

MASTER OF COMPUTER SCIENCE AND ENGINEERING 1<sup>st</sup> Year 1<sup>st</sup> Semester EXAMINATION 2025

## Advances in Artificial Intelligence

Full Marks 100

Answer all questions

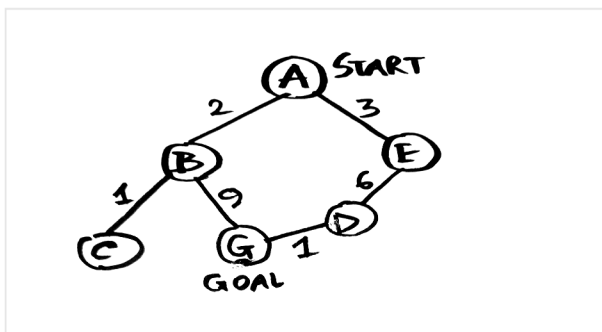
Time 3 Hours

1. Entries in the first column of the following table have to be suitably paired with the entries in its second column so that which aspect of intelligent behaviour is truly exhibited by which app/tool can be made clear.

App/Tool	Aspect of intelligent behaviour
Google Bard (An AI Chatbot)	perception
Pragyan rover of Chandrayan 3 Mission	reasoning
3D Chess Game for Windows 10	learning
Amazon's Recommendation system	acting in a complex environment
Face lock in mobile phones	communication

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2(a) Consider the following State space graph. The numbers labelling edges represent the costs of traversing the respective edges. Find the most effective path to reach the goal state G from the start state A, using A\* algorithm. Also mention the cost of the path so found.



Node (n)	h(n)
A	11
B	6
C	99
D	1
E	7
G	0

(b) Give a Hill Climbing function for 8 Puzzle.

(c) To solve what kind of problems Genetic Algorithms (Gas) are applied? Write the major steps of operation of Simple Genetic Algorithm (SGA).

10+4+9

3(a) Represent the following sentences with Predicate calculus Well formed formulas:

[ Turn over

Penguins cannot fly. Crows and Sparrows can fly. Not every bird can fly. No dog can fly.

(b) Find the most general unifier (mgu) of  $\{P(a,y),P(x,f(b))\}$

(c) Consider the following sentences:

All politicians are orators. John is a politician. All orators are famous. Use resolution to answer the question "Is John famous?" Also mention the control strategy you followed for resolution refutation.

**(2x4)+4+10**

4(a) Mention few sources of uncertainty in real world knowledge. Why Predicate calculus is not sufficient for reasoning under uncertainty?

(b) Give Bayes' rule for evidence E and hypotheses H and  $\sim H$ .

In a community 1% of population has certain disease and the remaining 99% are free from this disease. A test is conducted to detect this disease. The test is not very accurate. 95% of the people with the disease tests positive. And 2% of the people free from the disease (falsely) tests positive.

If a randomly selected person from the community tests positive, what is the probability that she/he has the disease?

(c) For some patient, the focus of diagnosis is restricted within the set

$U=\{\text{hep,cirr,gall,pan}\}$ . In this, **hep** stands for hepatitis, **cirr** for cirrhosis, **gall** for gall-stone, and **pan** for pancreatic cancer. Two different sources of evidence support the following beliefs, denoted by  $m_1$  and  $m_2$ :

$m_1\{\text{hep,cirr}\}=0.6$ ,  $m_2\{\text{cirr,gall,pan}\}=0.7$

Use Dempster-Shafer theory to find the combined beliefs for various combinations of diagnoses.

**4+10+6**

5(a) Give a geometric interpretation of the working of a Perceptron as a linear classifier.

(b) What is the major limitation of a Perceptron as pointed out by Minsky and Papert (1969)?

(c) Give the major steps of operation of Back Propagation learning algorithm.

(d) What are training set, validation set and test set?

(e) Explain the problem of Over-fitting in a neural network. How can you manage this problem while training a Multi Layer Perceptron?

**8+4+8+3+7**