“Adjacency Matrix”.

1. The number of elements in the adjacency matrix of a graph having 7 vertices is _____

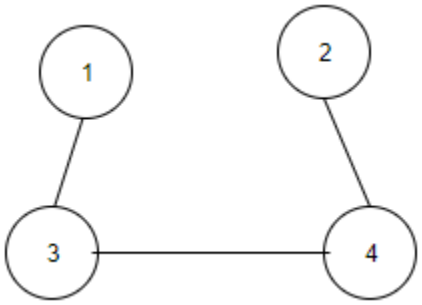
a) 7
b) 14
c) 36
d) 49

View Answer

Answer: d

Explanation: There are n*n elements in the adjacency matrix of a graph with n vertices.

2. What would be the number of zeros in the adjacency matrix of the given graph?



a) 10
b) 6
c) 16
d) 0

View Answer

Answer: b

Explanation: Total number of values in the matrix is 4*4=16, out of which 6 entries are non zero.

3. Adjacency matrix of all graphs are symmetric.

a) False
b) True

View Answer

Answer: a

Explanation: Only undirected graphs produce symmetric adjacency matrices.

4. The time complexity to calculate the number of edges in a graph whose information in stored in form of an adjacency matrix is _____

a) O(V)
b) O(E^2)
c) O(E)
d) O(V^2)
View Answer
Answer: d
Explanation: As V entries are 0, a total of V^2-V entries are to be examined.

5. For the adjacency matrix of a directed graph the row sum is the _____ degree and the column sum is the _____ degree.
a) in, out
b) out, in
c) in, total
d) total, out
View Answer
Answer: b
Explanation: Row number of the matrix represents the tail, while Column number represents the head of the edge.

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6. What is the maximum number of possible non zero values in an adjacency matrix of a simple graph with n vertices?
a) (n*(n-1))/2
b) (n*(n+1))/2
c) n*(n-1)
d) n*(n+1)
View Answer
Answer: c
Explanation: Out of n*n possible values for a simple graph the diagonal values will always be zero.

7. On which of the following statements does the time complexity of checking if an edge exists between two particular vertices is not, depends?
a) Depends on the number of edges
b) Depends on the number of vertices
c) Is independent of both the number of edges and vertices
d) It depends on both the number of edges and vertices
View Answer
Answer: c
Explanation: To check if there is an edge between to vertices i and j, it is enough to see if the value of A[i][j] is 1 or 0, here A is the adjacency matrix.

8. In the given connected graph G, what is the value of rad(G) and diam(G)?
a) 2, 3
b) 3, 2
c) 2, 2
d) 3, 3
View Answer
Answer: a
Explanation: Value of eccentricity for vertices A, C is 2 whereas for F, B, D, E it is 3.

9. Which of these adjacency matrices represents a simple graph?
a) [[1, 0, 0], [0, 1, 0], [0, 1, 1]]
b) [[1, 1, 1], [1, 1, 1], [1, 1, 1]]
c) [[0, 0, 1], [0, 0, 0], [0, 0, 1]]
d) [[0, 0, 1], [1, 0, 1], [1, 0, 0]]
View Answer
Answer: d
Explanation: A simple graph must have no-self loops, should be undirected.

10. Given an adjacency matrix A = [[0, 1, 1], [1, 0, 1], [1, 1, 0]], The total no. of ways in which every vertex can walk to itself using 2 edges is _____
a) 2
b) 4
c) 6
d) 8
View Answer
Answer: c
Explanation: A^2 = [[2, 1, 1], [1, 2, 1], [1, 1, 2]], all the 3 vertices can reach to themselves in 2 ways, hence a total of 3*2, 6 ways.

11. If A[x+3][y+5] represents an adjacency matrix, which of these could be the value of x and y.
a) x=5, y=3
b) x=3, y=5
c) x=3, y=3
d) x=5, y=5
View Answer
Answer: a
Explanation: All adjacency matrices are square matrices.

12. Two directed graphs(G and H) are isomorphic if and only if A=PBP-1, where P and A are adjacency matrices of G and H respectively.
a) True

b) False
View Answer
Answer: a
Explanation: This is a property of isomorphic graphs.

13. Given the following program, what will be the 3rd number that'd get printed in the output sequence for the given input?

```
#include <bits/stdc++.h>
using namespace std;
int cur=0;
int G[10][10];
bool visited[10];
deque <int> q;

void fun(int n);

int main()
{
          int num=0;
          int n;
          cin>>n;

          for(int i=0;i<n;i++)
          for(int j=0;j<n;j++)
          cin>>G[i][j];

          for(int i=0;i<n;i++)
        visited[i]=false;

        fun(n);
          return 0;
}

void fun(int n)
{
          cout<<cur<<" ";
          visited[cur]=true;
          q.push_back(cur);

          do
        {
                    for(int j=0;j<n;j++)
```

```
                {
                       if(G[cur][j]==1 && !visited[j])
                    {
                           q.push_back(j);
                           cout<<j<<" ";
                           visited[j]=true;
                     }

                 }

                   q.pop_front();
                   if(!q.empty())
                   cur=q.front();
           }while(!q.empty());
}
```

Input Sequence:-

```
9
0 1 0 0 0 0 0 0 1
1 0 0 0 0 0 0 0 0
0 0 0 1 1 1 0 0 1
0 0 1 0 0 0 0 0 0
0 0 1 0 0 0 0 1 0
0 0 1 0 0 0 1 0 0
0 0 0 0 0 1 0 1 1
0 0 0 0 1 0 1 0 0
1 0 1 0 0 0 1 0 0
```

a) 2
b) 6
c) 8
d) 4

View Answer

Answer: c
Explanation: The given code performs the breadth first search routine on the Graph. The sequence obtained would be 0 1 8 2 6 3 4 5 7.

