

CHUKA



UNIVERSITY

UNIVERSITY EXAMINATIONS

EXAMINATION FOR THE AWARD OF DEGREE OF BACHELOR OF SCIENCE IN APPLIED COMPUTER SCIENCE AND BACHELOR OF SCIENCE IN COMPUTER SCIENCE

COSC 341: ARTIFICIAL INTELLIGENCE

STREAMS: Y3S2

TIME: 2 HOURS

DAY/DATE: WEDNESDAY 19/4/2023

11.30 A.M. – 1.30 P.M.

Instructions to Candidates:

1. Answer Question 1 and Any Other Two questions.
2. **Mobile phones are not allowed** in the examination room.
3. **No Reference Material** is allowed in the exam Room.
4. You are not allowed to write on this examination question paper.
5. Write legibly on both sides of an answer sheet
6. Begin each question on a new page.
7. Write legibly on both sides of an answer sheet

SECTION A:

Answer all the questions in this section.

QUESTION 1

(30 MARKS)

- a) Define the following terms: (2 Marks)
 - i. Artificial Intelligence
 - ii. A priori knowledge
- b) Outline the main difference between heuristic search and uninformed search. (2 marks)
- c) Describe two characteristics of a good knowledge representation technique. (2 Marks)
- d) Briefly describe the meaning of term “problem search”. (2 Marks)
- e) Explain the meaning of the term Expert System as applied in AI. (2 Marks)
- f) With aid of an example differentiate between narrow AI and general AI. (4 Marks)

g) What are the potential economic impacts of AI, both in terms of benefits and drawbacks? (4 Marks)

h) Discuss the P.E.A.S representation as used in Artificial Intelligence. (4 marks)

i) Translate the following into first –order logic: (4 Marks)

i. Every person is loved by some other person

ii. SGR took all the COSC341 students to Uganda

j) Consider the following knowledge base of a family tree:

father_of(john,peter).

father_of(john,jim).

father_of(kim,steve).

gender(jim,male).

student(jim,CHKUNI).

Formulate Prolog queries to find the following:

i. All the fathers in the family tree. (2 Marks)

ii. Determine if jim is a student of CHKUNI. (2 Marks)

SECTION B:

Answer any two questions in this section.

QUESTION 2 (20 MARKS)

a) Draw a well labelled diagram showing the main parts of an expert system. (4 Marks)

b) Explain three challenges a knowledge engineer might face in collecting knowledge. (3 marks)

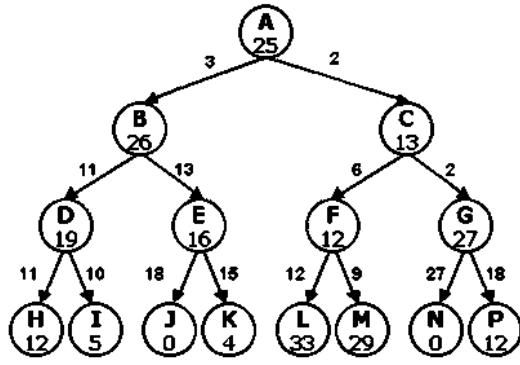
c) Suppose you are given the following search space:

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

- i. Draw the state space of this problem. (5 marks)
- ii. Assume that the initial state is A and the goal state is G. Show how each of the following search strategies would find a path from the initial state to the goal state.
 - a. Uniform cost. (4 marks)
 - b. Depth First Search. (4 marks)

QUESTION 3 (20 MARKS)

- a) Natural Language Processing is one of the main areas of artificial intelligence that has been widely explored. Discuss three areas of application related to NLP. (6 marks)
- b) A search tree is shown below where each circle represents a node corresponding to a state in the search space. The estimated cost (i.e. h function) for finding a solution from a node is shown in its circle. The two nodes with $h = 0$ are goal states and the other terminal nodes are dead-ends. (i.e. states that can never reach a goal). Actual link costs are marked on the links between the nodes. Thus the path cost (i.e. g function) of a node is equal to the sum of the link costs from the root to that node.



- i. Find the most cost-effective path to reach the goal state using A* algorithm. (7 Marks)
- ii. Find the most cost-effective path using greedy BFS Algorithm. (7 Marks)

QUESTION 4 (20 MARKS)

- a) Explain the knowledge engineering process? (3 marks)
- b) Justify the statement that “Artificial Intelligence is Multi-disciplinary” (3 marks)
- c) Show the validity of the following statements using truth tables.
 - i). $((A \vee B) \wedge \neg B \Rightarrow C$
 - ii). $P \wedge \neg(P \wedge Q) \Leftrightarrow (P \wedge Q) \wedge R$
 (6 marks)
- d) Jane wants to design a robot that can be used for vacuum tube cleaning namely IBOT. Describe the robot using the PEAS description technique. (8 marks)

QUESTION 5 (20 MARKS)

- a) State three types of knowledge that can be represented and used for reasoning in an intelligent system. (3 marks)
- b) Describe any three real-world applications of the searching strategies. (3 Marks)
- c) State and explain three inferencing methods. (3 Marks)
- d) Explain four elements of defining problem search strategy. (4 Marks)
- e) Semantic network representation is closer to the way humans structure knowledge by building mental links between things than the predicate logic. Use the information below to create a semantic network. (7 Marks)

Tom is a cat, Tom caught a bird, Tom is owned by John, Tom is ginger in colour, Cats like cream, The cat sat on the mat, A cat is a mammal, A bird is an animal, All mammals are animals, Mammals have fur

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