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CMSC 471

Artificial Intelligence

Summer 2021

Quiz 4

Due: As long as it is 10-AUG-2021 anywhere on Earth (AOE)

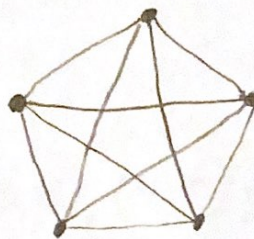
<https://time.is/Anywhere on Earth>

20 points

6 questions

4 pages

1. Draw the  $K_5$  graph.

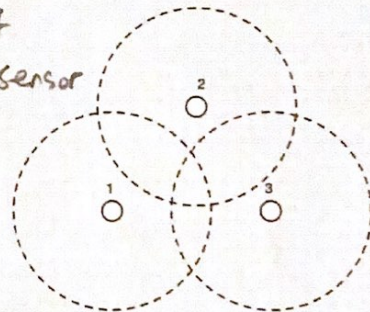


1

2. Draw the graph for the agents shown below. Dashed circles around agents indicate sensor footprints that detect neighbors.



sensors cannot  
detect other sensor  
fields, only  
other nodes.



1

3. Draw the graph

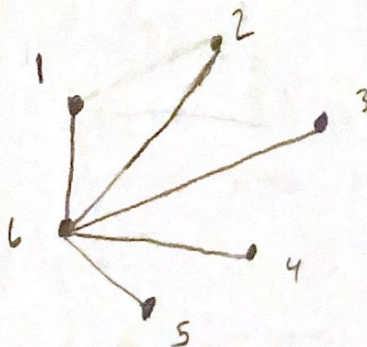
$G = (\{1, 2, 3, 4, 5, 6\}, E)$ , where

$(i, j) \in E$ , if and only if  $i = 6$  or  $j = 6$

$E = (6, 1), (6, 2), (6, 3), (6, 4), (6, 5), (1, 6), (2, 6), (3, 6), (4, 6), (5, 6)$

← Order of

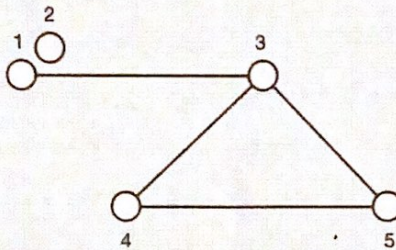
Edge Coordinates  
doesn't matter  
in undirected  
graph, these  
are duplicates,



1



4. A multiagent system is shown using the cartoon below:



a) What is vertex set,  $V$ ? 1

$$V = \{1, 2, 3, 4, 5\}$$

b) What is the edge set,  $E$ ? 1

$$E = \{(1, 3), (3, 4), (3, 5), (4, 5)\}$$

c) Mathematically express the cartoon as a graph,  $G$ . 1

$$G = (\{1, 2, 3, 4, 5\}, \{(1, 3), (3, 4), (3, 5), (4, 5)\})$$

d) What is the neighborhood set of Agent 4? 1

$$N(4) = \{3, 5\}$$

e) What is the degree of Agent 3? 1

$$\text{Deg}(3) = 3$$

f) What is the number of connected components? 1

$$1 \quad (\text{node 2 is isolated})$$

g) What is the clustering coefficient of Agent 3? 2

$$CC(3) = \frac{1}{3}$$

$$\text{deg}(3) = 3$$

$k_3$  has 3 links

without node 3

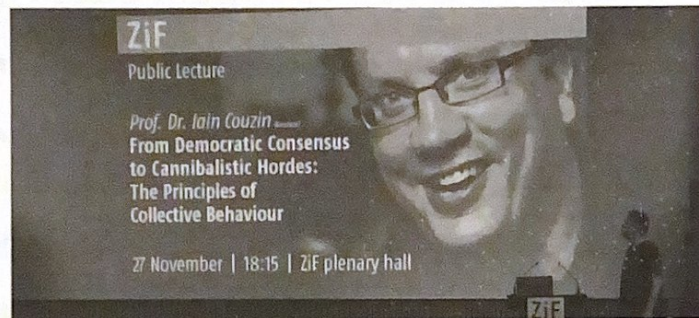
1.

