

**THE UNIVERSITY OF DODOMA  
COLLEGE OF INFORMATICS AND VIRTUAL EDUCATION  
SCHOOL OF INFORMATICS**



**UNDERGRADUATE UNIVERSITY EXAMINATION  
SECOND SEMESTER 2013/2014**

**CS 321: ARTIFICIAL INTELLIGENCE**

**Date: June, 2014**

**Time Allocated: 3 Hours**

**Instructions:**

1. *This question paper consists of 7 Questions organized in two Sections.*
2. *Answer ALL Questions in Section A and Two Questions in Section B.*
3. *Question Five (5) is Compulsory.*
4. *All University of Dodoma Examination Regulations Apply.*

## SECTION A [40 MARKS]

### Question One

With at least two (2) factors for each; clearly, differentiate between strong and weak artificial intelligence.

[6.0 Marks]

### Question Two

- State three (3) Laws of Robotics' according to Isaac Asimov's conclusions in 1940. [4.5 Marks]
- What do you understand by Commonsense Knowledge as used in Artificial Intelligence Systems? [1.0 Mark]
- As far as Commonsense Knowledge Engineering is concerned; State three (3) main requirements needed for Engineering Commonsense knowledge. [4.5 Marks]

### Question Three

Consider English sentences below;

- Anyone passing his history exams and winning the lottery is happy.
  - Anyone who studies or is lucky can pass all his exams.
  - John did not study but he is lucky
  - Anyone who is lucky wins the lottery.
- Convert the above sentences into FOL (First Order Logic). [4.0 Marks]
  - Convert the sentences in a) above into CNF (Conjunctive Normal Form). [6.0 Marks]

### Question Four

Nine missionaries and nine cannibals are on the **left** bank of a river. There is one canoe which can carry either **three** or six people **only**. There is one canoe which can carry either **three** or six people **only**. There is one canoe which can carry either **three** or six people **only**. There is one canoe which can carry either **three** or six people **only**. There is one canoe which can carry either **three** or six people **only**. There is one canoe which can carry either **three** or six people **only**. There is one canoe which can carry either **three** or six people **only**. There is one canoe which can carry either **three** or six people **only**. There is one canoe which can carry either **three** or six people **only**.

- State the **Initial** and **Final** states, the **Operators**, the **Constraints** and the **Path Cost**. [2.0 Marks]
- Use the Search Strategy to find a way to get everyone to the **right** bank of the river according to the question requirements. Note: Indicate the states at each stage and on each side of the river until you reach the goal state. [11.0 Marks]
- What is the **Path Cost**? [1.0 Mark]

## SECTION B [60 MARKS]

### Question Five

- ✓ a) As far as Knowledge Representation Issues in Artificial Intelligence Systems is concerned; one needs to know about things he/she wants to represent, and needs to know some means by which things can be manipulated. What do you think are the two (2) important levels considered important in Knowledge Representation? [6.0 Marks]
- ✓ b) Sketch the Knowledge Typology Map showing the two (2) main knowledge types and where those types originate. [6.0 Marks]
- ✓ c) With reference to knowledge acquisition for agent development; clearly, and with aid of well labeled diagrams where necessary, differentiate between "Manual Knowledge Acquisition" and "Mixed-initiative knowledge acquisition" ways of building intelligent agents. [16.0 Marks]

- ✓ d) State which of the two ways is considered hard in building intelligent agents when compared to the other. Give your reason(s). [2.0 Marks]

### Question Six

- What do you understand by a "**Neural Network**"? [1.5 Marks]
- Consider the mathematical representation of a neuron in figure 1.1.

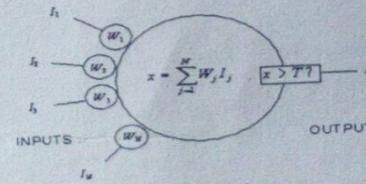
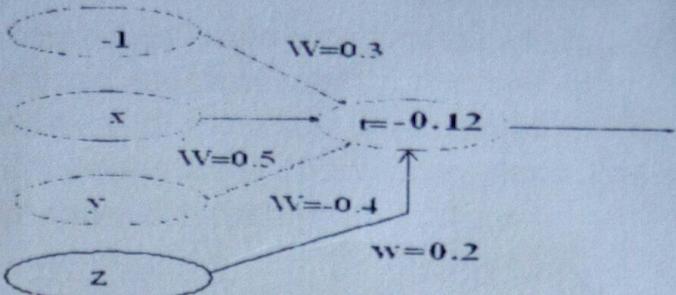


Figure 1.1

Normally a neuron calculates a weighted sum of inputs and compares it to a threshold. Using the above expression:

