Social Networks

Week-1 Assignment

1.
If there exist a graph where nodes represents students and edges represents friendship, then for a rumour to be spread across entire class -

A. Every student must know every other student.
B. The graph needs to be connected.
C. The graph need not be connected.
D. Will spread in any case.

Answer - (B)

Reference - Lecture-1
Timestamp - 2:25

Solution -
If the graph is not connected, then there exists at least one student who has no friend and hence will not know about the rumour.

2.
If x = random.randrange(5,10), which values can x take?

I) 5
II) 8
III) 4
IV) 10

A. Only I, II, IV
B. Only I, II, III
C. Only II, III
D. Only I, II

Answer - (D)

Reference - Lecture-3
Timestamp - 7:00

Solution -

random.randrange(start,stop) gives out a random integer including the start value while excluding stop.

3.
If x = random.randint(3,6), which values can x take?

I) 5
II) 4.3
III) 3
IV) 6

A. Only I, II
B. Only I, III
C. Only I, III, IV
D. Only I

Answer - (C)

Reference - Lecture-3
Timestamp - 8:55

Solution -
random.randint(start,stop) gives a random integer including both start and stop values.

4.
What will be the output of the following code snippet?

```
x = [5, 2, 7, 3, 8]
try:
        a = x[5]
        if(a%2 == 0):
                print("It is an even number")
        else:
                print("It is an odd number")
except:
        print("Element does not exist")
```

A. It is an even number
B. It is an odd number
C. Element does not exist
D. The code won't run

Answer - (C)

Reference - Lecture-6
Timestamp - 37:30

Solution -
Since there are only 5 elements in the list, x[5] doesn't exist and so will throw an error(IndexError: list index out of range) and so the code will move to the except block.

5.
What will be the output of the following code snippet?

```
import random
x = []
for i in range(7):
    x.append(random.randint(1,5))
x.sort()
x.append({"one":1, "two":2})
print(len(x))
```

A. 9
B. 8
C. 7
D. 10

Answer - (B)

Reference - Lecture-3
Timestamp - 16:41

Solution -
7 random numbers(between 1 & 5) are being added to the list.
Dictionaries inside lists are considered as single elements.
Hence, The length of the list is 8.

6.
Maximum number of edges that can be present in a graph with 10 nodes are -

A. 100
B. 45
C. 50
D. 55

Answer - (B)

Reference - Lecture-5

Timestamp - 6:55

Solution -
Maximum number of edges in a graph with n nodes = $\frac{n(n-1)}{2}$

7.
For a complete graph Z with 5 nodes if $A = \frac{z.order()}{z.size()}$, what will be the value of A?

A. $\frac{1}{4}$
B. $\frac{1}{8}$
C. $\frac{1}{2}$
D. $\frac{1}{16}$

Answer - (C)

Reference - Lecture-5
Timestamp - 6:37

Solution -
z.order() gives the total number of nodes i.e equal to 5.
z.size() gives the total number of edges i.e equal to $\binom{n}{2} = \frac{n(n-1)}{2} = 10$
So, A = $\frac{5}{10} = \frac{1}{2}$

8.
What will nx.dijktra_path(G,u,v) return?

A. Returns shortest path from u to v in a weighted graph
B. Returns shortest path length
C. Returns all possible paths from u to v
D. Returns no. of possible paths from u to v.

Answer - (A)

Reference - Lecture-6
Timestamp - 22:45

Solution -
The function returns the shortest path from source to target in a weighted graph.

9.
What will nx.gnp_random_graph(20,0.5) return?

A. Returns graph with 20 nodes with half of the nodes connected.
B. Returns graph with 20 nodes with each edge to be put with probability 0.5
C. Returns a connected graph with 10 nodes.
D. Returns a graph with 10 nodes with each edge to be put with probability 0.5

Answer - (B)

Reference - Lecture-5
Timestamp - 9:22

Solution -
nx.gnp_random_graph(x,y)
The function generates a graph with x nodes with each edge to be put with probability y.

10.
Maximum number of graphs possible from 50 nodes are -

A. $50 * 50$
B. $2^{\binom{50}{2}}$
C. $\binom{50}{2}$
D. 50^{50}

Answer - (B)

Reference - Lecture-7
Timestamp - 1:55

Solution -
Total number of edges with n nodes be X = $\frac{n*(n-1)}{2}$
Total number of graph containing 0 edges = $\binom{x}{0}$
Total number of graph containing 1 edges = $\binom{x}{1}$
Total number of graph containing 2 edges = $\binom{x}{2}$
And so on,
Hence total number of possible graphs with X edges = $\binom{x}{0} + \binom{x}{1} + \binom{x}{2} + ... + \binom{x}{x} = 2^x$

Social Networks

Week 2 Questions

1.
For graph G, what will the following code snippet return?

```
values = nx.degree(G).values()
x =0
for value in values:
   if(x<value):
      x = value
return x
```

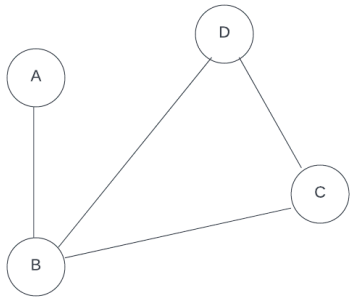
A. Returns the number of nodes with the minimum degree.
B. Returns the number of nodes with the maximum degree.
C. Returns the minimum degree of the graph.
D. Returns the maximum degree of the graph.

Reference - Lecture-21
Timestamp - 18:42

Answer - (D)

Solution -
values = list of degrees of each node in the graph.
x = maximum degree of the graph.

2.



The density of the given graph above is?

A. 4/3

B. $2/3$
C. $1/3$
D. $3/4$

Reference - Lecture-21
Timestamp - 28:00

Answer - (B)

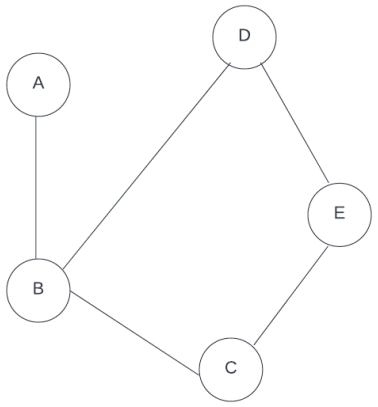
Solution -

$Density\ of\ a\ graph = \frac{2|E|}{|V|(|V|-1)}$

Where,
E = Number of edges
V = Number of nodes

3.

For the given graph, If $A = \frac{Highest\ degree}{\Sigma degree}$, what will be the value of A?



A. $\frac{3}{5}$
B. $\frac{2}{5}$
C. $\frac{2}{15}$
D. $\frac{3}{10}$

Reference - lecture-14
Timestamp - 3:23

Answer - (D)

Solution -
Highest degree = 3
$\Sigma degree = 2|E|$, where $E = number\ of\ edges$

4.
Which of the following is an example of a Directed graph?

I. Network of Instagram followers
II. Ancestral Tree
III. Email network
IV. Road network

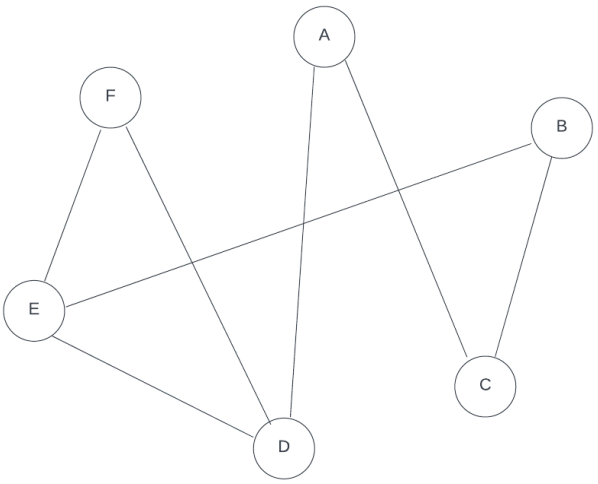
A. Only IV
B. Only I, II
C. Only II, III
D. Only I, II, III

Reference - Lecture-19
Timestamp -2:20

Answer - (D)

Solution-
The Road network is an undirected graph whereas the other graphs are directed.

5.
If $X = \frac{clustering\ coefficient\ of\ node\ E}{clustering\ coefficient\ of\ node\ F}$ in the given graph, the value of X is ___.



A. 1
B. $\frac{1}{3}$

C. $\frac{1}{9}$

D. $\frac{2}{3}$

Reference - Lecture-21
Timestamp - 31:00

Answer - (B)

Solution -

$$Clustering\ Coefficient\ of\ a\ node\ = \frac{Number\ of\ edges\ present\ among\ neighbours\ of\ the\ node}{Total\ number\ of\ edges\ possible\ among\ the\ neighbours}$$

So,

Clustering coefficient of node E = $\frac{1}{3}$

Clustering coefficient of node F = $\frac{1}{1}$

Hence, $X = \frac{1}{3}$

6.
Which of the following is/are network dataset format?

I. GraphML
II. Pajek NET
III. Comma Separated Value(Edge List format)

A. Only II
B. Only III
C. Only I, III
D. Only I, II, III

Reference - Lecture-19
Timestamp - 3:40

Answer - (D)

7.
In graph G, where nodes represent words in a dictionary and there is an edge between two nodes if the two words are synonymous. Then, choose the correct option according to the given two statements.

Statement I: The graph G is connected.
Statement II: If the word A is connected to B & B is connected to C, then A is synonymous to C.

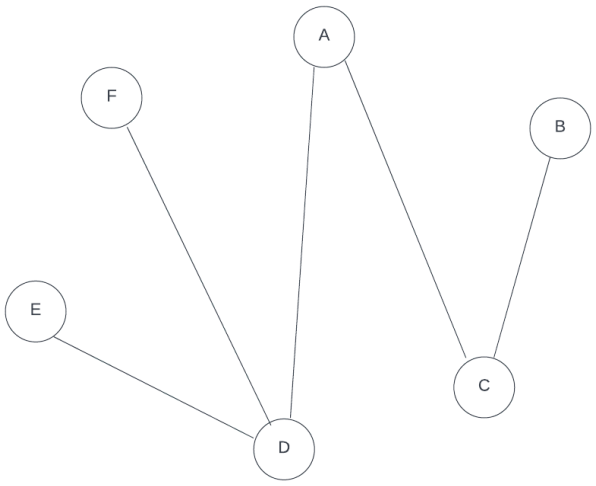
A. Both statements are incorrect.
B. Statement I is incorrect & Statement II is correct.
C. Statement I is correct & Statement II is incorrect.
D. Both statements are correct.

Reference - lecture-16
Timestamp - 1:40

Answer - (C)

Solution-
Every word gets connected to some word which in turn leads to a connected graph.
If A is a synonym of B and B is a synonym of C, then A might not be a synonym of C.

8.
The diameter of the given graph G is ___.



A. 5
B. 4
C. 3
D. 2

Reference - Lecture-21
Timestamp - 34:30

Answer - (B)

Solution - The maximum length between any two nodes in a graph is known as the Diameter.
From node B to node E distance is 4.

9.
If there exist n nodes with no edges initially then, what is the probability of node V being isolated after including $nlog(n)$ edges uniformly at random?

