




المادة: Social Network Analysis
المدة: ساعة ونصف
الأستاذ: د. حسين هزيمة

المرحلة: الإجازة
السنة المنهجية: الثالثة
الاختصاص: علم البيانات - Data Science

Documents are NOT authorized

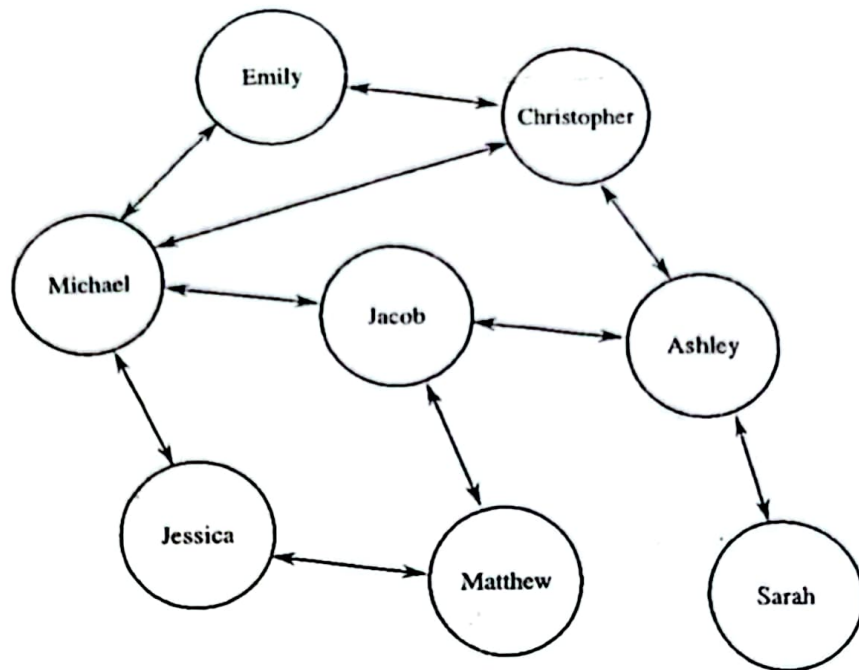
Question 1: (32 pts) multiple-choice and T/F questions:

1. A path from v_0 to v_0 in a graph G , can repeat a vertex or edge, is called	a. Walk b. Circuit c. Cycle d. Path
2. A path from v_0 to v_0 in a graph G , cannot repeat a vertex or edge, is called	a. Walk b. Circuit c. Cycle d. Path
3. Graph C_1 is called 	a. Complete graph b. Connected graph c. Simple graph d. Cycle graph

1. In directed graphs a node's edge is bidirectional.	T	<input checked="" type="radio"/> F
2. A graph that has loops is called a simple graph	T	<input checked="" type="radio"/> F
3. A bipartite graph exists has no two vertices within the same set are connected.	<input checked="" type="radio"/> T	F
4. A path is the same as shortest path	T	<input checked="" type="radio"/> F
5. Local neighbourhood overlap is a node level feature	T	<input checked="" type="radio"/> F

Question 2: (30 pts) centrality measures:

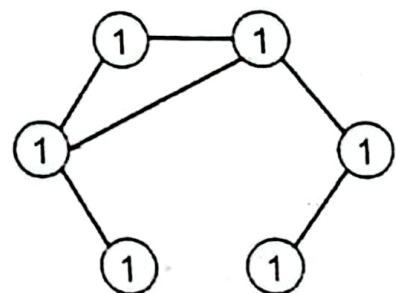
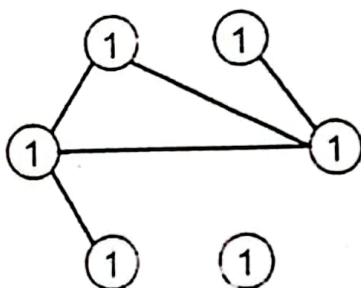
1. Given the following graph G :



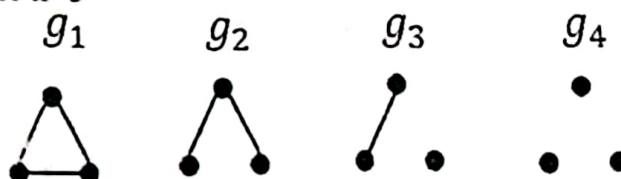
- Write the adjacency matrix of G . 3 points.
- Find the degree centrality (dc) Jacob, Sarah, and Emily, and determine the node with the highest dc. 13 points.
- Calculate the closeness centrality (cc) Matthew, Ashley, and Micheal, and determine the node that has the highest cc. 14 points.

Question 3: (38 pts) graph features:

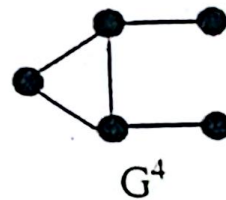
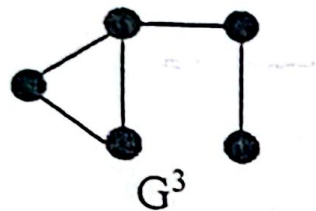
- Find the clustering coefficient of graph G in part 3). 10 pts.
- What is the possible number of graphlets of G ? 5 pts.
- Given the following two graphs G^1 and G^2 , find the similarity between these two graphs using Weisfeiler-Lehman Kernel color refinement algorithm. 15 pts



- Given the following graphlets for $k=3$



And the following two graphs G^3 and G^4 , calculate and find the graphlet kernel $K(G^3, G^4)$ of the two graphs. 8 points.



Appendix

$cc(v) = 2N_v / K_v(K_v - 1)$	$s = C(n, K)$ where $k = n(n-1)/2$
$C_{D_i} = \frac{\sum_{j=1}^n a_{ij}}{n-1}$	$C(x) = \frac{N-1}{\sum_y d(y, x)}$
$C_{btw}(v) = \sum_{s,t \in N} \frac{\sigma_{s,t}(v)}{\sigma_{s,t}}$	FLASH
$a \cdot b = \sum_{i=1}^n a_i b_i = a_1 b_1 + a_2 b_2 + \dots + a_n b_n$	$K(G, G') = \Phi(G)^T \Phi(G')$
$K(G, G') = f_G^T f_{G'}$	