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**BRAINWARE UNIVERSITY**

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Term End Examination 2025-2026**Programme – M.Tech.(CSE)-AIML-2025****Course Name – Computational Social Networks****Course Code - MTA20504****(Semester II)****Full Marks : 60****Time : 2:30 Hours**

[The figure in the margin indicates full marks. Candidates are required to give their answers in their own words as far as practicable.]

Group-A

(Multiple Choice Type Question)

1 x 15=15

1. *Choose the correct alternative from the following :*

- (i) Recognize the core focus of the Social Network Perspective.
 - a) Individual psychological traits
 - b) Attributes like age and income
 - c) Structure of relationships
 - d) Geographic population density
- (ii) Interpret the implication of a node having a Degree Centrality of zero.
 - a) The node is a hub
 - b) The node is isolated
 - c) The node is a bridge
 - d) The node is central
- (iii) Analyze the structural implication of a node having a high Out-Degree but zero In-Degree in a directed graph.
 - a) The node is a pure consumer
 - b) The node is a pure source/broadcaster
 - c) The node is a bridge
 - d) The node is isolated
- (iv) Demonstrate the property of a Signed Graph representing a balanced triad.
 - a) The product of edge signs is negative
 - b) The sum of edge signs is zero
 - c) The product of edge signs is positive
 - d) The graph has no edges
- (v) Investigate the main limitation of using Snowball Sampling.
 - a) It is too expensive
 - b) It isolates the ego
 - c) It creates bias towards nodes with higher degree
 - d) It cannot handle directed edges
- (vi) Analyze the connectivity of a graph where the algebraic connectivity (second smallest eigenvalue) is zero.
 - a) The graph is fully connected
 - b) The graph is disconnected
 - c) The graph is a complete graph
 - d) The graph is a star graph
- (vii) Analyze the effect of high Network Constraint on an individual actor's creativity.
 - a) It increases access to diverse information
 - b) It limits exposure to non-redundant information
 - c) It creates structural holes
 - d) It guarantees high betweenness
- (viii) Deduce the consequence of a network having zero Structural Holes.

- a) The network is rich in brokerage opportunities
 c) The network is disconnected
 (ix) Deconstruct the composition of an Ego Network.
 a) It contains the ego, alters, and ties between alters
 c) It contains only the ego and no edges
 (x) Evaluate the resilience of a Scale-Free network against targeted attacks on hubs.
 a) It is highly robust
 c) It is unaffected
 (xi) Assess the structural change in a Watts-Strogatz model as rewiring probability p moves from 0 to 1.
 a) It transitions from Random Graph to Lattice
 c) It transitions from Scale-Free to Lattice
 (xii) Deconstruct the Small World phenomenon into its constituent properties.
 a) High Diameter, Low Clustering
 c) Low Diameter, High Clustering
 (xiii) Justify the inclusion of a Damping Factor in the PageRank algorithm.
 a) It prevents infinite loops (rank sinks) and ensures convergence
 c) It removes all links from the graph
 (xiv) Distinguish the degree distribution of an Erdos-Renyi graph from a Barabasi-Albert graph.
 a) ER is Poisson; BA is Power Law
 c) Both are Poisson
 (xv) Examine the growth mechanism in the Barabasi-Albert model.
 a) Nodes are added with random connections
 c) Nodes are never added
- b) The network is redundant and information circulates in loops
 d) The network is a random graph
 b) It contains the entire population of the world
 d) It contains only random nodes
 b) It is extremely fragile
 d) It is identical to a random network
 b) It transitions from Lattice to Random Graph
 d) It stays the same
 b) Low Diameter, Low Clustering
 d) High Diameter, High Clustering
 b) It increases the calculation speed
 d) It ensures all nodes have equal rank
 b) ER is Power Law; BA is Poisson
 d) Both are Power Law
 b) Nodes are added with connections proportional to existing degree
 d) Edges are removed over time

Group-B

(Short Answer Type Questions)

3 x 5=15

2. Define Social Network Analysis. (3)
3. Construct the adjacency matrix for an undirected dyad connected by a single edge. (3)
4. Use Multidimensional Scaling (MDS) to interpret the layout of a social graph. (3)
5. Critique the Erdos-Renyi model's ability to represent the Clustering Coefficient of real social networks. (3)
6. Compare the Linear Threshold Model and the Independent Cascade Model of influence spread. (3)

OR

- Examine the role of Heavy Tails in the spread of computer viruses. (3)

Group-C

(Long Answer Type Questions)

5 x 6=30

7. Explain Structural Balance theory with examples. (5)
8. Describe different sources of network data. (5)
9. Prepare a strategy for Snowball Sampling to collect a dataset on a hidden population. (5)
10. Justify the use of Blockmodeling for simplifying complex social networks. (5)
11. Justify why real-world social networks are described as having Heavy Tail distributions rather than Poisson distributions. (5)

12. Analyze the mechanism by which the Preferential Attachment model generates a scale-free (5) network.

OR

Compare and contrast the Erdos-Renyi model and the Watts-Strogatz model regarding the (5) Clustering Coefficient.

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