A. $\frac{1}{e}$
B. $\frac{1}{nlog(n)}$
C. $\frac{1}{n}$
D. $\frac{1}{n^2}$

Reference - Lecture-24
Timestamp - 18:00

Answer - (D)

Solution -
Probability of node V not including after $nlog(n)$ edges =

$$\left(\left(1-\frac{1}{\frac{n}{2}}\right)^{\frac{n}{2}}\right)^{2log(n)} = \left(\frac{1}{e}\right)^{2log(n)} = \left(\frac{1}{e^{log(n)}}\right)^2 = \left(\frac{1}{n}\right)^2$$

10.
Choose the data set format which starts with the keyword “graph”?

A. GML
B. Graph Exchange XML
C. Pajek Net format
D. GEXF

Reference - Lecture-19
Timestamp - 7:50

Answer - (A)

Solution -
The structure of a GML file is -

```
graph
[
  node
  [
   id A
```

```
  ]
  node
  [
   id B
  ]
   edge
  [
   source B
   target A
  ]
]
```

Social Networks

Week 3 Assignment

1.
If A denotes the set of friends Avanish has and B denotes the set of friends Bhavesh has, which of the following best describes their friendship's neighbourhood overlap?

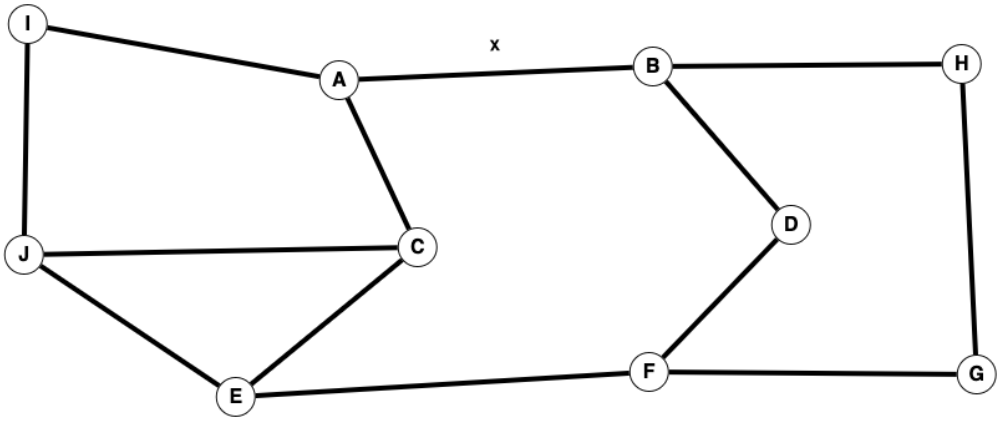
A. $|A \cap B|$
B. $|A \cup B|$
C. $|(A \cap B)| / |(A \cup B)|$
D. $|(A \cup B)| / |(A \cap B)|$

Reference - Lecture-29
Timestamp - 9:05

Answer - (C)

Solution - Neighbourhood overlap is the ratio of common friends of two people to their total friends.
Timestamp : 9:05 Lecture 3

2.
Which of the following statements is/are true with respect to the edge X in the graph given below?



I. It is a weak tie.

II. It is a local bridge.
III. It is a strong tie.

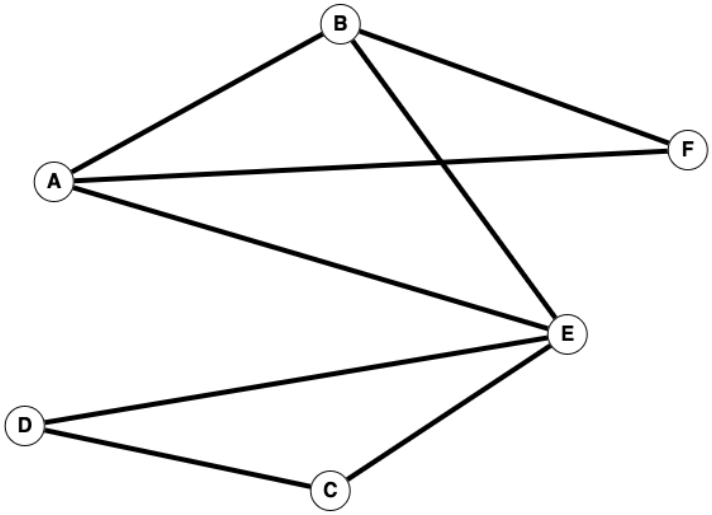
A. Only I
B. Only III
C. I and II both
D. II and III both

Reference - Lecture-30
Timestamp - 8:35

Answer - (C)

Solution -
Since node A and B don't form a triangle and they don't know each other's friends, the edge X is a weak tie.
Since edge X is connecting two clusters, it is a bridge.

3.
In the given graph, nodes represent people and edges represent friendships. If $E_{ij} = Friendship\ Embeddedness\ between\ i\ \&\ j$, then choose the correct option.



A. $E_{AB} > E_{CD}$
B. $E_{AB} = E_{CD}$
C. $E_{AB} < E_{CD}$

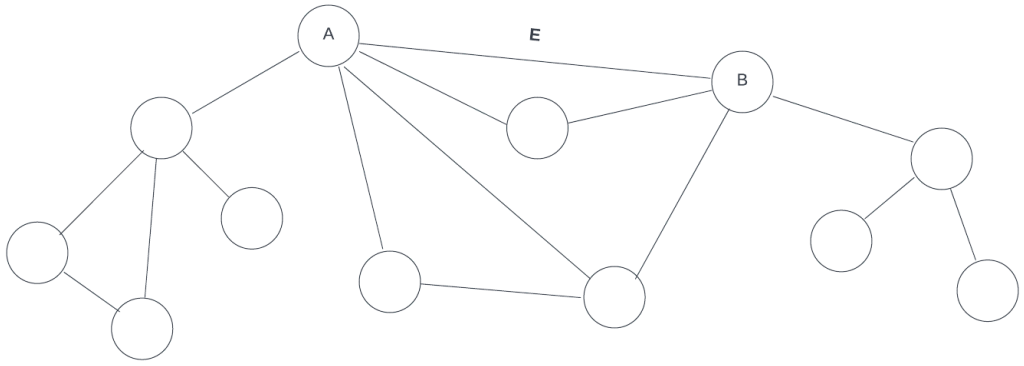
D. $E_{AB} \leq E_{CD}$

Reference - Lecture-33
Timestamp - 0:30

Answer - (A)

Solution -
A and B have more common friends compared with C and D, therefore their friendship embeddedness is higher.

4.
Which of the following statements are correct about edge E in the following graph?



I. The neighbourhood overlap is 0.5
II. It is a strong tie
III. It is not a local bridge.

A. Only I
B. Only II
C. Only I, II
D. Only II, III

Reference - Lecture-31
Timestamp - 5:10

Answer - (D)

Solution -

The neighbourhood overlap is 0.4 (2 common friends among 5 total friends). So (I) is wrong. It is a strong tie because there are triads between A and B. For the same reason, it is not a local bridge.

5.
Ram reaches space and becomes friends with an alien community. What role/property of social networks is at display here with respect to Ram?

A. Structural holes
B. Brokerage
C. Both A and B
D. Closure

Reference - Lecture-34
Timestamp - 7:35

Answer - (C)

Solution -
Since Ram is the only person connecting humans with aliens there is a structural hole. Anyone who wants to reach aliens has to go through Ram and therefore it displays brokerage.

6.
The audience of the Batman vs Superman fight are very passionate and there are equally large number of supporters on both sides. What properties would you expect in the network formed by the audience?

A. Closure
B. Brokerage
C. Structural holes
D. Both A and B

Reference - Lecture-34
Timestamp - 6:30

Answer - (D)

Solution -

A population with only closure will support only one side. A population without closure would not be united in support of their favourite hero. Hence we need both brokerage and closure to keep things interesting.

7.
While implementing the Girvan Newman algorithm on a certain graph G, you observe that edge E_1 gets removed after E_2. What can you comment about them?

A. E_1 has higher betweenness than E_2
B. E_2 has higher betweenness than E_1
C. E_1 has more shortest paths passing through it.
D. Both (A) and (C)

Reference - Lecture-36
Timestamp - 1:15

Answer- (B)

Solution -
The Girvan Newman algorithm removes edges with highest betweenness until the graph gets disconnected. Higher betweenness means more shortest paths passing through an edge.

8.
If community A is a better community than B, then which of the following holds True?

A. Ratio of intra edges to inter edges is higher in A
B. Ratio of intra edges to inter edges is higher in B
C. Ratio of intra edges to inter edges is same in both communities as they are part of the same graph.
D. Cannot say anything.

Reference - Lecture-35
Timestamp - 1:00

Answer - (A)

Solution -
Good community is one which has more edges inside itself rather than outside.

9.

How many connected components do you expect to see in a graph once the Girvan Newman algorithm halts when used for finding two good communities within the graph?

A. 1
B. 2
C. 3
D. 4

Reference - Lecture-36
Timestamp - 11:10

Answer - B

Solution -
While we are removing edges with highest betweenness centrality in a graph, if we get two disconnected clusters, we can be assured that this is the optimum community.

10.
Choose the correct option based on the given two statements.
Statement I - The nodes at the ends of a local bridge in a graph have no common nodes.
Statement II - Removing bridges from a graph leads to a disconnected graph

A. Both Statements are correct.
B. Statement I is incorrect & Statement II is correct.
C. Statement I is correct & Statement II is incorrect.
D. Both Statements are incorrect.

Reference - Lecture-30
Timestamp - 5:00

Answer - (C)

Solution -
People having common friends are actually having a strong tie.
Bridges connects two disjoint clusters in a graph.

Social Networks

Week 4 Questions

1.
Rahul became friends with Ram. Ram is an avid follower of Cricket. Ram repeatedly took Rahul to watch cricket matches with him and soon Rahul also started following Cricket. Which of the following accurately represents the following phenomenon?

A. Selection
B. Triadic closure
C. Social influence
D. Focal Closure

Reference - Lecture-42
Timestamp - 2:28

Answer - (C)

Solution -
Rahul starts developing the habit of following cricket after becoming friends with Ram. This is a case of social influence

2.
Ram and Shyam were two new entrants in Kendriya Vidyalaya Ropar. Their similarity measure then was 0.005. They became friends on day 5. What is the most likely similarity measure right before they became friends?

A. 0.004
B. 1.1
C. 0.005
D. 0.01

Reference - Lecture-43
Timestamp - 4:00

Answer - (D)

Solution-

On average, we observe that similarity measures tend to increase before two people become friends(the increase in similarity measure leads to the formation of friendship). Also, it cannot be more than 1. Hence, the answer is (D)

3.
On an IIT campus, we observe that the friendships among the 1st year and 2nd year students are greater than the friendship within 1st year and 2nd year students combined. What can we infer about the homophily of this network?

