

***"Investing in Africa's Future"***



**COLLEGE OF BUSINESS, PEACE, LEADERSHIP AND  
GOVERNANCE**

**CSC 301 ARTIFICIAL INTELLIGENCE  
END OF FIRST SEMESTER EXAMINATIONS**

**NOVEMBER/DECEMBER 2018**

**LECTURER: T. MUTERO**

**DURATION: (3 HRS)**

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***INSTRUCTIONS***

- This paper consists of **five (5)** questions.
  - Paper consists of **five (5)** printed pages
  - **Answer any four (4)** questions.
  - Where part marks are allocated to subsections of a question, the marks are enclosed in brackets [].
  - Start each question on a fresh page
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**Question 1**

- a) Describe the difference between the operation of a *simple reflex agent* and a *goal based agent*. [4 marks]
- b) For a *game of chess without a clock*, choose and explain whether the environment is:
  - i. Fully observable or partially observable
  - ii. Deterministic or strategic or stochastic
  - iii. Static or dynamic
  - iv. Single agent or multi agent
  - v. Episodic or sequential [5 marks]

c) Complete the following truth table below:

$P$	$Q$	$\neg P$	$P \wedge Q$	$P \vee Q$	$P \Rightarrow Q$	$P \Leftrightarrow Q$
0	0					
0	1					
1	0					
1	1					

Table 1

[6 marks]

d) Using truth tables verify the following equivalences

$A \wedge (B \vee C) \cong (A \wedge B) \vee (A \wedge C)$

[10 marks]

**Question 2**

- a) Distinguish between propositional logic and first order logic. [2 marks]
- b) Let the following propositional symbols have the following meaning:
  - A** – Tatenda wins the first prize in a competition
  - B** – Tinashe wins the second prize in a competition
  - C** – Chido wins the third prize in a competition

Express each of the following English sentences in propositional logic:

- i. If Tatenda wins the first prize, then either Tinashe wins the second prize or Chido wins the third prize in the competition. [3 marks]
- ii. If Tatenda wins the first prize, then Chido does not win the third prize in the competition. [3 marks]



- c) Represent each of these sentences in first order logic:
- At least one planet has life on it. [2 marks]
  - There is a mushroom that is purple and poisonous. [3 marks]
  - All birds cannot fly. [2 marks]
- d) Consider the following map:

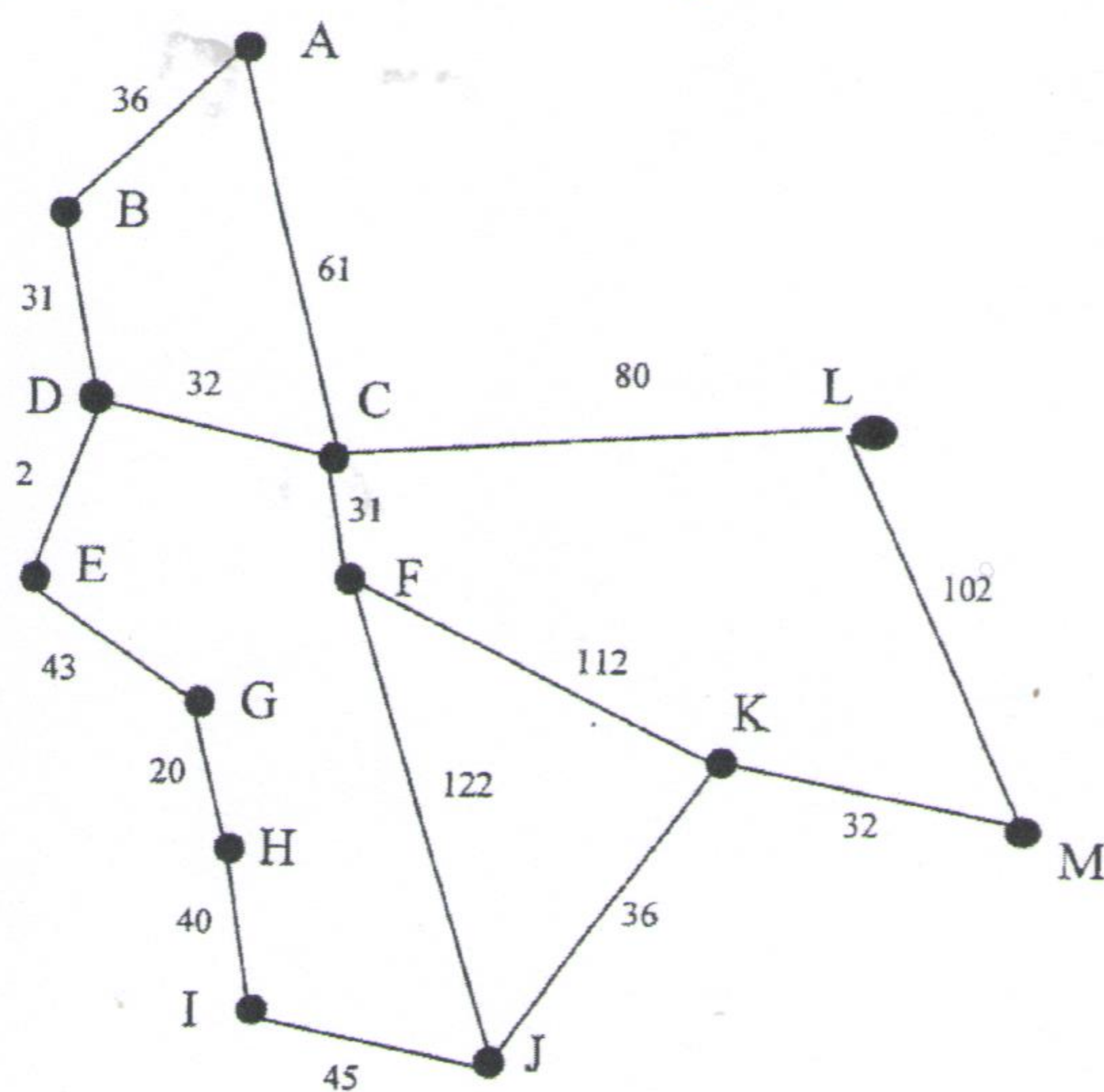


Fig 1.

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:

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

Table 2

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. The straight line distance to M is given in the table above. [10 marks]



### Question 3

- a) Distinguish between the terms effector and actuator. [4 marks]
- b) Sensors provide percepts for robots. Describe one type of sensor that is used by robots. [2 marks]
- c) Explain what *multiple inheritance* is in semantic network systems. [3 marks]
- d) Explain what AO\* algorithm is and how it works through the use of a suitable example. [4 marks]
- e) Suppose that a search tree has root A, which has children B, C and D, that B has children E and F, that C has children G, H, I and J and that D has child K. furthermore suppose that nodes F and I are goal nodes.
- Draw the search tree [3 marks]
  - What is the branching factor of node C? [2 marks]
  - List the order in which the nodes are visited:
    - Breadth first search [2 marks]
    - Depth first search [2 marks]
    - Iterative deepening search [3 marks]

### Question 4

- a) Explain the purpose of defuzzification. In your solution name at least one method used for defuzzification. [6 marks]
- b) Name two (2) strengths and two (2) weaknesses of fuzzy expert systems in artificial intelligence. [4 marks]
- c) Consider the information given below:
- Ravi likes all kinds of food*
  - Apple and chicken are food*
  - Anything anyone eats and is not killed is food*
  - Ajay eats peanuts and is still alive*
  - Ravi eats that with Ajay eats*

**Prove that Ravi likes peanuts**

**[15 marks]**



### **Question 5**

- a) It is believed that the number of kilometers that can be driven per litre of gasoline for a car depends on the following factors: weight of the car, horsepower, make, manual/automatic gear and the radius of its wheels. You are required to draw a well labelled neural network with one input layer having five nodes, one hidden layer with four nodes and an output layer with one node to demonstrate the above scenario. **[6 marks]**
- b) Suggest two limitations of artificial neural networks. **[4 marks]**
- c) Explain the following terms with respect to genetic algorithms:
- i) Chromosomes **[2 marks]**
  - ii) Fitness function **[2 marks]**
  - iii) Cross-over **[3 marks]**
  - iv) Mutation **[3 marks]**
- d) Define what you understand by the term fuzzy logic, clearly explaining how it is different from a traditional two state logic. **[5 marks]**

\*\*\*\*\***END OF EXAMINATION PAPER**\*\*\*\*\*