Assignment Week 9
Social Networks

1. Which of the following is true for G(1000, 0.5) random network:
    a. The density of the network will be 0.5
    b. The clustering coefficient will be 0.5
    c. Each node will be added with probability 0.5.
    d. **Each edge will be placed with probability 0.5**.

2. Given set E = {1, 2, 3, 4, 5, 6, 7, 8, 9, 10}, we pick a value a_1 uniformly at random from this set E. Next, we pick another value a_2 , again uniformly at random from this set E. Similarly we pick 8 more values, a_3 , a_4 , ..., a_10. Look at the sum S = a_1 + a_2 + ... + a_10. Let p(i) be the probability that S = i, i.e., the probability that the sum of these randomly chosen 10 elements is i. We plot i on the X-axis and p(i) on the Y axis. Choose the correct statement from the following:
    a. The plot has very high values in the beginning but then drops.
    b. The plot is a constant curve.
    c. The plot is a bell shaped curve.
    d. The plot is linear.

    Explanation: The probability distribution of the sum of random variables depicts a bell shaped curve.

3. Power law degree distribution in real world networks generally follows the characteristic equation $y = 1/k^a$. What is the value of 'a' here?
    a. 1 <a< 2
    b. 2 <a< 3
    c. 3 <a< 4
    d. None of the above

    Explanation: In real world power law degree distributions, the value of 'a' has been observed to be between 2 and 3.

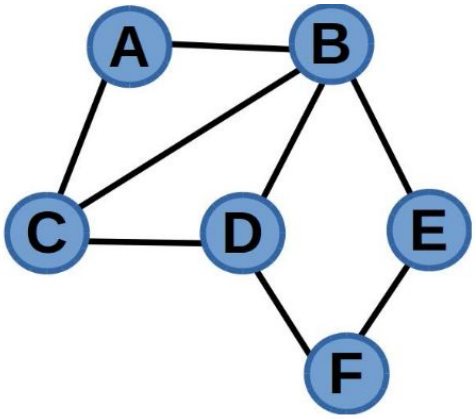
4. How does the power law degree distribution come by in real world networks?:
    a. By preferential attachment
    b. By random linking
    c. By uniform edge connection
    d. No hypothesis is found.

    Explanation: Barabasi and Albert proposed a hypothesis that the real world networks are evolved using the preferential attachment and this gives birth to power law degree distribution.

5. In the preferential attachment, a new coming node will prefer to make the connection with the node having:
    a. Fewer friends
    b. More friends
    c. Average number of friends
    d. None of the above

    Explanation: In the preferential attachment model, a new coming node prefers to make the connection with the node having the higher degree. So, this model gives birth to power law degree distribution.

6. Given a network being generated by 'rich get richer' phenomenon. The following Figure shows the snapshot of the network at time t. A new node 'u' enters the network at time t+1 and makes an edge with one of the existing nodes. The probability of 'u' making an edge with an existing node 'w' is defined as p(w). Which of the following equations is correct?



    a. p(A) < p(C) < p(B)
    b. p(E) < p(D) < p(B)
    c. p(F) < p(C) < p(B)
    d. All of the above

    Explanation: p(A) = 2/16, p(B) = 4/16, p(C) = 3/16, p(D) = 3/16, p(E) = 2/16, p(F) = 2/16

7. Let G be a set of 5 graphs generated using Erdos-Renyi model with (n, p) parameters. Similarly, let H be a set of 5 graphs generated using Barabasi-Albert model with (n, m) parameters. Which of the following is true (Assume standard definitions for n, m and p):
    a. No. of edges in all the graphs in G is same, the no. of edges in all the graphs in H may vary.
    b. No. of edges in all the graphs in H is same, the no. of edges in all the graphs in G may vary.

c. No. of edges in all the graphs in G is same, No. of edges in all the graphs in H is same
d. No. of edges in all the graphs in both, G and H, varies in each iteration

Explanation: In (n, p), p is the probability, while in (n, m), m is the number of edges.

8. Given set E = {1, 2, 3, ..., 19, 20}. We pick a value a_1 uniformly at random from this set E. Next, we pick another value a_2 , again uniformly at random from this set E. Similarly we pick 18 more values, a_3 , a_4 , ..., a_20 (a total of 20 numbers are picked). Look at the sum S = a_1 + a_2 + ... + a_20 . Which of the following sets define the range from which the sum S can have values from?
    a. {1, 2, ..., 19, 20}
    b. {20, 11, ..., 19, 200}
    c. {1, 2, ..., 9, 400}
    d. {20, 11, ..., 399, 400}

    Explanation: The minimum value of S will be 20 when all the selected elements a_1 , a_2 , ..., a_20 have a value 1 each. The maximum value of S will be 40000 when all the selected elements a_1 , a_2 , ..., a_20 have a value of 20 each. Hence the correct option is D.