CHUKA   **UNIVERSITY**

UNIVERSITY EXAMINATIONS

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

COSC 341: ARTIFICIAL INTELLIGENCE

STREAMS: **(Y3S2)**   **TIME: 2 HOURS**

DAY/DATE: WEDNESDAY 14/07/2021   **8.30 A.M. – 10.30 A.M.**

INSTRUCTIONS
- Answer question ONE and any other TWO from SECTION B

Question one (30 Marks)

a) What is the work of the following in Prolog programming language? **(4 Marks)**

    i.   .

    ii.   ;

    iii.   :-

    iv.   _

b) Explain any two characteristics of agents. **(3 Marks)**

c) Define a goal state. **(2 marks)**

d) Differentiate between factual and Heuristic Knowledge as applied in expert system.

    (4 Marks)

e) Describe an algorithm to search a graph for a path or for a shortest path. **(4 Marks)**

f) What is a heuristic? Explain with an example, why heuristics are crucial in improving the efficiency of AI systems. **(3 Marks)**

g) Using examples differentiate between forward and backward reasoning. **(3 Marks)**

h) Translate the following into predicate calculus.

   i.   Every gardener who lives in a city likes the sun. **(2 Marks)**

  ii.   All cats like fish, cats eat everything they like. Ziggy is a cat. **(2 Marks)**

i) Explain three areas where Natural language processing could be popularly applied in Chuka University. **(3 Marks)**

Question 2 (20 Marks)

a) Explain the limitation of the greedy Best First Search technique as compared to the A* search technique. **(4 Marks)**

b) If it's raining outside, then June puts the top up on her convertible. June did put the top up on her convertible. Using logical inference rules answer the question: "Is it raining?" **(4 Marks)**

c) A Kenyan based university is involved in active research on the design and development applications of Artificial Intelligence. Giving an example for each case identify where the following Artificial Intelligence systems may mostly be applied at the University: **(4 Marks)**

   i.   Multi-layer Perceptron

  ii.   Case Based Reasoning Systems

d) What is cost for reaching the goal start F & G. **(8 Marks)**
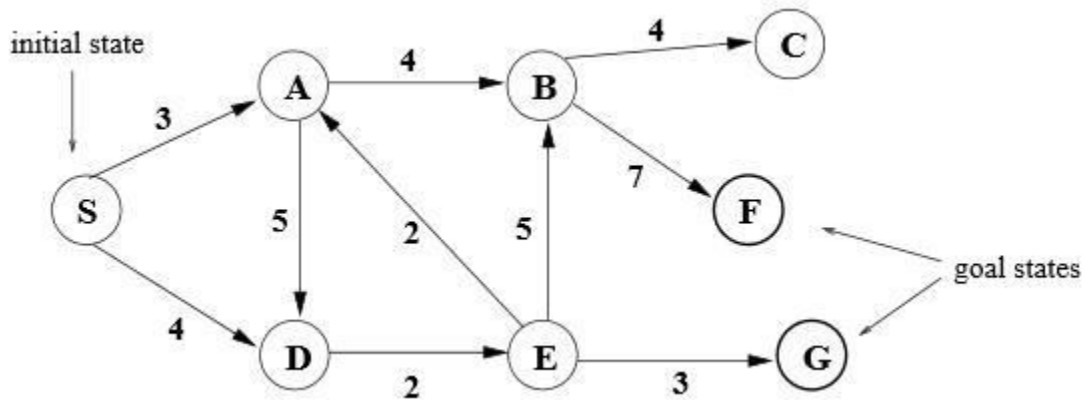
Question 3 (20 Marks)

a) Using appropriate illustration explain the operations of the following algorithms. **(6 Marks)**

   i.   Hill climbing

  ii.   Depth limited search

  iii.   uninformed search

b) Describe three knowledge representation techniques highlighting the advantages of each technique. **(8 Marks)**

c) Consider the following expert system facts and rules:

R1: IF one has at least 1 million shillings to invest AND has basic knowledge of running businesses THEN he should invest in securities.

R2: IF the persons annual income is 50 million AND has basic knowledge of running businesses THEN he should invest in stocks.

R3: IF a person is younger than 30 but older than 22 THEN he should invest in stocks.

R4: IF a person is younger than 30 but older than 22 THEN he has basic knowledge of running businesses.

R5: IF a person is wants to invest in stocks THEN he should invest KenGen shares.

FACTS: Person has at least 1 million shillings to invest.
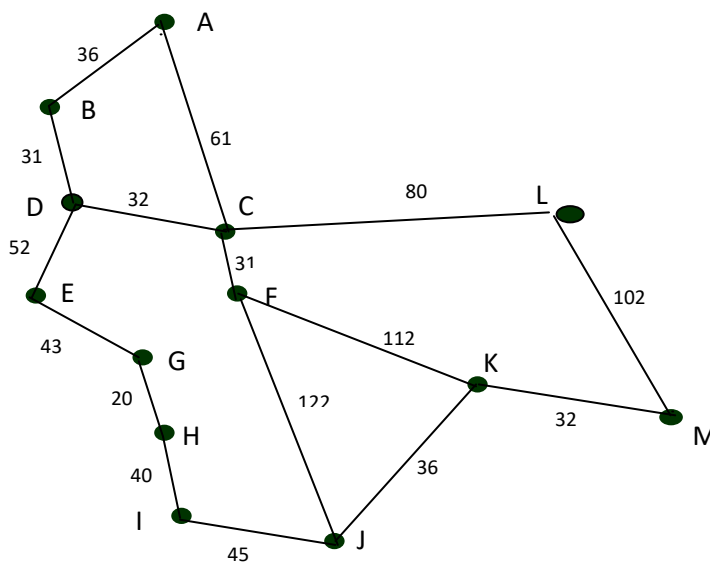
Person is 25 years old

GOAL: Does he/she invest with Safcom shares?

Answer the question using forward and backward chaining approaches. **(6 Marks)**

Question 4 (20 Marks)

a) Using a well labeled diagram describe the components of an expert system. **(6 Marks)**

b) Consider the following map. **(10 Marks)**

Using the A* algorithm work out a route from town A to town M. Use the following cost functions.

- G(n) = The cost of each move as the distance between each town (shown on map).
- H(n) = The Straight Line Distance between any town and town M. These distances are given in the table below.

Provide the search tree for your solution and indicate the order in which you expanded the nodes. Finally, state the route you would take and the cost of that route.

Straight Line Distance to M

A	223		E	165		I	100		M	0
B	222		F	136		J	60			
C	166		G	122		K	32			
D	192		H	111		L	102			

c) The straight line distance heuristic used above is known to be an admissible heuristic. What does this mean and why is it important? **(4 marks)**

Question 5 (20 Marks)

a) What is FOPL stands for and explain its role in Artificial Intelligence? **(4 marks)**
b) Using three brief examples of knowledge representation, explain how knowledge may be represented in the knowledge base. **(6 Marks)**
c) Intelligent agents are software entities that carry out some set of operations on behalf of a user or another program with some degree of independence or autonomy, explain the types of agents. **(6 Marks)**
d) For each of the following agents, develop a PEAS description of the task environment:

(4 Marks)

    i.   Internet shopping agent.

    ii.   E-Learning teaching assistant.

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