

**M.TECH DEGREE EXAMINATIONS: NOV/ DEC 2024**

(Regulation 2018)

Third Semester

**DATA SCIENCE**

P18ITE0014 : Social Media Analytics

**COURSE OUTCOMES**

**CO1:** Explain the Evolution of Social Networks

**CO2:** Analyse the structure of Social Networks

**CO3:** Explore the knowledge from disciplines as diverse as sociology, mathematics, computer science.

**CO4:** Discuss the Online interactive demonstrations and hands-on analysis of real-world data sets.

**Time: Three Hours**

**Maximum Marks: 100**

**Answer all the Questions:-**

**PART A (10 x 1 = 10 Marks)**

1. **Assertion (A):** In social network analysis, graphs are used to represent relationships because they provide a visual and mathematical structure for analyzing connections and patterns. CO1 [K<sub>2</sub>]

**Reason (R):** Structural holes in a network refer to gaps between two disconnected groups that can be bridged by a node, potentially increasing the node's social capital.

- a) Both A and R are Individually true and R is the correct explanation of A      b) Both A and R are Individually true but R is not the correct explanation of A  
c) A is true but R is false      d) A is false but R is true

2. In social network analysis, a \_\_\_\_\_ is a gap between two groups or individuals in a network that, when bridged, can create opportunities for increased social capital. CO1 [K<sub>1</sub>]

- a) Strong tie      b) Weak tie  
c) Network closure      d) Structural hole

3. CO2 [K<sub>2</sub>]

List I	List II
A. Homophily	i. Analysis of positive and negative relationships.
B. Structural balance	ii. Explains patterns of group-based segregation.

C. Affiliation	iii. Tendency of individuals to associate with similar others.
D. Spatial model of segregation	iv. Joining groups or associations to connect with others.

- |    | A   | B  | C   | D   |
|----|-----|----|-----|-----|
| a) | ii  | i  | iii | iv  |
| b) | iii | iv | i   | ii  |
| c) | iv  | i  | ii  | iii |
| d) | iii | i  | iv  | ii  |

4. Matching type item with multiple choice code

CO2 [K<sub>2</sub>]

List I	List II
A. Diffusion in networks	ii. Influence of local network structure on diffusion.
B. Cascades and clusters	iv. Finding a target node using local information in a network.
C. Six degrees of separation	i. Spread of behavior or information across nodes.
D. Decentralized search	iii. Concept of any two individuals being connected through six links.

- |    | A   | B  | C   | D   |
|----|-----|----|-----|-----|
| a) | ii  | i  | iii | iv  |
| b) | ii  | iv | i   | iii |
| c) | iv  | i  | ii  | iii |
| d) | iii | i  | ii  | iv  |

5. **Assertion (A):** The concept of "six degrees of separation" demonstrates that any two individuals in the world are connected by a short chain of relationships.

CO3 [K<sub>2</sub>]

**Reason (R):** Decentralized search in networks relies on local information to effectively navigate and identify connections between nodes.

- |   |   |
|---|---|
| a) Both A and R are Individually true and R is the correct explanation of A | b) Both A and R are Individually true but R is not the correct explanation of A |
| c) A is true but R is false   | d) A is false but R is true   |

6. The \_\_\_\_\_ structure of the web describes its division into core, in-links, out-links, and disconnected components.

CO3 [K<sub>1</sub>]

- |                 |         |
|-----------------|---------|
| a) Hierarchical | b) Star |
| c) Bow-Tie      | d) Ring |

7. Which of the following are true about the structure and analysis of the World Wide Web?

CO4 [K<sub>2</sub>]

- The World Wide Web can be represented as a directed graph with web pages as nodes and hyperlinks as edges.
- The Bow-Tie Structure of the web consists of core, in-links, out-links, and