A. Homophily is 0
B. Homophily is greater than 0.5
C. Homophily is 0.5
D. Homophily is less than 0.5

Reference - Lecture-44
Timestamp - 11:30

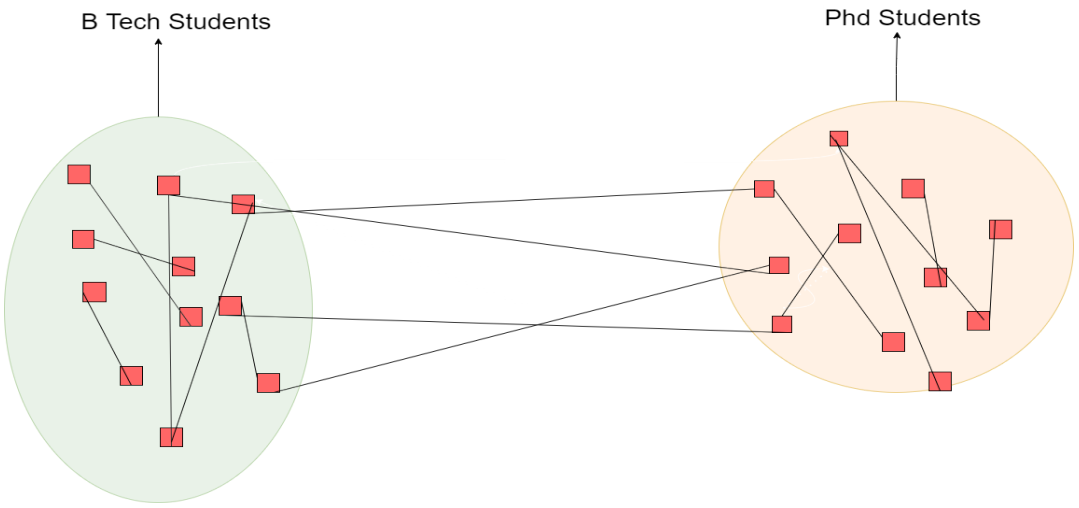
Answer - (D)

Solution -
Say friendships across 1st year and 2nd year be F_{12}, friendships within 1st years be F_{11}, friendships within 2nd years be F_{22}. Then, the probability of selecting across edges is

$$\frac{F_{12}}{F_{11}+F_{22}+F_{12}} > \frac{F_{12}}{F_{12}+F_{12}} > \frac{1}{2}$$

Hence, Homophily is $1 - p < \frac{1}{2}$.

4.
Raghavan is a warden in the Ganga hostel. He observes the following graph of the friendship of B.tech and PhD students of Ganga hostel. What is the homophily of the network?



A. $\frac{1}{2}$

B. $\frac{3}{4}$

C. $\frac{1}{4}$

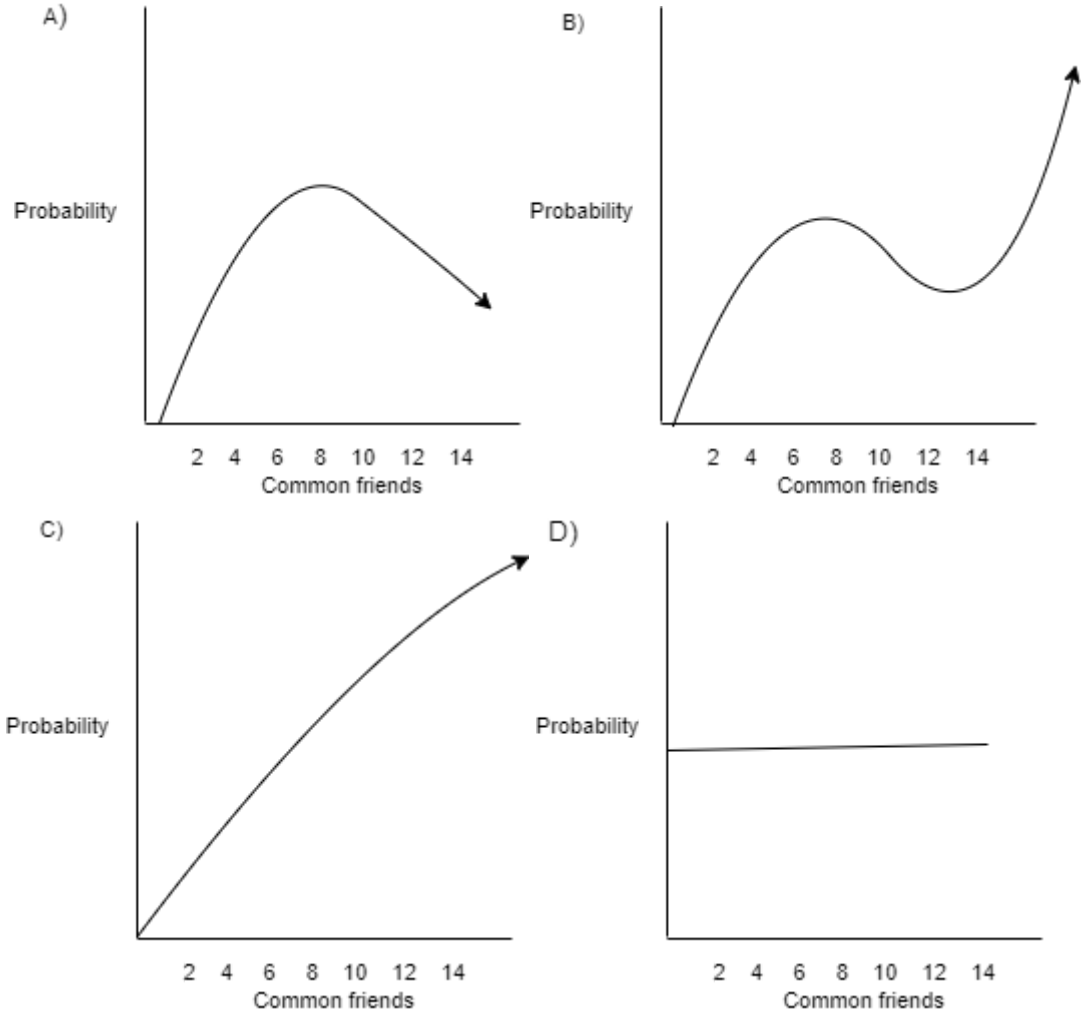
D. 1

Reference - Lecture-44
Timestamp - 13:10

Answer - (A)

Solutions -
The expected number of edges across is $\frac{1}{2}$ of 16 = 8. Hence, Homophily is $1 - \frac{1}{2} = \frac{1}{2}$.

5.
Which of the following correctly depicts the probability of any two persons(A and B) being friends with respect to the number of their common friends?



Reference - Lecture-50
Timestamp - 4:30

Answer - (C)

Solution -
There exists a linear relationship between common friends and the probability of A and B being friends.

6.
The probability of Jon and Eva not being friends given that they have a common friend is 0.8. What is the probability of them being friends given that they have 8 common friends?

A. 0.83
B. 0.16
C. 0.2
D. 0.5

Reference - Lecture-50
Timestamp - 5:10

Answer - (A)

Solution -
The probability of being a friend for 8 common friends is $1 - (0.8)^{0.8} = 0.83$.

7.
Ram and Raghav both are part of the Royal cricketing club. They meet at the club and gradually become friends. This phenomenon is known as?

A)Social influence
B)Triad closure
C)Foci Closure
D)Membership Closure

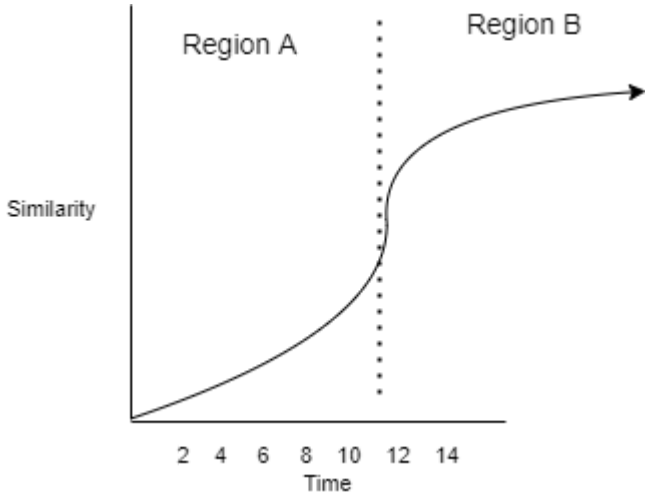
Reference - Lecture-45
Timestamp - 1:30

Answer - (C)

Solution -

They become friends because they belong to the same club(common focus) and this is foci closure.

8.
The increase in similarity in region B can be attributed to which phenomenon?



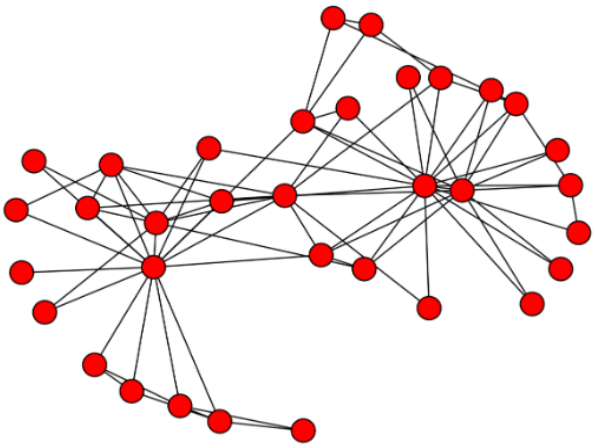
A. Selection
B. Social influence
C. Triadic Closure
D. Foci Closure

Reference - Lecture-43
Timestamp - 8:10

Answer - (B)

Solution -
Since the similarity increases in region B after they have become friends, it can be attributed to social influence.

9.
If nodes represent players and edges between players represent friendships, then which of the following phenomenon might have resulted in the following network?



Royal Cricket Club

I. Foci Closure
II. Social influence
III. Selection
IV. Membership Closure

A. Only I
B. Only IV
C. Only I, IV
D. Only I, III

Reference - Lecture-45
Timestamp - 1:30

Answer - (C)

Solution -
This is a network representing the royal cricket club. Hence the foci closure phenomenon i.e people belonging to the same club becoming friends and the membership closure phenomenon i.e people pulling their friends to cricket club will be most dominant.

10.
Given that the homophily in a network consisting of class A and class B is very high i.e greater than $\frac{1}{2}$. Choose the correct option.

I. Across edges are low in proportion.
II. People tend to make friends within their group.
III. The probability of selecting an across edge is low.
IV. People tend to make friends outside their group.

A. Only IV

B. Only I, II
C. Only I, III
D. Only I, II, III

Answer - (D)

Solution -
Statements I, II & III are equivalent.

Social Networks

Week 5 Questions

1.
Given each individual exists in a 2-dimensional grid, which is not an acceptable value of tolerance for an individual?

A. 9
B. 3
C. 5
D. 6

Reference - Lecture-54
Timestamp - 5:00

Answer - (A)

Solution -
In a 2 dimensional grid, each individual has a maximum of 8 neighbours. This means that the tolerance can vary between 0 to 8.

2.
In a 2-D simulation of Schelling's Model of Segregation if t=8(where “t” refers to the number of neighbours), will we see any red and blue nodes touching each other once equilibrium has been reached?

A. Yes
B. No

Reference - Lecture-55
Timestamp - 2:45

Answer - (B)

Solution -
Given that t=8, each individual must be surrounded by their own colour or a blank box. This means that no red and blue node can touch each other given that equilibrium has been reached.

3.

In a 2-D Grid of $100 * 100$ nodes, at max how many nodes can have 8 neighbours?