- By applying a mathematical representation of a Neuron; calculate the outputs of the Perceptron represented by figure 1.2 in a tabular form. (Note: Use I<sub>1</sub>, I<sub>2</sub>, I<sub>3</sub>, and I<sub>4</sub> for inputs -1, x, y and z respectively). [8.0 Marks]

- ii. State the status of the inputs  $I_1, I_2, I_3$  and  $I_4$  at which the Perceptron will fire. [4.0 Marks]



**Figure 1.2**

- c) Briefly, describe three (3) main sources of uncertainty in artificial intelligence reasoning systems. [6.0 Marks]
- d) For each of the truth tables below say whether it is possible for a perceptron to learn the required output. In each case, explain the reason (s) behind your decision. [10.5 Marks]

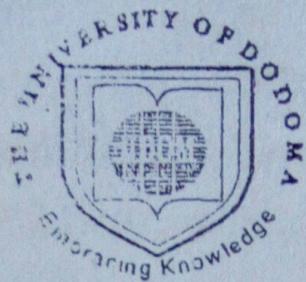
### Question Seven

- a) Define "Reasoning" as used in "Artificial Intelligence Reasoning Systems". [1.5 Marks]
- b) Based on the definition in 1 a) above, describe briefly two main conditions guiding the reasoning process of any knowledge system. [4.5 Marks]
- c) Consider the reasoning problem below;

Maximilian's birthday is tomorrow. In recent years, each year it has rained only 5 days. The weatherman has predicted rain for tomorrow. When it actually rains, the weatherman correctly forecast rain 90% of the time. When it does not rain, the weatherman incorrectly forecasts rain 10% of the time. By applying Bayes' Theorem, calculate the probability that it will rain on Maximilian's birthday. Based on your final answer, provide the final conclusions concerning the chances of raining on Maximilian's birthday. [10.0 Marks]

- d) Briefly, describe your understanding on the "Disciple Approach to Intelligent Agents Development". [4.0 Marks]
- e) Draw a well labeled diagram illustrating the architecture of the disciple shell where the current version of the disciple learning agent shell and methodology is implemented. [10.0 Marks]

# THE UNIVERSITY OF DODOMA



## COLLEGE OF INFORMATICS AND VIRTUAL EDUCATION SCHOOL OF INFORMATICS

### DEPARTMENT OF COMPUTER SCIENCE

### CS308 INTRODUCTION TO ARTIFICIAL INTELLIGENCE

### UNIVERSITY EXAMINATION

Duration: 3 Hours

Time: 08:00-11:00hrs

Date: 23<sup>rd</sup> September, 2011

#### Instructions:

- i. This Question paper consists of 7 Questions organized in TWO Sections.
- ii. Answer ALL Questions from Section A and THREE Questions from section B.
- iii. Questions 4 and 7 are COMPULSORY

## SECTION A (24 Marks)

1. a) Complete the paragraph below.

"Any AI system that seeks to model and reasoning in such a world must be able to deal with  
(i) ..... compensate for lack of knowledge,  
(ii) ..... resolve ambiguities and contradictions and  
(iii) ..... update its world knowledge base over time". (1.5Marks).

- b) According to Poole's Framework of Knowledge Representation of 1998, "computer requires a well-defined problem description to process and also provide well-defined and acceptable solution". To collect fragments of knowledge one needs: first to (a)..... description in our spoken language and then (b)..... it in formal language so that computer can understand.

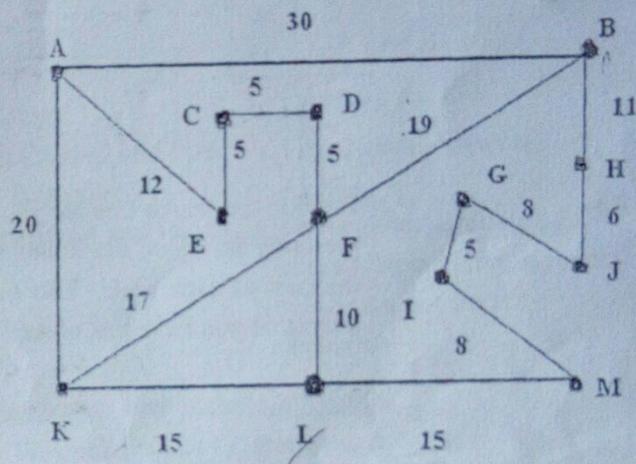
- Complete the above paragraph. (2 Mark).
- Diagrammatically, illustrate Poole's knowledge representation framework. (4.5 Marks).