14. For which type of graph, the given program won't run infinitely? The Input would be in the form of an adjacency Matrix and n is its dimension (1<n<10).

```
#include <bits/stdc++.h>
using namespace std;
```

```
int G[10][10];
void fun(int n);

int main()
{
          int num=0;
          int n;
          cin>>n;
          for(int i=0;i<n;i++)
                    for(int j=0;j<n;j++)
                    cin>>G[i][j];
          fun(n);
          return 0;
}

void fun(int n)
{
          for(int i=0;i<n;i++)
          for(int j=0;j<n;j++)
          if(G[i][j]==1)
          j--;
}
```

a) All Fully Connected Graphs
b) All Empty Graphs
c) All Bipartite Graphs
d) All simple graphs

View Answer

Answer: b

Explanation: For any graph (except empty graph) having edges, the condition G[i][j]==1 would hold true, which would result in an infinite loop.

15. Given the following adjacency matrix of a graph(G) determine the number of components in the G.

```
[0 1 1 0 0 0],
[1 0 1 0 0 0],
[1 1 0 0 0 0],
[0 0 0 0 1 0],
[0 0 0 1 0 0],
[0 0 0 0 0 0].
```

a) 1
b) 2
c) 3
d) 4
View Answer
Answer: c
Explanation: 0th 1st and 2nd vertices form a component, 3rd and 4th forms another and 5th vertex forms a component of a single vertex.

“Adjacency List”.

1. Space complexity for an adjacency list of an undirected graph having large values of V (vertices) and E (edges) is _____
a) O(E)
b) O(V*V)
c) O(E+V)
d) O(V)
View Answer
Answer: c
Explanation: In an adjacency list for every vertex there is a linked list which have the values of the edges to which it is connected.

2. For some sparse graph an adjacency list is more space efficient against an adjacency matrix.
a) True
b) False
View Answer
Answer: a
Explanation: Space complexity for adjacency matrix is always O(V*V) while space complexity for adjacency list in this case would be O(V).

3. Time complexity to find if there is an edge between 2 particular vertices is _____
a) O(V)
b) O(E)
c) O(1)
d) O(V+E)
View Answer
Answer: a
Explanation: The maximum edges a vertex can have is V-1.

4. For the given conditions, which of the following is in the correct order of increasing space requirement?
i) Undirected, no weight
ii) Directed, no weight
iii) Directed, weighted
iv) Undirected, weighted
a) ii iii i iv
b) i iii ii iv
c) iv iii i ii
d) i ii iii iv
View Answer
Answer: a
Explanation: i) takes v+4e, ii) takes v+2e, iii) takes v+3e, iv) takes v +6e space.

5. Space complexity for an adjacency list of an undirected graph having large values of V (vertices) and E (edges) is _____
a) O(V)
b) O(E*E)
c) O(E)
d) O(E+V)
View Answer
Answer: c
Explanation: In an adjacency list for every vertex there is a linked list which have the values of the edges to which it is connected.

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6. Complete the given snippet of code for the adjacency list representation of a weighted directed graph.

```
class neighbor
{
        int vertex, weight;
        ____ next;
}

class vertex
{
```

```
                string name;
                _____ adjlist;
        }

        vertex adjlists[101];
```

a) vertex, vertex
b) neighbor, vertex
c) neighbor, neighbor
d) vertex, neighbor
View Answer
Answer: c
Explanation: Vertex would have a name and a linked list attached to it.

7. In which case adjacency list is preferred in front of an adjacency matrix?
a) Dense graph
b) Sparse graph
c) Adjacency list is always preferred
d) Complete graph
View Answer
Answer: b
Explanation: In case of sparse graph most of the entries in the adjacency matrix would be 0, hence adjacency list would be preferred.

8. To create an adjacency list C++'s map container can be used.
a) True
b) False
View Answer
Answer: a
Explanation: We can create a mapping from string to a vector, where string would be the name of the vertex and vector would contains the name of the vertices to which it is connected.

9. What would be the time complexity of the following function which adds an edge between two vertices i and j, with some weight 'weigh' to the graph having V vertices?

```
vector<int> adjacent[15] ;
vector<int> weight[15];

void addEdge(int i,int j,int weigh)
{
        adjacent[a].push_back(i);
        adjacent[b].push_back(j);
```

```
        weight[a].push_back(weigh);
        weight[b].push_back(weigh);
}
```

a) O(1)
b) O(V)
c) O(V*V)
d) O(log V)

View Answer

Answer: a
Explanation: The function win in the constant time as all the four step takes constant time.

10. What would be the time complexity of the BFS traversal of a graph with n vertices and $n^{1.25}$ edges?
a) O(n)
b) O($n^{1.25}$)
c) O($n^{2.25}$)
d) O(n*n)

View Answer

Answer: b
Explanation: The time complexity for BFS is O(|V| + |E|) = O(n + $n^{1.25}$) = O($n^{1.25}$).