 1 & 0 \end{pmatrix}$

c) $\begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}$

d) $\begin{pmatrix} 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 \\ 1 & 0 & 0 & 1 \\ 0 & 1 & 1 & 0 \end{pmatrix}$

99. Which of the following is a circulant matrix?

a) $\begin{pmatrix} 2 & 1 & 3 \\ 3 & 1 & 2 \\ 1 & 3 & 2 \end{pmatrix}$

b) $\begin{pmatrix} 1 & 2 & 3 \\ 3 & 1 & 2 \\ 2 & 3 & 1 \end{pmatrix}$

c) $\begin{pmatrix} 1 & 2 & 3 \\ 2 & 3 & 1 \\ 3 & 1 & 2 \end{pmatrix}$

d) $\begin{pmatrix} 1 & 2 & 3 \\ 2 & 1 & 3 \\ 1 & 3 & 2 \end{pmatrix}$

100. Which of the following is a maximal planar graph?

a) C_5

b) K_5

c) K_4

d) C_4