UNIVERSITY OF WEST LONDON

School of Computing and Engineering

Artificial Intelligence
Mock Exam

Date: **TBC**   Time Allowed: **3 Hours + 10 minutes reading time**

During reading time candidates are not permitted to write anything in the examination answer book, but may make rough notes on this question paper.

Instructions to candidates:

QUESTIONS TO ANSWER: ANSWER **FOUR** QUESTIONS ONLY

If more than four questions answered, the first four answers as they appear in the examination answer book will be selected for marking.

Working for all your answers must be clearly shown.

MARKING SCHEME:

MARKS FOR EACH QUESTION AS INDICATED AGAINST EACH QUESTION

This is a closed book examination

Question 1 - Agents (Total = 25 Marks)

a) In AI agents are supposed to have a rational behaviour. Describe what "rationality" means for an agent.
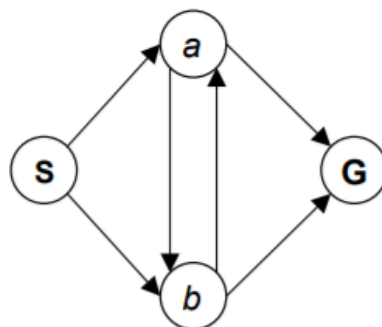
(9 marks)

b) Describe what an agent's "state" describes. and what the "state space graph" is. Provide an example for each one.

(16 marks)

Question 2 – Searching (fundamentals) (Total = 25 Marks)

a) How can we avoid redundant paths in TREE-SEARCH?

(10 marks)

b) Build a search tree for the following state space. Arrows indicate the possible actions (paths). S is the 'initial state', and G is the 'goal state'.

(15 marks)



Question 3 – Searching (strategies) (Total = 25 Marks)

a) In "informed" search, what is a heuristic?

(10 marks)

b) For each of the following search strategies, work out the path returned by the search on the graph shown below. In all cases, assume ties resolve in such a way that states with earlier alphabetical order are expanded first. Arrows indicate the possible actions (paths), and values show the cost of actions. The start and goal state are S and G, respectively.
1) Depth-first search.
2) Breadth-first search.
3) Uniform cost search.

(15 marks)
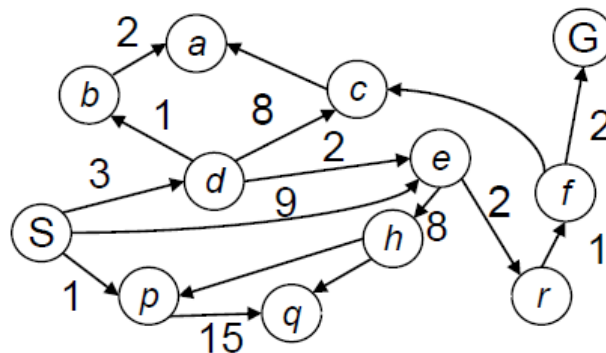
Question 4 – Constraint-Satisfaction Problems (CSP)   (Total = 25 Marks)

a)   One strategy to solve CSP's is the backtracking approach. Describe its main steps.

(10 marks)

b)   Explain why it is a good heuristic to choose the variable that is most constrained but the value that is least constraining in a CSP search.

(15 marks)

Question 5 – Probability + Bayes' Nets   (Total = 25 Marks)

a)   What does "Uncertainty" mean in the context of AI?.

(9 marks)

b)   Table below is a joint distribution (a table of probabilities) which captures the likelihood of each possible outcome. Use the table to work out the marginal distributions P(T) and P(W).

$$P(T, W)$$

T	W	P
hot	sun	0.4
hot	rain	0.1
cold	sun	0.2
cold	rain	0.3

(16 marks)

Question 6 – Learning (Total = 25 Marks)

a) Describe Explain the concept of unsupervised learning, and provide one example.

(9 marks)

b) Consider the following data set comprised of three input attributes (Height, Hair, and Eyes) and one binary output (Class):

Height	Hair	Eyes	CLASS
short	blonde	blue	$\oplus$
short	dark	blue	$\ominus$
tall	dark	brown	$\ominus$
tall	blonde	brown	$\ominus$
tall	dark	blue	$\ominus$
short	blonde	brown	$\ominus$
tall	red	blue	$\oplus$
tall	blonde	blue	$\oplus$

Use the decision tree algorithm to learn a decision tree for these data. Show the computations made to determine the attribute to split at each node.

(16 marks)