A) $99 * 99$
B) $97 * 97$
C) $98 * 98$
D) $98 * 97$

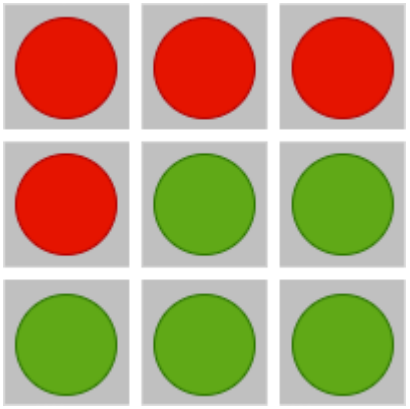
Reference - Lecture-57
Timestamp - 2:45

Answer - (C)

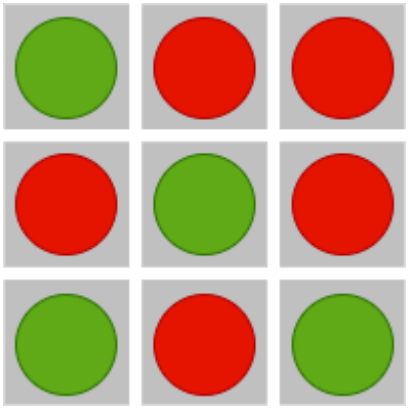
Solution -
In a grid of n by n nodes, all nodes except the border nodes can have 8 neighbours. Thus in an $n * n$ grid, $(n - 2) * (n - 2)$ nodes can have 8 neighbours.

4.
In the below situations, given t=4("t" is the number of neighbours), which centre node is **NOT** stable?

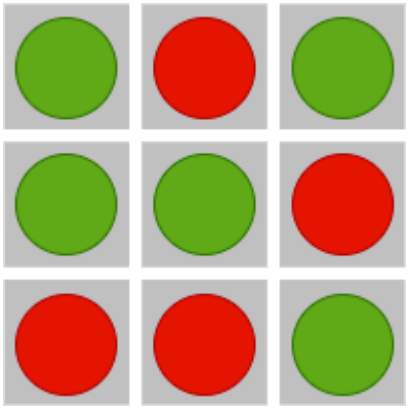
A.



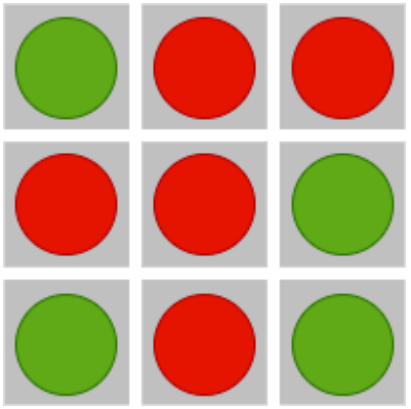
B.



C.



D.

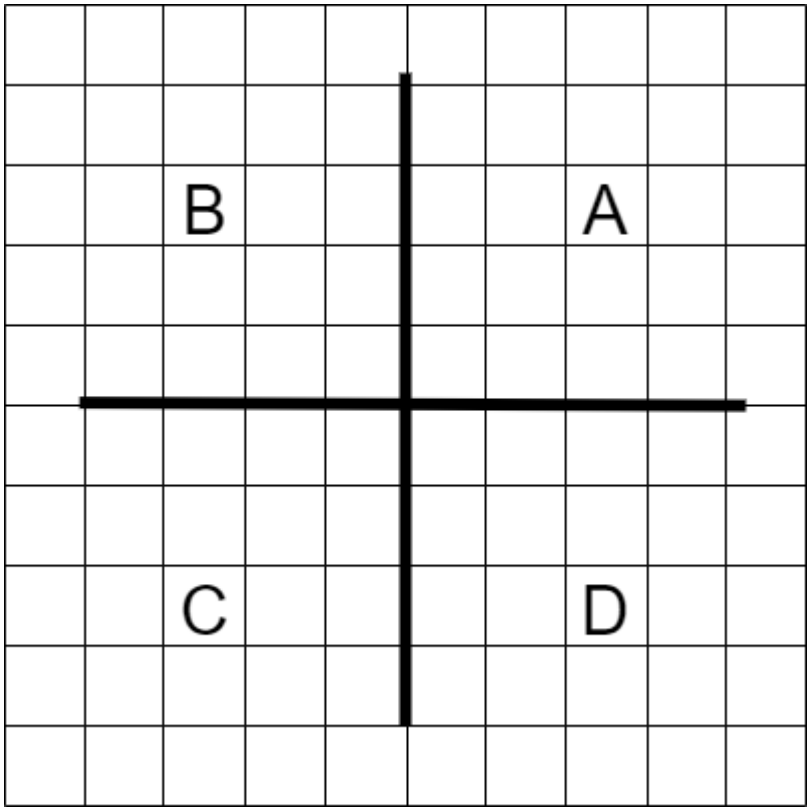


Reference - Lecture-57
Timestamp - 5:23

Answer - (B)

Solution -
Since t=4, the central node must have at least 4 nodes with the same colour as itself, surrounding it.

5.
A 10 x 10 grid is generated by the given code and is divided into four equal parts namely A, B, C & D. In which section does the point (7,8) lie?




```
import networkx as nx
N =10
G= nx.grid_2d_graph(N,N)
import matplotlib.pyplot as plt
nx.draw(G)
plt.show()
```

```
# distorted graph generated by networkx
G.nodes()
#print(G)
pos = dict((n,n) for n in G.nodes())
#print(pos)
nx.draw(G,pos)
plt.show()
# graph arranged in a grid like manner.
```

A) A
B) B
C) C
D) D

Reference - Lecture-58
Timestamp - 6:00

Answer - (A)

Solution -
Since the nx.draw() function plots the grid vertically instead of horizontally, points 7 & 8 will lie in section A.

6.
A triangle network with at least two positive relationships is ____ stable.

A) Always
B) Sometimes
C) Never

Reference - Lecture-64
Timestamp - 4:39

Answer - (B)

Solution -
A triangle network with such conditions may have 2 positive and one negative relationship or 3 positive relationships. In the case of 3 positive relationships, the network will be stable. However, in the case of two positive and one negative relationship, we get an unstable network.

7.
Which social belief does the following stability conversion denote?

A) A friend's friend is an enemy.
B) An enemy's friend is a friend.
C) An enemy's enemy is a friend.
D) An enemy's friend is a friend.

Reference - Lecture-68
Timestamp - 1:30

Answer - (C)

Solution -
Here we can see that three people who initially were enemies converged into a situation where two became mutual friends and remained enemies against the third. Thus we can see that an enemy's enemy is a friend.

Questions 8, 9 & 10 are connected.

8.
If country A is at war with B, let's say a certain country X has good relationships with both A and B, what will be a stable situation for country X?

A) $A \,\&\, X = -$ AND $B \,\&\, X = -$
B) $A \,\&\, X = +$ AND $B \,\&\, X = +$
C) $A \,\&\, X = +$ AND $B \,\&\, X = -$
D) $A \,\&\, X = -$ AND $B \,\&\, X = +$

Reference - Lecture-68
Timestamp -3:25

Answer - (C)

9.
Another country Y is in the same situation as country X as explained in the previous question(Q-8). Y is on good terms with X. Given X chooses to maintain a positive relationship with A, due to how many resulting unstable triangle(s) will Y be unstable?

A) 3
B) 2
C) 4
D) 1

Reference - Lecture-68
Timestamp - 3:25

Answer - (B)

Solution: Here Y is on good terms with all countries. But due to the fallout between A and B, Y must pick a side for there to be stability in the network. The triads that generate instability for Y are A-Y-B and X-Y-B.

10.
Since Y is friends with all Countries, how many minimum friendships will Y need to break so that we have a stable system(by breaking a friendship, the positive relationship is converted to a negative relationship)?

A) 2
B) 3
C) 4
D) 1

Reference - Lecture-68
Timestamp - 3:25

Answer - (D)

Solution -
Given that X has already sided with A, Y has the option to either side with B or A. In the case Y sides with B, it will have to have negative relationships with both A and X. On the other hand if Y sides with A, it will only have to have one negative relationship with B.

Social Networks

Week-6 Assignment

1.
If nx represents networkx library then, for a graph G, what does nx.pagerank(G) returns?

A. Returns a List of PageRanks of the node.
B. Returns a Dictionary where keys are nodes and values are PageRanks of the node.
C. Returns a List of nodes sorted in ascending order according to PageRank.
D. Returns a Dictionary where keys are PageRanks and values are lists of nodes with the same PageRanks.

Reference - Lecture-82
Timestamp - 8:00

Answer - (B)

Solution -
nx.pagerank(G) returns a Dictionary with keys as nodes and values as PageRanks of those nodes.

2.
Web graph is a ____.

A. Complete graph
B. Undirected graph
C. Directed graph
D. Bipartite graph

Reference - Lecture-75
Timestamp - 7:45

Answer - (C)

Solution -
In a web graph, nodes represent web pages and an edge represents a hyperlink of another page on that page which is directional.

3.

Let there exist n nodes with no edges in between them initially. We start moving from one node to the other(probability of moving from any node to any other node being the same) and creating an edge between the nodes if there already isn't. After a large number of iterations, the graph generated will be?

I. Bipartite graph
II. Connected graph
III. Acyclic graph
IV. Complete graph

A. Only I
B. Only II
C. Only IV
D. Only II, IV

Reference - Lecture-76
Timestamp - 2:15

Answer - (D)

Solution -
After a large number of iterations, we will have edges from every node to every other node. Hence, the graph is complete as well as connected.

4.
Google PageRank algorithm uses -

A. Dictionary of web pages created manually by Google workers.
B. List of pages relevant to the search and rank those pages based on their creation date.
C. Web graph and Searching algorithms like Depth First Search.
D. Web graph and random walk algorithm.

Reference - Lecture-79
Timestamp - 3:00

Answer - (D)

Solution -
Google PageRank uses web graphs(nodes as web pages and edges as links from one page to the other) and Random walk algorithm in which we take a random walk across the graph and after a large number of iterations, rank the pages based on the number of times we visited a page.

5.

Choose the correct option based on the two statements given below.

Statement I: The PageRank of a node only depends on its out-degree value.
Statement II: The PageRank of node A can be higher than that of node B even if fewer nodes have an edge going to A compared with node B.

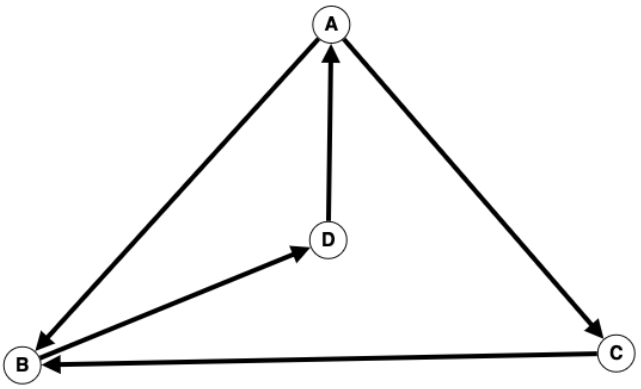
A. Both statements are incorrect.
B. Statement I is incorrect & Statement II is correct.
C. Statement I is correct & Statement II is incorrect.
D. Both statements are correct.

Reference - Lecture-86
Timestamp - 6:50

Answer - (B)

Solution -
If popular nodes point to node A even if fewer nodes are pointing to it can lead to a high PageRank.

6.
If the initial PageRank of each node is $\frac{1}{4}$ for the given graph below, what will be the PageRank of the nodes after 1 iteration?