- \* 2. a) It's true that "Learning is an important area in AI and perhaps more so than planning". Briefly describe the validity of the above statement. (2 Marks).

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## SECTION B (36 Marks)

4. Consider the following map (not drawn to scale).



Use the A\* algorithm to 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.

5

- ✓ Chinise
- ✓ Properties of McCulloch and Pitts
- ✓ Turing Test

### Straight Line Distance to M

A	56	M	0	E	29	I	8
B	22			F	30	J	5
C	30			G	14	K	30
D	29			H	10	L	15

- a) Provide the search tree for your solution, showing the order in which the nodes were expanded and the cost at each node. You should not re-visit a town that you have just come from. (8 Marks).
- b) State the route you would take and the cost of that route. (4 Marks).
5. a) What do you understand by a "Neural Net"? (2 Marks).
- b) "Computer Systems are good at some aspects while at same time not good at other aspects".
- Is the above statement TRUE or FALSE? (0.5 Marks).
  - Complete the table below based on statement 5. b). (5 Marks).

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- b) Match the following AI pioneers to the area of AI for which they are associated with. (5 Marks):

#### List A

- i. Samuel.
- b. McCulloch and Pitts.
- f. Schaeffer.
- d. Minsky and Papert.
- e. Searle.
- c. ELIZA
- v. Weizenbaum.
- g. Newell and Simon.

#### List B

- a. LISP
- b. First Neural-Network
- c. ELIZA
- d. Proved that perceptrons cannot learn functions which are not linearly separable.
- e. Chinese Room
- f. Chinook
- g. Physical Symbol System Hypothesis
- h. Seminal work for chess
- i. Seminal work for checkers
- j. MYCIN.

(Note: Provide your answers in a tabular form as shown below)

i	ii	iii	iv	v	vi	vii	viii	ix	x
a	h	d	g	i	f	e	y	b	j

Shaches  
Sachar

\* 3. Consider six English sentences below;

- i. John likes all kinds of food.
- ii. Apples are food.
- iii. Chicken is food.
- iv. Anything anyone eats and isn't killed by is food.
- v. Bill eats peanuts, and is still alive.
- vi. Sue eats everything that Bill eats.

a) Convert the sentences into predicate logic. (3 Marks).

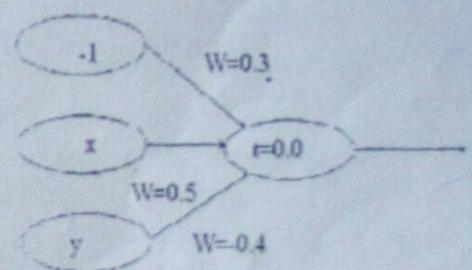
b) Prove by Refutation that John eats Peanuts. (3 Marks).

c) What do you consider to be the type of knowledge exchanged mostly in text-based on-line conversations?  
(1.5 Marks).

d) Why do you think the answer you provided in 3 (c) above is correct? (1.5 Marks).

Normally a neuron calculates a weighted sum of inputs and compares it to a threshold. Using the above expression:

- i. Calculate the outputs of the perceptron below in a tabular form. (Note: Use  $I_1$ ,  $I_2$  and  $I_3$  for inputs -1,  $x$  and  $y$  respectively). (3 Marks).
- ii. State the status of the inputs  $I_1$ ,  $I_2$  and  $I_3$  at which the perceptron will fire. (2 Marks).



7. Consider the 8 puzzle below.

2	8	7
3	1	4
5	6	.

- i. Using breadth first search, show the search tree that would be built down to level 2 (assume level zero is the root of the tree). (3 Marks).
- ii. Using depth first search, show the state of the search tree down the level 3 (stop once you have expanded one node that goes to level 3). (3 Marks).
- iii. What is the worst-case time and space complexity of the above two algorithms. (3 Marks).
- iv. Is either depth-first-search or breadth-first-search complete or optimal? Justify your answer. (3 Marks).

Good at	Not so good at
(a)	(b)
	(c)
	(d)
	(e)

- c) For each of the truth tables below say whether it is possible for a perceptron to learn the required output. In each case, explain the reason behind your decision. (4.5 Marks)

Table A				
Input	0	0	1	1
Input	0	1	0	1
Required	0	1	1	0
Output				

Table B				
Input	0	0	1	1
Input	0	1	0	1
Required	0	0	1	1
Output				

**Table C**

Input	0	0	1	1
Input	0	1	0	1
Required Output	1	1	1	1

6. a) Mention two (2) advantages and two (2) disadvantages of ANN? (2 Marks).

e) Describe the features of a McCulloch-Pitts neural network. (5 Marks).

f) Consider the mathematical representation of a neuron below.

