UNIVERSITY EXAMINATIONS: 2023/2024

EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE IN INFORMATION TECHNOLOGY / BUSINESS I. T/ APPLIED COMPUTING/ INFO. SECURITY & FORENSICS/ SOFTWARE DEV.

BIT 3207/ BBIT 2110/ BAC 3106/ BSD 2207/ BISF 2106:

ARTIFICIAL INTELLIGENCE/ PRINCIPLES OF A.I

FULL TIME/PART-TIME/DSTANCE LEARNING

ORDINARY EXAMINATIONS

DATE: APRIL, 2024 TIME: 2 HOURS

INSTRUCTIONS: Question One Is Compulsory, Choose Two Other Questions

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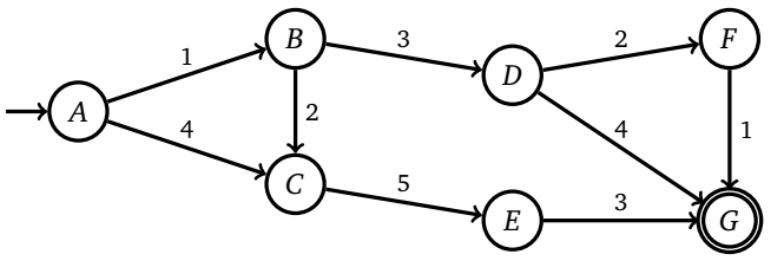
QUESTION ONE (20 MARKS) Compulsory

a) Explain the factors that a rational agent should depend on at any given time. **(3 Marks)**

b) Discuss the rationale of ***search*** in artificial intelligence. **(2 Marks)**

c) The following is a representation of a search problem, where A is the start node and G is the goal. Each edge is labeled by the cost to traverse that edge. There is also a heuristics h(n) which is defined in the table. Answer the following questions:



n	$h(n)$
A	5
B	3
C	4
D	3
E	3
F	1
G	0

i. Define the problem formulation. **(2 Marks)**

ii. Outline any six components of a search problem. **(3 Mark**

d) Explain why Knowledge Representation is important in artificial intelligence. **(2 Marks)**

e) Translate the following statement into First-order Predicate logic. **(4 Marks)**

i. Every student except Susan smiles

ii. Every boy who loves Faith hates every boy who Faith loves.

f) Distinguish between forward and backward reasoning, in the appropriate context. Give an example where applicable. **(4 Marks)**

QUESTION TWO (15 MARKS)

a) Make use of a valid example to describe inferential knowledge. **(3 Marks)**

b) Consider figure Q below. To answer the questions that ask for a path, please give your answers in the form 'S − A − D − G.' Deduce and show the path that will be returned by the following search strategies.

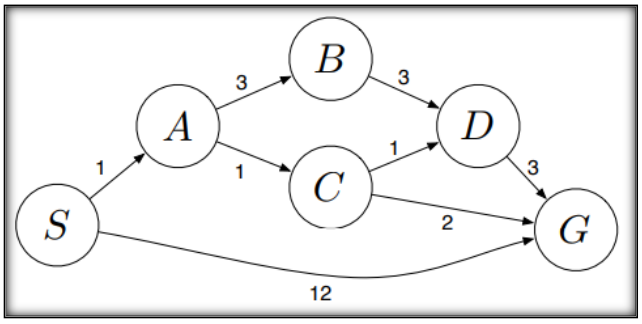


Figure Q.

i. Depth- First Search. **(2 Marks)**

ii. A* graph search, using a consistent heuristic. **(2 Marks)**

c) Missionaries and Cannibals is a problem in which 3 missionaries and 3 cannibals want to cross from the left bank of a river to the right bank of the river. There is a boat on the left bank, but it only carries at most two people at a time (and can never cross with zero people). If cannibals ever outnumber missionaries on either bank, the cannibals will eat the missionaries. A state can be represented by a triple, (*m c b*), where *m* is the number of missionaries on the left, *c* is the number of cannibals on the left, and *b* indicates whether the boat is on the left bank or right bank. For example, the initial state is (3 3 L) and the goal state is (0 0 R).

Operators are:

- MM: 2 missionaries cross the river
- CC: 2 cannibals cross the river
- MC: 1 missionary and 1 cannibal cross the river

- M: 1 missionary crosses the river
- C: 1 cannibal crosses the river

Required

Represent a state space diagram showing all the legal states and transitions from states corresponding to all **legal** operations. **(8 Marks)**

QUESTION THREE (15 MARKS)

a) Differentiate between Strong AI and Week AI. **(4 Marks)**

b) Discuss a learning agent, use a simplified diagram to highlight the major parts. **(7 Marks)**

c) Represent the following knowledge in a semantic network. **(4 Marks)**

Dogs are Mammals	Birds have Wings
Mammals are Animals	Bats have Wings
Birds are Animals	Bats are Mammals
Fish are Animals	Dogs chase Cats
Worms are Animals	Cats eat Fish
Cats are Mammals	Birds eat Worms
Cats have Fur	Fish eat Worms
Dogs have Fur	

QUESTION FOUR (15 MARKS)

a) Describe the use of each, in each case support your answer with a valid example.

   i. Propositional logic and Predicate logic. **(4 Marks)**

   ii. Justify why predicate logic is preferred over propositional logic. **(2 Marks)**

b) Define AI and hence, discuss how AI has been used to enhance the following areas. **(4 Marks)**

   i. Intrusion Detection

   ii. Consumer Marketing

c) You have recently been employed as the Chief AI Officer at a company that builds social network games. You are working on the game code-named ***Vita-Vikali***. The game consists of networks of players linked together on a graph. The nodes of the graph are players and two players share a link if they are friends. In the game:

   • The server assigns each player a role of either Warrior, Sorceress, Archer, or Blacksmith.

   • The server needs to assign roles to players on the graph such that no friends have the same role.

   • The server uniformly randomly chooses N players to hold magical tokens. These players must be assigned the same role.

   Required;

Formulate the problem as a constraint satisfaction problem. {hint: -Describe the variables, the values, the constraints, etc.} **(5 Marks)**