

CHUKA



UNIVERSITY

UNIVERSITY EXAMINATIONS

RESITS/SPECIAL EXAMINATIONS

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

COSC 341: ARTIFICIAL INTELLIGENCE

STREAMS:

TIME: 2 HOURS

DAY/DATE: TUESDAY 29/8/2023

8.30 A.M. – 10.30 A.M.

Instructions to Candidates:

1. Answer Question 1 and Any Other Two questions.

QUESTION 1 (30 MARKS)

- a) Define the following terms: (2 Marks)
 - i. Artificial Intelligence
 - ii. Kernel trick
- 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)

QUESTION 2 (20 MARKS)

a) Draw a well labelled diagram showing the main parts of an expert system. (8 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

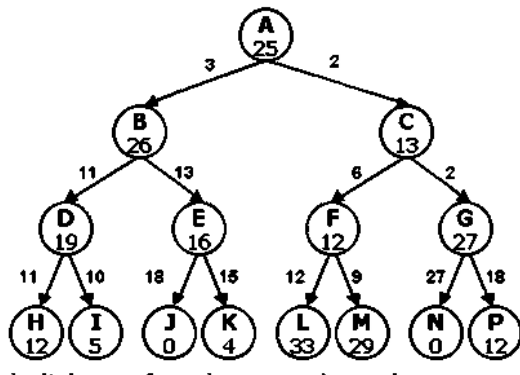
i. Draw the state space of this problem. (5 marks)

- 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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