- |     |   |     |                   |
|-----|---|-----|-------------------|
| 14. | What does the concept of homophily suggest in social networks?                  | CO2 | [K <sub>2</sub> ] |
| 15. | How does social influence affect affiliation in online networks?                | CO3 | [K <sub>2</sub> ] |
| 16. | What is the Bow-Tie structure of the web?                                       | CO3 | [K <sub>2</sub> ] |
| 17. | How does the PageRank algorithm rank web pages?                                 | CO4 | [K <sub>2</sub> ] |
| 18. | What is the purpose of clustering in social network graphs?                     | CO4 | [K <sub>1</sub> ] |
| 19. | What is meant by cascading behavior in networks?                                | CO2 | [K <sub>1</sub> ] |
| 20. | What does the "Six Degrees of Separation" concept refer to in network dynamics? | CO3 | [K <sub>2</sub> ] |

**PART C (10 x 5 = 50 Marks)**

- |     |  |     |                   |
|-----|--|-----|-------------------|
| 21. | Explain the role of formal methods in analyzing social network data. How do paths and connectivity help in understanding social relations in a network? Provide examples to support your explanation.                                    | CO1 | [K <sub>2</sub> ] |
| 22. | Analyze the concept of Six Degrees of Separation in the context of network dynamics. How does decentralized search leverage this concept, and what are its applications in real-world networks?  | CO1 | [K <sub>3</sub> ] |
| 23. | Explain the SimRank algorithm and its application in social network analysis. How does it measure the similarity between nodes, and how is it related to structural balance in social networks? Discuss its uses in community detection. | CO2 | [K <sub>2</sub> ] |
| 24. | Describe how graphs can be used to represent social relationships. Discuss the types of graphs commonly used and how they help in identifying important structural features like cliques, bridges, and clusters.                         | CO2 | [K <sub>2</sub> ] |
| 25. | Discuss the significance of strong and weak ties in social networks. How do weak ties contribute to the spread of information or influence in a network? Provide examples of real-world applications.                                    | CO3 | [K <sub>2</sub> ] |
| 26. | Analyze the mechanisms underlying homophily in social networks. How does selection and social influence play a role in network formation, and what impact do these mechanisms have on online communities?                                | CO3 | [K <sub>3</sub> ] |
| 27. | Explain the PageRank algorithm in the context of web search. How does it determine the importance of a webpage, and what role does link analysis play in modern search engines? Discuss its applications.                                | CO4 | [K <sub>3</sub> ] |
| 28. | Explain the Bow-Tie structure of the web. How does this structure help in understanding the connectivity and isolation of components within the World Wide Web? Discuss its significance in web search and information retrieval.        | CO4 | [K <sub>1</sub> ] |
| 29. | Describe the concept of clustering in social network graphs. Explain how algorithms like the Girvan-Newman algorithm are used for community detection. How do communities within a network help in understanding its overall structure?  | CO3 | [K <sub>1</sub> ] |
| 30. | Discuss the concept of cascading behavior in networks. How do thresholds and clusters affect the diffusion of information, and what is the impact of cascading behavior on social media and online networks?                             | CO4 | [K <sub>3</sub> ] |

**Answer any TWO Questions**

**PART D (2 x 10 = 20 Marks)**

- |     |  |     |                   |
|-----|--|-----|-------------------|
| 31. | Analyze the impact of homophily and social influence on network dynamics. How do they work together to shape the structure of social networks, and what role do they play in the diffusion of information or behaviors? Provide real-world examples and discuss the implications for online communities or marketing strategies. | CO1 | [K <sub>3</sub> ] |
|-----|--|-----|-------------------|

32. Discuss the concept of structural balance in social networks. How does the principle of structural balance influence the development of both positive and negative relationships within a network? Critically evaluate the limitations of this theory particularly in the context of complex, real-world social networks. Use examples of both balanced and unbalanced networks to support your argument. CO3 [K<sub>3</sub>]
33. Evaluate the use of PageRank and link analysis techniques in modern web search engines. While these algorithms are effective in ranking pages, what are their limitations in terms of capturing the full complexity of human behavior and the evolving nature of the web? How can these techniques be adapted to improve search relevance and address challenges such as spam or biased results? CO4 [K<sub>3</sub>]

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