A. $B = \frac{3}{8}$ & $C = \frac{1}{8}$
B. $B = \frac{3}{8}$ & $C = \frac{1}{4}$
C. $B = \frac{1}{2}$ & $C = \frac{1}{4}$
D. $B = \frac{1}{2}$ & $C = \frac{1}{8}$

Reference - Lecture-84

Timestamp - 3:30

Answer - (A)

Solution -
After 1st iteration,
PageRank of B = $\left(\frac{1}{2} * \frac{1}{4}\right) + \frac{1}{4} = \frac{3}{8}$
PageRank of C = $\left(\frac{1}{2} * \frac{1}{4}\right) = \frac{1}{8}$

7.
Given below is an adjacency matrix for a graph. X & Y are PageRank of nodes 2 & 3 respectively after 2 iterations and $Z = \frac{X}{Y}$. If the initial PageRank of each node is $\frac{1}{4}$, the value of Z is ____.

$$\begin{bmatrix} 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 1 \\ 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 \end{bmatrix}$$

A. $\frac{1}{4}$
B. $\frac{1}{8}$
C. $\frac{5}{3}$
D. $\frac{3}{5}$

Reference - Lecture-84
Timestamp - 3:00

Answer - (C)

Solution -
PageRank of node 2 = $\frac{5}{16}$
PageRank of node 3 = $\frac{3}{16}$
Hence, Z = $\frac{5}{3}$.

8.

In a random graph with n nodes, to visit all nodes in a random walk, the number of nodes required to be travelled is _____.

A. n^2
B. $\frac{n*(n-1)}{2}$
C. $\frac{n}{log(n)}$
D. $n * log(n)$

Reference - Lecture-76
Timestamp - 7:55

Answer - (D)

Solution -
$n * log(n)$ number of nodes are required to visit all nodes if we take a random walk in a graph.

9.
In a graph of students with edges representing friendship, choose the correct option based on the two statements given below.

Statement I - Taking a random walk and dropping 1 coin to each node while visiting. Students accumulating the most coins will be most popular.
Statement II - Giving an equal number of coins to all students at the beginning and then each student has to distribute them equally to all of their friends at every snap. After a large number of snaps, the student with the most coins will be the most popular.

A. Both statements are correct.
B. Statement I is correct and statement II is incorrect.
C. Statement I is incorrect and statement II is correct.
D. Both statements are incorrect.

Reference - Lecture-78
Timestamp - 2:55

Answer - (A)

Solution -
Both techniques come to equilibrium after large iterations which can be used for ranking the nodes.

10.

What does Teleportation mean?

A. Choosing a node uniformly at random in a graph.
B. Creating an edge between any 2 random nodes.
C. Creating an edge between the highest and lowest-ranked nodes.
D. Changing the leader in a graph manually.

Reference - Lecture-84
Timestamp - 1:40

Answer - (A)

Solution -
Teleportation is used in the PageRank algorithm to fix the problem of dead ends in a random walk.

Social Networks

Week 7 Assignment

1.
Factors which influence diffusion are -

I. Payoff
II. Key people
III. Cascade formation

A. Only I
B. Only II
C. Only I, II
D. I, II and III

Answer - (D)
Solution -
If the payoff is high, ideas travel over the network rapidly.
Since Key people have a large number of connections, through them the idea distributes quickly.
If there exist clusters in a network with high threshold values, the diffusion of an idea becomes difficult.

2.
When is it easy to convince a community to adopt new ideas?

A. When the density of the community is high.
B. When the density of the community is low.

Reference - Lecture-92
Timestamp - 13:20

Answer - (B)
Solution -
The higher the density of the community the more difficult it gets to inject new ideas.

3.

If in a social network, an idea starts from one person and slowly reaches other parts of the network. This phenomenon is known as _____.

A. Randomness
B. Diffusion

Reference - Lecture-89
Timestamp - 2:00

Answer - (B)
Solution -
The phenomenon where an idea spreads over a network is known as Diffusion.

4.
The density of a cluster is d if -

A. The average friends of all nodes inside the cluster is d.
B. d fraction of the nodes friends are present inside the cluster.
C. d fraction of the nodes friends are present outside the cluster.

Reference - Lecture-93
Timestamp - 5:15

Answer - (B)
Solution -
The density of a cluster is d if for all nodes in the cluster, there are d fraction of friends present inside the cluster for each node.

5.
If the payoff of watching a documentary & listening to songs is 0.5 and 0.4 respectively. 4 of your friends decides to watch movie and 6 of them listens to songs. Which one should you pick?

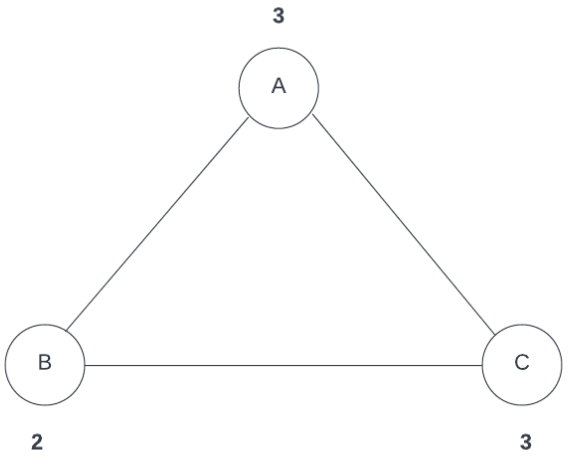
A. Watch the documentary
B. Listen to songs

Reference - Lecture-90
Timestamp - 5:00

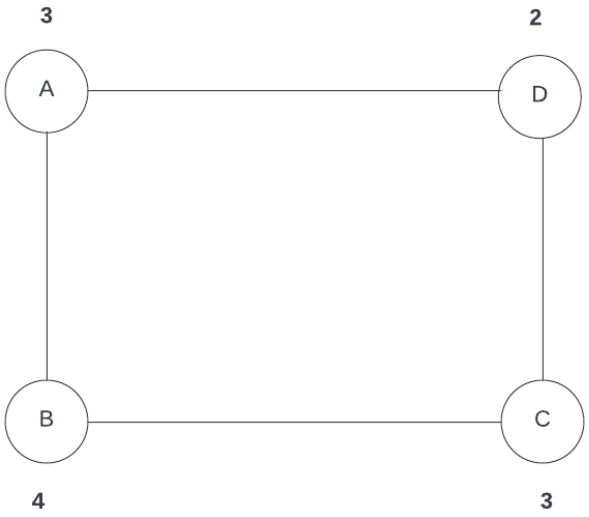
Answer - (B)

Solution -
Payoff for listening to songs is higher than that of watching the documentary.
$0.4 * 6 > 0.5 * 4$

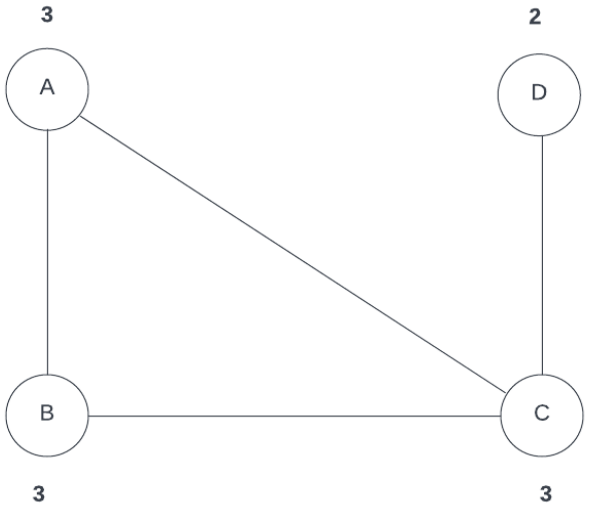
6.
If the value above the node is its threshold value to join the protest then, in which of the following graphs, protest is likely to happen?



I.



II.



III.

A. Only I
B. Only II
C. I and II
D. I and III

Reference - Lecture-94
Timestamp - 5:30

Answer - (D)
Solution -
In option- II, node B requires 3 more nodes connected to it to join the protest but only has 2.
In options- I & III, the threshold value for each node is satisfied.

7.
_____ is the technique in which we identify key people in the network using which the idea gets spread very fast.

A. Diffusion
B. Viral marketing
C. Randomness
D. Clustering

Reference - Lecture-92
Timestamp - 8:00

Answer - (B)
Solution -
Viral marketing finds key nodes which has high connectivity with the network using which the idea gets spread rapidly.

8.
The payoff for watching movie and studying for Ram is p & q respectively. He has 20 friends out of which 8 decides to study and remaining decides to watch movie. If he decides to study, which of the following option is correct?

A. $2p > 3q$
B. $3p < 2q$
C. $2p < 3q$
D. $3p > 2q$

Reference - Lecture-91
Timestamp - 1:20

Answer - (A)
Solution -
Payoff for studying should be greater than that of watching movie for deciding to study.
Therefore, $8p > 12q$ i.e $2p > 3q$.

9.
A cascade cannot be complete in a network with threshold of adoption = q, if there exist a cluster with density _____.

A. Greater than q
B. Less than q
C. Less than $1 - q$
D. Greater than $1 - q$

Reference - Lecture-93
Timestamp - 6:50

Answer - (D)
Solution -

Since more friends are inside the cluster who decides not to adopt the idea, the cascade cannot be completed.

10.
Which of the following factors cause problems in the adoption of a new idea in a network?

I. High payoff
II. High threshold value
III. Cluster of density greater than (1 - threshold value)
IV. Cluster of density less than (1 - threshold value)

A. Only I
B. Only II
C. II and III
D. II and IV

Answer - (C)
Solution -
High payoff increases the adoption rate of an idea in a network.
Whereas,
Higher threshold value requires higher number of friends to also be interested in adopting the idea.
If cluster of density of greater than (1 - threshold value), higher number of friends exist inside the cluster who don't want to adopt the idea.

Social Networks

Week 8 Assignment

1.
In a social network, if tour guides point people to tourist destinations, which of the following is correct ?

A. Hubs are represented by tour guides and authorities by tourist destinations.
B. Hubs are represented by tourist destinations and authorities by tour guides.
C. Tourist spots and tour guides both act as hubs.
D. Tour guides and tourist destinations both represent authorities.

Reference - Lecture-107
Timestamp - 05:58

Answer - (A)
Solution -
Since tourist guides are pointers and tourist destinations are resources, they represent hubs and authorities respectively.

2.
If a Markov matrix A whose eigenvectors and eigenvalues are v1,v2 and λ1, λ2 respectively is applied on a vector V repeatedly k times, which of the following is true considering we keep normalising the resultant vector after each iteration and λ1 is the greater eigenvalue and k is very large?

A. $A^kV = v1$
B. $A^kV = v2$
C. $A^kV = v1 + v2$
D. $A^kV = v1 - v2$

Reference - Lecture-113
Timestamp - 06:26

Answer - (A)
Solution -
Since the greater eigenvalue is 1 the vector moves more and more towards the eigenvector associated with the greater eigenvalue.

3.
What will be the coordinates of the vector (5, 7) after normalizing it to a unit circle centred at the origin?

A. (0.81, 0.58)

B. (0.58, 0.81)
C. (0.18, 0.58)
D. (0.85, 0.18)

Reference - Lecture-108
Timestamp - 3:10

Answer - (B)
Solution -
Normalization of a vector is done by dividing its components by the square root of the sum of the squares of both of its components.

