University of Chittagong

Department of Computer Science and Engineering

7th Semester B.Sc. (Engg.) Examination-2020

Course Code: CSE-713 Course Title: Artificial Intelligence

Total marks: 52.5 Marks Time: 4.00 hours

[Answer any ***three*** questions from each of the ***Group-A*** and ***Group-B***. A separate answer script must be used for Group-A and Group-B. Figures in the right-hand margin indicate full marks.]

Group-A

1. a) Give a scientific definition of intelligence. Do you think the following definition of intelligence constitutes a scientific definition? If not, justify your answer. 2

"Intelligence is the acquiring and applying knowledge."

b) Discuss the different approaches of AI. Which one do you think is appropriate and why? 2

c) Find out the following about the automated taxi driving agent. 1+1.75+2

i) Identify its PAGE (Percepts, Actions, Goals, and Environment) description.

ii) Characterize its environment as being either: accessible or inaccessible; deterministic or nondeterministic; episodic or non-episodic; static or dynamic; and discrete or continuous; explaining what each of your selected terms means.

iii) What agent architecture is best for the Mars Rover? Justify your answer.

2. a) How can you formulate a search problem? Give examples of data structures that can be used to represent a state-space both in explicit and implicit ways. 1.75

b) Give the initial state, goal test, successor function, and cost function for each of the following. 2

i) In the travelling salesperson problem (TSP) there is a map involving N cities some of which are connected by roads. The aim is to find the shortest tour that starts from a city, visits all the cities exactly once, and comes back to the starting city.

ii) Missionaries and Cannibals problem: 3 missionaries and 3 Cannibals are on one side of the river. 1 boat carries 2 Missionaries must never be outnumbered by cannibals. Give a plan for all to cross the river.

c) Suppose you have the following search space: 1+3+1

State	Next	Cost
A	B	4
A	C	1
B	D	3
B	E	8
C	C	0
C	D	2
C	F	6
D	C	2
D	E	4
E	G	2
F	G	8

State	h
A	8
B	8
C	6
D	5
E	1
F	4
G	0

i) Draw the state-space of this problem.

ii) Assume that the initial state is A and the goal state is G. Show how each of the following search strategies would create a search tree to find a path from the initial state to the goal state. • Uniform cost • Greedy search • A* search

iii) At each step of the search algorithm, show which node is being expanded and the content of fringe.

3. a) What is a heuristic function? Consider the following block world problem: 2.5

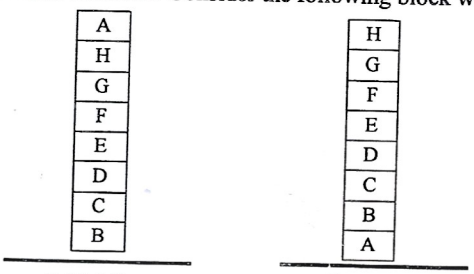


Fig.: A Hill Climbing Problem.

Show that the hill-climbing procedure is failed with the local heuristic function but works perfectly with the global heuristic function.

b) Iterative-deepening (ID) is a type of search algorithm, which is said to combine the benefits of breadth-first and depth-first search. Explain, using a diagram or otherwise, how ID achieves these benefits. 2

c) When is breadth-first search an *admissible* search strategy? Briefly explain. 1.75

d) Describe the Minimax algorithm for searching game trees. 2.5

4. Consider the following facts: 2+2+2+2.75

(i) Marcus was a man.
(ii) Marcus was a Pompeian.
(iii) Marcus was born in 40 A.D.
(iv) All men are mortal.
(v) All Pompeians died when the volcano erupted in 79 A.D.
(vi) No mortal lives longer than 150 years.
(vii) It is now 2021.
(viii) Alive means not dead.
(ix) If someone dies, then he is dead at all later times.

a) Translate these facts into well-formed formulas (WFFs) in predicate logic.
b) Answer the question "*Is Marcus alive now?*" using backward reasoning.
c) Convert the formulas into clause form.
d) Prove that "*Marcus is not alive now.*" using resolution.