← 2/3 links present





5. Watch this video on *Collective Behavior* and answer the following questions:

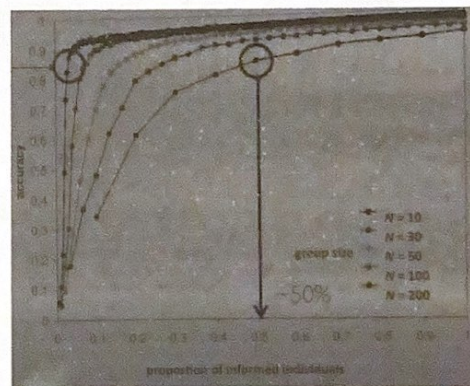


<https://www.youtube.com/watch?v=6wy1CP-mM08>

a) Briefly comment on the finding summarized by the graph below:

2

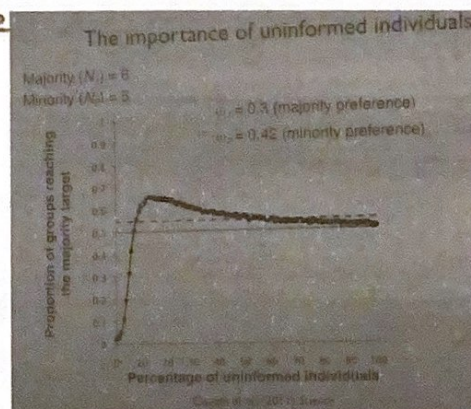
The findings showed that as group size increased, the proportion of informed individuals needed for an 85% or greater accurate consensus decreased by several magnitudes. In a large enough group, less than 5% of individuals needed to be informed for the total group to make an accurate assessment.



b) Briefly comment on the finding summarized by the graph below:

2

The findings show the importance of uninformed opinions. They allow for the group to come to a consensus that sides with the majority of the group. With a less than 10% inclusion of uninformed vote, the minority preference is chosen if the minority preference strength is high enough.



3

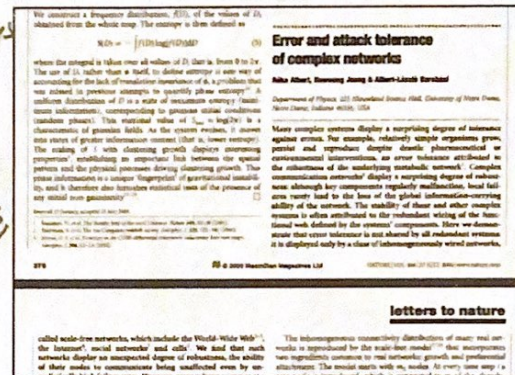


6. Research the following network concepts using the associated publications.

a) Briefly describe the difference between *exponential* and *scale-free* networks.

1.5

Exponential networks are homogeneous most nodes have approx. the same number of links. Scale free networks are inhomogeneous, the majority of the nodes have one or two connections, but a few nodes have a large number of connections guaranteeing that the system is fully connected.

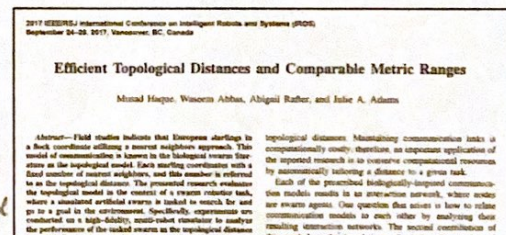


<https://barabasi.com/177.pdf>

b) Briefly describe the *dominant node set*.

1.5

A dominant node set is a set of nodes in a graph  $G$  where every node not in the dominant set is adjacent to a node in the dominant node set. There is believed



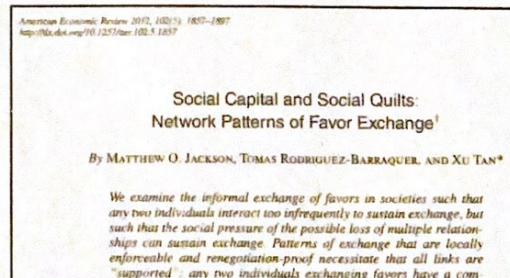
<https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&number=8206160>

to be no efficient algorithm for finding the smallest dominant node set in any graph.

c) Briefly describe the difference between *clustering* and *support*.

2

Network clustering measures the extent that two friends of a given agent are friends with each other. Support measures the number of pairs of friends that have a third friend in common.



<https://pubs.aeaweb.org/doi/pdfplus/10.1257/aer.102.5.1857>

END