4.
What will be the resultant vector when we apply the matrix M on the vector (7, 9)?
Where, M =

$$\begin{bmatrix} 5 & 6 \\ 8 & 3 \end{bmatrix}$$

A. (91, 82)
B. (27, 56)
C. (89, 83)
D. (12, 45)

Reference - Lecture-108
Timestamp - 5:20

Answer - (C)
Solution -
(7*5 + 9*6, 7*8 + 9*3) = (89, 83)

5.
Which of the following is a property of a Markov matrix?

A. All the eigenvalues are greater than 1.
B. The smallest eigenvalue is 1.
C. The largest eigenvalue is 1.
D. All the eigenvalues are less than 1.

Reference - Lecture-113
Timestamp - 4:30

Answer - (C)
Solution -
In a Markov matrix, the biggest eigenvalue is equal to 1.

6.
Is the given matrix a Markov matrix?

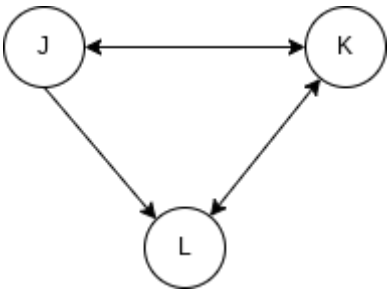
$$\begin{bmatrix} \frac{1}{2} & \frac{1}{2} & 1 \\ \frac{1}{4} & \frac{1}{2} & 0 \\ \frac{1}{4} & 0 & 0 \end{bmatrix}$$

A. Yes
B. No

Reference - Lecture-113
Timestamp - 4:10

Answer - (A)
Solution -
The sum of the columns of a Markov matrix adds up to 1.

7.
What values of PageRank will the nodes (J, K, L) of the given graph have after the first iteration if the initial values are ⅓ for each node?



A. (0, ½, ½)
B. (⅙, ½, ⅓)
C. (⅓, ⅓, ⅓)
D. (½, ⅙, ⅓)

Reference - Lecture-103
Timestamp - 4:40

Answer - (B)
Solution -
J will give ⅙ each to K and L. K will give ⅙ each to J & L. L will give ⅓ to K.

8.

8.
In a social network of recommenders and resources, how can the rating of node X increase if a higher rating is considered good?

Statement I - By pointing Good nodes at X.
Statement II - By pointing X at good nodes.

A. Both statements are correct.
B. Statement I is correct & Statement II is incorrect.
C. Statement I is incorrect & Statement II is correct.
D. Both statements are incorrect.

Reference - Lecture-107
Timestamp - 4:30

Answer - (C)
Solution -
A node can act as both hub and authority and thus its rating increases in both ways i.e. making good suggestions and being pointed at by good recommenders.

9.
Will a PageRank graph with the below adjacency matrix converge?

$$\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

A. Yes
B. No

Reference - Lecture-104
Timestamp - 03:30

Answer - (A)
Solution -
Since the columns add up to 1, this PageRank will converge.

10.
Choose the correct option based on the given statements.

Statement I - Applying a matrix on its eigenvectors only changes the direction of the eigenvector.
Statement II - Eigenvectors of a matrix are linearly dependent on each other.

A. Both statements are correct.
B. Statement I is correct & Statement II is incorrect.

C. Statement I is incorrect & Statement II is correct.
D. Both the statements are incorrect.

Reference - Lecture-111
Timestamp - 2:40

Answer - (D)
Solution -
Eigenvectors are linearly independent and only change their magnitude when their corresponding matrix is applied to them.

Social Networks

Week 9 Assignment

1.
In a random graph with 500 nodes and edges between any two nodes with a probability of 0.27, where can one expect the peak of the degree-distribution graph?

A. 270
B. 500
C. 135
D. 100

Reference - Lecture-115
Timestamp - 10:30

Answer - (C)
Solution -
In a normal distribution, the peak of the degree-distribution graph is seen around the middle of the domain. Thus here we can say the peak is expected to be around 500*0.27=135.

2.
In a random graph with 500 nodes, if A, B & C are the number of nodes with degrees 0, 300 & 600 respectively. What is the relationship between A, B & C?

A. A < B < C
B. B < C < A
C. A < C < B
D. C < B < A

Reference - Lecture-116
Timestamp - 8:10

Answer - (C)
Solution -
Given that the graph present on the nodes is random, the distribution of the degree of nodes will be a normal distribution. Thus we can say that nodes having: Degree 350 > Degree 600 > Degree 0.

3.

Amit tosses 6 dices and stores the sum of the numbers he gets. If he plots the sum of the numbers on the x-axis and the frequency on the y-axis, in what range is the peak of the given distribution expected to be?

A. 6 - 10
B. 18 - 24
C. 30 - 36
D. 10 - 16

Reference - Lecture-116
Timestamp - 8:45

Answer - (B)
Solution -
Since we know that sum of multiple random variables gives a normal distribution, we can say that the sum of the outcomes of the 6 dice also comes out to be a normal distribution which begins at 6 and ends at 36. Thus the peak will come out to be around 21 which is in the range of 18-24.

4.
The power law states that the frequency (plotted along the y-axis) is inversely proportional to $k^{(a)}$ where k is the values plotted along the x-axis. Here a is preferably between -

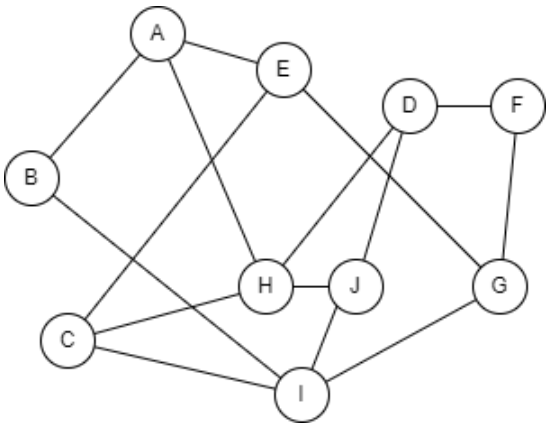
A. 0 & 1
B. -1 & 0
C. -2 & -1
D. 2 & 3

Reference - Lecture-119
Timestamp - 2:40

Answer - (D)
Solution -
The power law is observed when y=$k^{(a)}$ where a mostly lies in the range 2 to 3.

Questions 5, 6 & 7 are connected.

5.
In the given graph, a new node X is introduced. What is the probability of a new node being attracted to either A or B or D, given that X makes only one new friend?



A. 8/30
B. 9/30
C. 5/30
D. 7/30

Reference - Lecture-119
Timestamp - 6:18

Answer - (A)
Solution -
Since using the rich get richer phenomenon, the probability of becoming friends with someone is dependent upon the degree of that node, we can say that individually the probability of becoming friends with:
A is 3/30
B is 2/30
D is 3/30
And since we need to find the probability of becoming friends with A or B or D, the total probability is (3+2+3)/30= 8/30.

6.
In the above question, assume X made friends with C, D & E. Y is another new node which arrives at the next step. What is the probability that Y makes friends with C?

A. 5/30
B. 9/36
C. 4/36
D. 10/36

Reference - Lecture-119
Timestamp - 6:18

Answer - (C)

Solution -
After adding X we have a total of 18 friendships. Out of those 18, C is friends with 4. So, the probability of Y becoming friends with C is 4/36.

7.
From the past example, Y became friends with B. Z is yet another new node. Z is not friends with anyone. According to the richer get richer phenomenon, what is the probability that a new incoming student W, makes friends with Z?

A. 5/38
B. 6/36
C. 9/38
D. 0/38

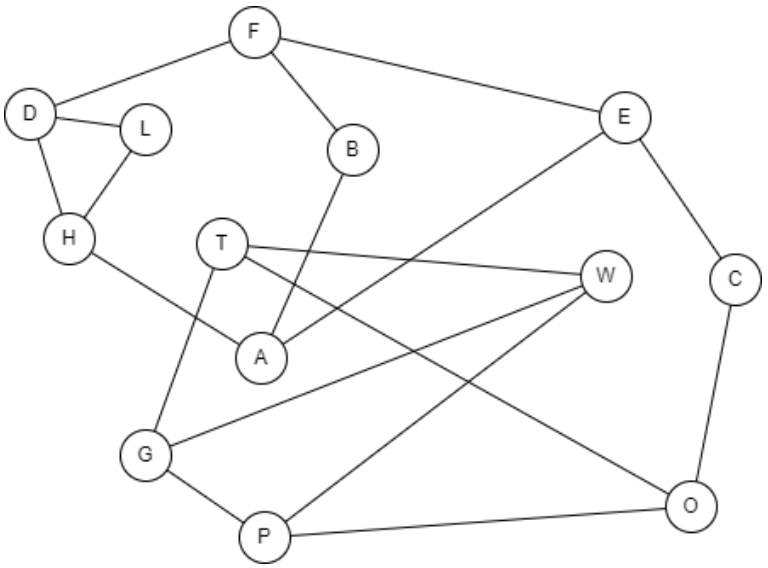
Reference - Lecture-119
Timestamp - 6:18

Answer - (D)

Solution -
Since Z is an isolated node, it has 0 friends. This means that by the rich getting richer phenomenon, the probability of W becoming friends with Z is 0/38.

8.
In the given graph below, with whom should a new node Q make friends so that another new node X has an equal probability of making friends with each node present(it is given that X joins after Q has made friends)?

The graph is at t=0. X comes at t=1. Y comes at t=2.



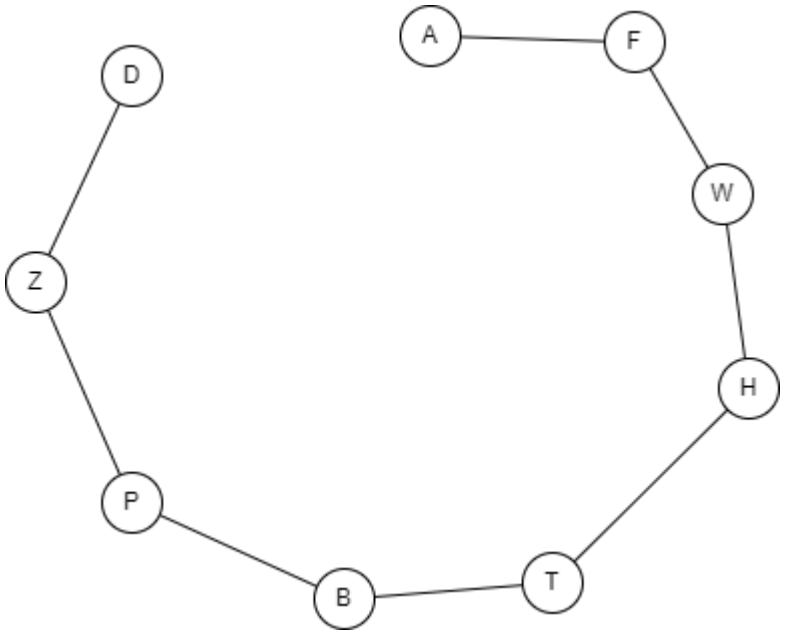
A. A, P, C
B. O, D, H
C. B, C, L
D. T, F, P

Reference - Lecture-119
Timestamp - 11:43

Answer - (C)

Solution -
If Q becomes friends with B, C & L, each node now has 3 friends. This means that the new node X has an equal probability of joining any node.