Group-B

5. a) Define forward and backward chaining. What are the factors that determine whether it is better to reason by using forward or backward chaining? 1.5

b) What is conflict resolution? Discuss any two of the approaches, which are used to solve conflict resolution. 1.5

c) Draw the architecture of a rule-based system. Following are the rules and initial facts in the rule-base and database of facts of a rule-based expert system. 5.75

R1: IF A and C THEN E	Initial facts in the database
R2: IF C and D THEN F	A, B (both are true)
R3: IF B and E THEN F	Objective:
R4: IF B THEN C	Prove hypothesis G (goal)
R5: IF F THEN G	

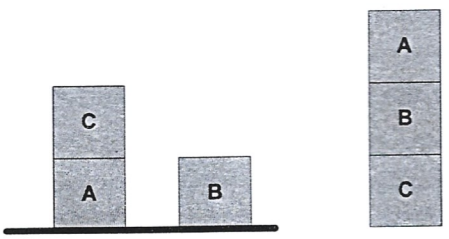
Prove the goal (G) by applying both forward chaining (FC) and backward chaining (BC) inference procedures. You need to show the sequence of firing the rules and also need to draw the search tree, in which propagation of truth for FC and backtracking of goals for BC are to be demonstrated diagrammatically.

6. a) Describe the STRIPS language for representing states, goals, and operators within a planning system. 2

b) Briefly explain why planning is difficult to cast as a state-space search problem. 1

c) Develop an effective and complete plan using the partial-order planning approach to convert the given initial state into the goal state. It could be fine if you address the flaws such as threats to causal links and open conditions in developing the final plan. 5.75

Sussman Anamoly Problem



Initial State Goal State

7. a) Taking into account of the example given below, explain the concept of uncertainty. 1.75

"The doorbell rang at 12'0 clock in the midnight.
Was someone there at the door?
Did Karim wake up?"

b) What will be happened if h' underestimates and overestimates h in A* algorithm? 2

c) What is an expert system? Describe the two essential capabilities of an expert system. 2

d) Why do we need the extension of the Bayes theorem? Write the equations and the semantics of the two extended Bayes theorems. Show two application areas of these extended Bayes theorems. Why do we need the extension of the Bayes theorem? 3

8. a) What is the Bayesian network? Describe the syntax and semantics of Bayesian networks with necessary examples. 1.5

b) A doctor knows that the disease meningitis causes the patient to have a stiff neck, say, 40% of the time. The doctor also knows some unconditional facts: the prior probability that a patient has meningitis is 1/50000, and the prior probability that any patient has a stiff neck is 1/25. Find the probability of patients with a stiff neck to have meningitis. 1.5

c) Your burglar alarm may or may not be sounding (node A). Possible causes of A are your house being burgled (node B) or a small earthquake (node E) setting it off by accident. Your reliable friend has called you saying that he thinks the alarm is sounding (node R). Your unreliable friend, who often calls when your alarm sounds, has not done so this time (node C). Your two friends do not have any contact with each other. 1+1+1+1+1.75

i) Draw a Bayesian network representing the variables, causes, and observations in this situation. The following are conditional probabilities for the events in the model:

$P(B) = 0.02$

$P(E) = 0.001$

$P(A|\neg B, \neg E) = 0.01$, $P(A|B, \neg E) = 0.9$, $P(A|\neg B, E) = 0.9$, $P(A|B, E) = 0.99$

$P(R|A) = 0.002$, $P(R|\neg A) = 0.999$ (NB these do not have to sum to 1)

$P(C|A) = 0.8$, $P(C|\neg A) = 0.1$ (NB these do not have to sum to 1)

ii) Compute the prior that the alarm is sounding.

iii) Compute the normalized likelihood that the alarm is sounding.

iv) Compute the posterior that the alarm is sounding.

v) Suppose that you hear a radio report that an earthquake has occurred near your home. Draw a modified Bayesian network to model this, and discuss qualitatively how your belief about each of A, E, and B would change. An earthquake has occurred and both Mary and Jhon call.