9.
In the given graph, each node represents a student and each edge represents a friendship. A new student X joins and makes 2 new friendships. With what probability does everyone have 2 friendships? (it is assumed that X makes both of its friendships simultaneously)



A. (1/16)*(2/16)
B. (1/16)*(1/16)
C. (2/16)*(2/16)
D. (0/16)*(1/16)

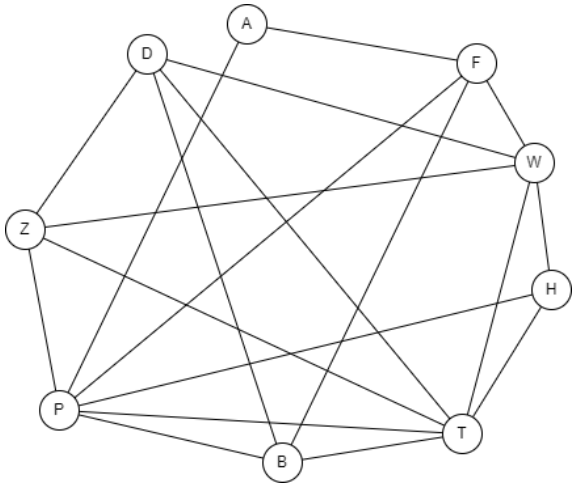
Reference - Lecture-119
Timestamp - 15:05

Answer - (B)
Solution -
For each student to have 2 friendships, X must become friends with A & D. The probability of becoming friends with A is 1/16 and that of becoming friends with D is 1/16. Since both events need to happen simultaneously, the total probability of each student having 2 friends is (1/16)*(1/16)

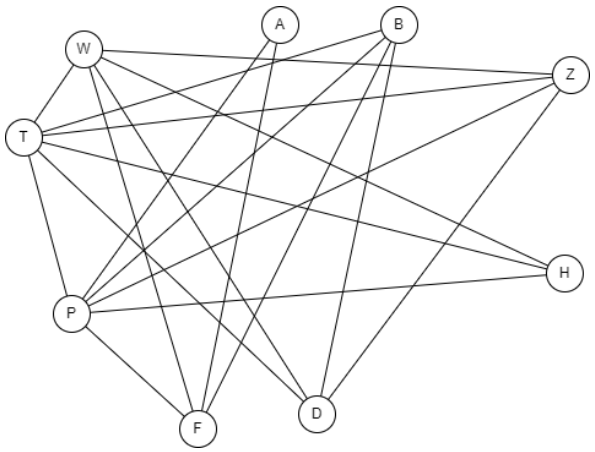
10.
Given below is the probability distribution for a new node to make friends with each node. Which of the following is the correct graph?

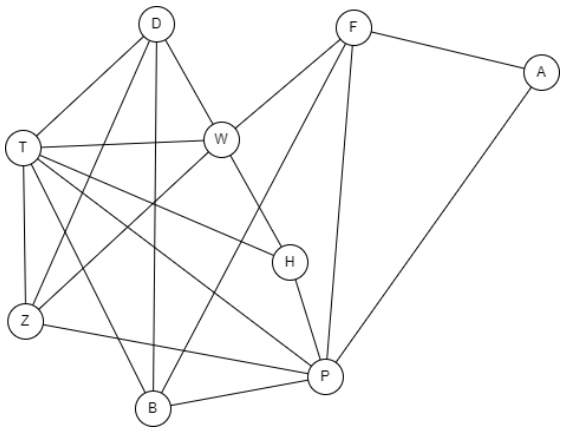
A	F	W	H	T	B	P	Z	D
2/38	4/38	5/38	3/38	6/38	4/38	6/38	4/38	4/38

I.



II.



III. 

A. Only I
B. Only II
C. Only II & III
D. Only I, II & III

Reference - Lecture-119
Timestamp- 13:39

Answer - (D)
Solution-
Here all graphs are modified versions of one another and represent the same probability distribution.

Social Networks

Week 10 Assignment

1.
In rich gets richer phenomena, the node which attracts more connections has ____.

A. Low degree
B. High degree
C. Average degree
D. Does not matter

Reference - Lecture-126
Timestamp - 0:30

Answer - (B)
Solution -
A person with large number of friends tends to attract more friends.

2.
Choose the correct option based on the given statements.

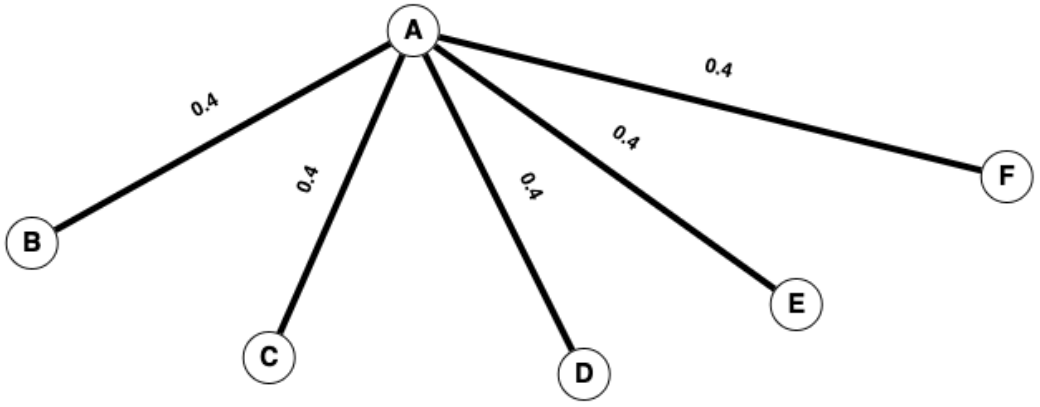
Statement I - A disease's spread depends on whether the network is sparsely connected or densely.
Statement II - A disease’s spread does not depend on its degree of contagiousness.

A. Both statements are correct.
B. Statement I is correct and statement II is incorrect.
C. Statement I is incorrect and statement II is correct.
D. Both statements are incorrect.

Reference - Lecture-129
Timestamp - 2:00

Answer - (B)
Solution -
If the network is densely connected, the disease will spread quickly.
If the degree of contagiousness of the disease is high, it will spread quickly.

3.
In the given graph, the probability of spreading a disease from node A to its connected nodes is 0.4. If the disease starts spreading from node A, then the expected number of nodes without the disease is _____.



A. 1
B. 2
C. 3
D. 4

Reference - Lecture-130
Timestamp - 12:55

Answer - (C)
Solution -
Probability of disease not spreading to the node = 0.6

Since, $E(x) = \sum_{1}^{n} P(x)$

So,

$E(number\ of\ nodes\ without\ disease) = 0.6 + 0.6 + 0.6 + 0.6 + 0.6 = 3$

4.
In Branching Process, the reproductive number(R_0) if the disease persists in the network with some positive probability($p > 0$) is ____.

A. Less than 1
B. Greater than 1
C. Equal to 1
D. Equal to p

Reference - Lecture-132
Timestamp - 7:00

Answer - (B)
The disease becomes an epidemic and persists in the network if $R_0 > 1$.

5.
If there exist a graph G, in which there are k nodes in level 1 and every node has k children then, number of nodes in i^{th} level will be ____.

A. i^k
B. $k * i$
C. $\frac{k*i}{2}$
D. k^i

Reference - Lecture-131
Timestamp - 2:00

Answer - (D)
Solution -
Each node in 1st layer has k children so in 2nd layer there will be $k * k$ i.e k^2 nodes.
Each node of 2nd layer has k children so in 3rd layer there will be $k * k^2$ i.e k^3 nodes.
Similarly, i^{th} layer will have $k * k^{(i-1)}$ i.e k^i nodes.

6.
In which of the following models can the disease stop spreading?

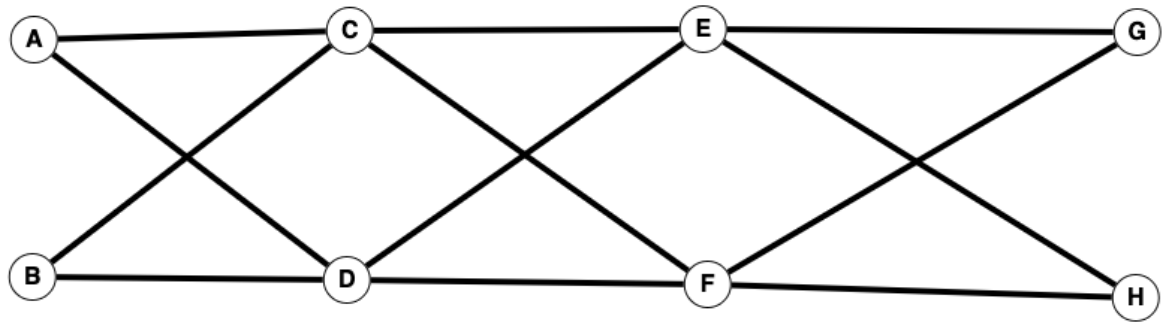
I. SIS model
II. SIR model

A. Only I
B. Only II
C. Niether I nor II
D. Both I and II

Reference - Lecture-134
Timestamp - 12:30

Answer - (D)
Solution -
In SIR model, nodes can become immune after it is infected.
In SIS model, there can exist networks where after specific time period, no node is infected and so the disease cannot spread.

7.
In the given graph, if nodes A & B are already infected with a disease and the probability of the disease spreading from a link is $\frac{1}{3}$. What is the probability that the disease will not spread till nodes E & F?



A. $(\frac{1}{3})^8$
B. $(\frac{1}{3})^4$
C. $(\frac{2}{3})^4$
D. $(\frac{2}{3})^8$

Reference - Lecture-136

Timestamp - 6:00

Answer - (C)
Solution -
The disease can spread to the nodes prior to E & F but should not reach E & F.
Hence, the probability that the disease will not spread from nodes C & D from any of the links is $\frac{2}{3} * \frac{2}{3} * \frac{2}{3} * \frac{2}{3} = (\frac{2}{3})^4$

8.
If there exist a network where disease is spreading and once a person recovers from the disease is still vulnarable to it. The disease exhibits _____.

I. SIS model
II. SIR model

A. Only I
B. Only II
C. Neither I nor II
D. Both I & II

Reference - Lecture-134
Timestamp - 10:00

Answer - (A)
Solution -
In SIS model, the person recovered from the disease still remains susceptible to the disease whereas in SIR model, the person becomes immune to the disease once they recover.

9.
If the probability of a link to remain open is p(1- p to be closed) in a graph and if at time T the connected nodes get infected, then this represents a _____.

A. SIR model
B. Percolation model
C. SIS model

Reference - Lecture-137
Timestamp - 12:00

Answer - (B)
Solution -
In percolation model if at time T, a node can be reached from the root node, then that node will get infected by the disease.

10.
In a SIS model, if probability of spreading disease is $\frac{1}{2}$, what will be the probability that a person who recovered from the disease is likely to get infected again?

A. 0
B. 1
C. $\frac{1}{2}$
D. $\frac{1}{4}$

Reference - Lecture-134
Timestamp - 10:34

Answer - (C)
Solution -
In SIS model, person who recovers remains susceptible to the disease with the same probability.

Social Networks

Week 11 Assignment

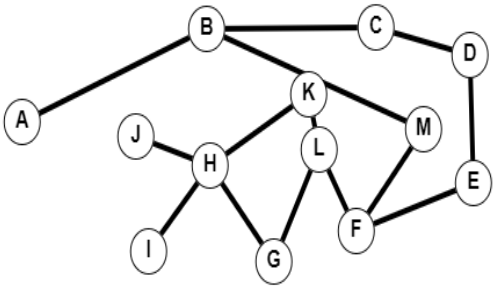
1.
Which of the following option best describes the small world effect?

A. Any two people are friends in the world.
B. Most people are isolated in a friendship network.
C. Any two people are connected in a friendship network with a small path length.
D. Friendship network representing the world is small.

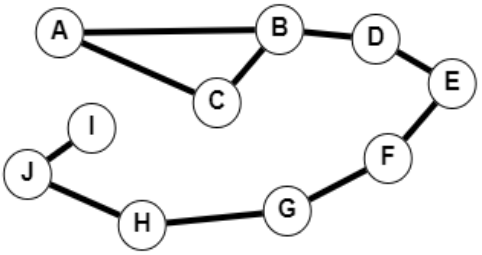
Reference - Lecture-143
Timestamp - 12:30

Answer - (C)
Solution-
According to the small world effect, most nodes can be reached from every other node by a small number of hops or steps.

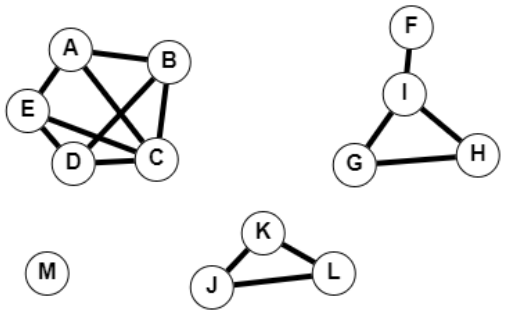
2.
Which of the following graph can represent the friendship network of a neighbourhood?



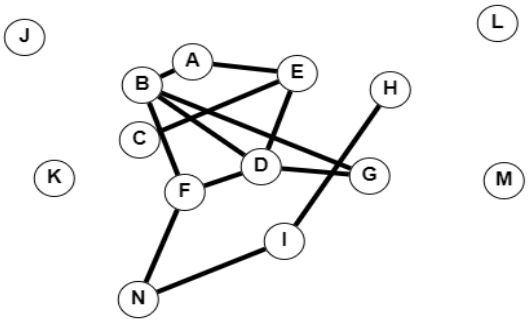
A.



B.



C.



D.

Reference - Lecture-144
Timestamp - 7:00

Answer - (A)
Solution -
The friendship graph is connected with the average length between any two nodes being 6.

3.
Rahul has 6 friends. Each of his friends also has 6 other unique friends and so on. How many people can Rahul reach within 3 hops(One hop is Rahul's immediate friends, 2nd hop is Rahul's friend's immediate friends and so on)?

A. 36
B. 258
C. 216
D. 0

Reference - Lecture-144
Timestamp - 8:40

Answer - (B)
Solution -
6 people in the first level.
$6^2 = 36$ people in the 2nd level.
$6^3 = 216$ people in the 3rd level.
Hence, the total no of people within 3 hops is $6 + 36 + 216 = 258$.

4.
Which of the following is the reason for the grid in friendship networks?

I. Homophily
II. weak ties
III. Rich get richer phenomenon

A. Only I
B. Only II
C. Only I, II
D. Only II, III

Reference - Lecture-145
Timestamp - 5:00

Answer - (A)
Solution -
The grid structure is the result of people/nodes close by becoming connected through friendships. This is due to Homophily.

5.
Ram creates a graph on networkx where he makes a 2d lattice and connects the nodes that are adjacent to each other through an edge. After doing so he randomly rewires a few of the edges with a probability of 0.02. What should be the average path length between any two nodes in this graph?

A. 10
B. 2
C. 6
D. 14

Reference - Lecture-146
Timestamp - 3:30

Answer - (C)
Solution -
The graph generated by Ram is according to the Watt-Strogatz model. Hence we observe a small world effect here which gives us an average path length to be 6.

6.
In a friendship network, the edges which are not in your neighbourhood and connect you to friends from distant regions represent -

A. strong ties
B. Homophily
C. weak ties
D. social influence

Reference - Lecture-147
Timestamp - 5:10

Answer - (C)
Solution -
The distant ties are weak ties in a social network since they are between two persons who are from different backgrounds and are small in number.

7.
In a friendship network, suppose Ram wants to reach Andrew through the shortest path between them. Ram has four friends - Raman, Raghav, George and Ashraf. Andrew's distance from Raman, Raghav, George and Ashraf is 10, 4, 6 & 9 respectively. If we chose the path to Andrew using decentralized search then the path to Andrew goes through which of his immediate friend of Ram?

A. Raman
B. Raghav
C. George
D. Ashraf

Reference - Lecture-149
Timestamp - 2:20

Answer - (B)
Solution -
Since Raghav is closest to Andrew we will go through Raghav.

8.
In a friendship graph, the distance between Ram and Andrew is 20. If we create edges according to the Watts-Strogatz model given k=2, what is the probability of them being friends through a weak tie?

A. 1
B. 0.05
C. 0.0025
D. 0.08

Reference - Lecture-149
Timestamp - 20:30

Answer - (C)
Solution -
The probability of them being friends is $\frac{1}{d^k}$, which is $\frac{1}{20^2} = 0.0025$.

9.

Which of the following option is false in a small world effect?

A. Every two people are connected with a path.
B. The average path length between any 2 people is 6.
C. People only form friendships within their neighbourhood.
D. We can attribute this phenomenon to weak ties and Homophily.

Reference - Lecture-145
Timestamp - 4:00

Answer - (C)
Solution -
If people only formed friendships within their neighbourhood, then weak ties won't be formed in the graph.

10.
Which of the following observation is correct according to Milgram's experiment?

A. Letter reached the destination within a small no of hops.
B. Letter didn't reach the destination.
C. Letter reached the destination within a large no of hops.
D. Letter reached the destination in one hop.

Reference - Lecture-144
Timestamp - 4:00

Answer - (A)
Solution -
Small world effect was observed in Milgram's experiment.

Social Networks

Week 12 Assignment

1.
Which of the following option is correct?

Statement I - As the number of weak ties in a graph increases, the diameter of the graph increases.
Statement II - As the number of weak ties in a graph increases, the diameter of the graph decreases.

A. Both statements are correct
B. Statement I is correct and statement II is incorrect
C. Statement I is incorrect and statement II is correct
D. Both statements are incorrect

Reference - Lecture-150
Timestamp - 11:00

Answer - (C)
Solution -
As the number of weak ties increases, the diameter of the graph reduces drastically.

2.
Choose the most relevant option which represents an Internet meme.

A. A video sent by your friend.
B. An urgent message from your friend.
C. A formal message.
D. Anything that gets spread over the internet.

Reference - Lecture-159
Timestamp - 2:10

Answer - (D)
Solution -
An Internet meme is an idea, behaviour, image, or style that is spread via the Internet, often through social media platforms.

3.
A sub-graph of a graph is known as k-core if _____.

A. Max degree of the sub-graph is k.
B. Each node has degree less than k.

C. Each node has degree greater than k.
D. Each node has degree greater than or equal to k.

Reference - Lecture-162
Timestamp - 10:00

Answer - (D)
Solution -
A k-core sub-graph has nodes with degree at least equal to k.

4.
Search on a Small World Network is known as -

A. Depth First Search
B. Breath First Search
C. Centralised search
D. Decentralised search

Reference - Lecture-155
Timestamp - 0:30

Answer - (D)

5.
In K-shell decomposition -

I. $k - core = \bigcup_{i \geq k} B(i)$ where, $b(i)\ is\ nodes\ with\ i - core$.
II. $k - core = \bigcup_{k} nodes\ with\ degree\ k.$
III. $k - core = \bigcup_{i=1} B(i)$ where, $b(i)\ is\ nodes\ with\ i - core$.

A. Only I
B. Only II
C. Only III
D. Only II, III

Reference - Lecture-162
Timestamp - 15:20

Answer - (A)
Solution -
In k-shell decomposition, k-core = $B(k) \cup B(k+1) \cup B(k+2) \cup B(k+3)$.....

Hence, k-core = $\bigcup_{j \geq k} B(j)$

6.

The time complexity of Myopic search in a small world network with n nodes is _____.

A. $O(log(n))$
B. $O(n)$
C. $O(n^2)$
D. $O(a^n)$ where, $a = constant$

Reference - Lecture-158
Timestamp - 12:30

Answer - (A)
Solution -
As the number of nodes increases, the time taken by myopic search in a small world network increases logarithmically.

7.
Choose the correct option.

Statement I - The influential power of a set of nodes is the probability with which they can spread disease if they get injected with it first.
Statement II - The influential power of a set of nodes X is the number of nodes that get infected with the disease if the disease starts with X.

A. Both statements are correct.
B. Statement I is correct and statement II is incorrect.
C. Statement I is incorrect and statement II is correct.
D. Both statements are incorrect.

Reference - lecture-164
Timestamp - 2:00

Answer - (C)
Solution -
If a set of nodes X gets infected with a disease then the number of nodes that will get infected if the disease spread is the influential power of the set X.

8.
Factors which govern whether an idea/meme becomes viral or not are -

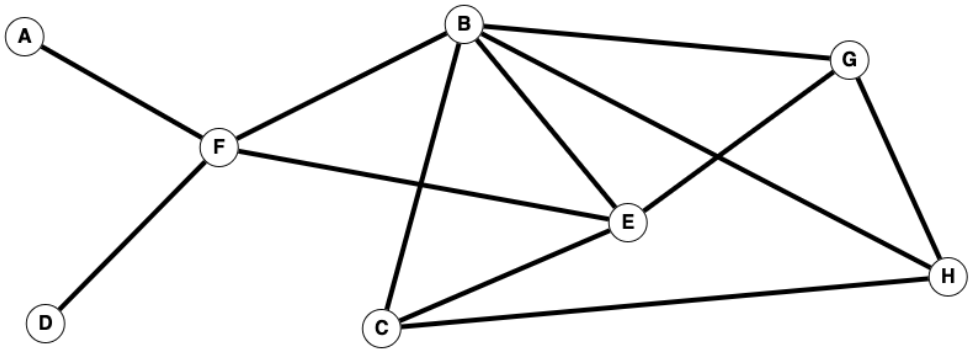
I. Novelty of idea/meme
II. Structure of the network
III. Key nodes

A. Only I
B. Only I, II
C. Only I, III
D. I, II and III

Reference - Lecture-160
Timestamp - 3:00

Answer - (D)
Solution -
If the idea/meme is good, more people will like it.
Idea/memes spread differently based on how people are connected in the network.
Reaching out to key nodes increases the spread of the idea/meme.

9.



For the given graph, the number of nodes in the 3-core is _____.

A. 8
B. 5
C. 6
D. 3

Reference - Lecture-162
Timestamp - 13:00

Answer - (B)
Solution -
1-core = {A, D}
2-core = {F}
3-core = {C, G, H, B, E}
Hence, there are 5 nodes in 3-core.

10.
Which factor has the most correlation with the influential power of a node?

A. Degree of the node
B. Closeness
C. Betweenness
D. Coreness

Reference - Lecture-165

Timestamp - 20:07

Answer - (D)
Solution -
To obtain the maximum influential power, one should look for the node with the highest coreness.