

**KABARAK**



**UNIVERSITY**

**EXAMINATIONS**

**2008/2009 ACADEMIC YEAR**

**FOR THE DEGREE OF BACHELOR OF SCIENCE IN  
COMPUTER SCIENCE**

**COURSE CODE: COMP 413**

**COURSE TITLE: ARTIFICIAL INTELLIGENCE**

**STREAM: Y4S1**

**DAY: WEDNESDAY**

**TIME: 2.00 – 4.00 P.M.**

**DATE: 25/03/2009**

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**INSTRUCTIONS:**

Answer The First Question and any Other Two Questions.

**PLEASE TURN OVER**

### **Question 1 (30 Marks)**

- (a). (i) What is Artificial Intelligence (AI)? **(1 Mark)**
- (ii) Give six differences between AI programs and traditional programs (procedural-language programs). **(3 Marks)**
- (b) Explain the work of any four personnel who are involved in expert systems development. **(4 Marks)**
- (c) Explain the four NLP understanding techniques. **(4 Marks)**
- (d) Explain the meanings of the following AI searching terms;
- (i) Goal. (ii) Stalemate
- (iii) Optimality (iv) Informed Search **(4 Marks)**
- (e) Use the truth table to proof the following two statements
- ( A  $\rightarrow$  B )  $\rightarrow$  ( not B  $\rightarrow$  not A )
- ( A  $\rightarrow$  B ) does not imply that ( B  $\rightarrow$  A ) **(4 Marks)**
- (f) Two three sided figures (with the sides numbered 1, 2, 3) are thrown. Find the probability of
- (i) not getting value 1 in any trial. (ii). Getting two 3s **(4 Marks)**
- (g) (i) Write a Prolog program to illustrate repetition. The program should output the first fifty integers i.e. 1, 2, 3, ... , 50. **(3 Marks)**
- (ii) Consider the following program.
- func(A, B, C):- (A<=B; C is A-B), (A>=B; C is B-A), (A\=B; C is 0).

**Required:** Write the output of the following queries based on the program. **(3 Marks)**

- |                       |                      |
|-----------------------|----------------------|
| (I). func(2, 7, M).   | (II). func(5, 4, 1). |
| (III). func(8, 2, a). | (IV). func(4, 4, T). |
| (V). func(5, 5, 1).   | (V). func(4, 1, F).  |

### **Question 2 (20 Marks)**

- (a) (i). Explain what neural networks AI research area deals with. Compare and contrast human neurons with the traditional CPU. **(4 Marks)**
- (ii). Describe one area where we can apply data mining in Kenya. **(3 Marks)**
- (b) What is the work of the following in Prolog programming language?
- (i) . (ii) ; (iii) :- (iv) \_ **(2 Marks)**
- (c) Consider the following rule: "Every cow has horns".

Further, assume the following facts.

“Tony is a cow”.

“Tim has horns”

“Jay has no horns”

“Leli is not a cow”.

“Either Suzy is a cow or Suzy has horns”

**Required:** State whether the following conclusions are **True** or **False** according to the rules of propositional logic. **(3 Marks)**

(i) “Tony has horns”

(ii) “Tim is a cow”

(iii). “Jay is not a cow”

(iv). “Leli has no horns”

(v). “Suzy has horns”

(vi). “One can not have horns and fail to be a cow”

(d). Consider the following rules.

Rule1: If **A** happens, then **C** can’t have happened.

Rule2: Either **B** or **D** must have happened.

Rule3: **E** not happening implies that **B** also has not happened.

Rule4: If **D** has happened, then **G** has also happened.

Rule5: If **F** happens, then **A** also has happened.

Rule6: If **C** has not happened, then **E** can’t have happened.

**Required**

(a) Represent the above knowledge using the appropriate AI logic. **(2 Marks)**

(b) Assume **F** happens. Do we conclude **G** happened? Run;

(i) A forward chaining. **(3 Marks)**

(ii) A backward chaining. **(3 Marks)**

### **Question 3 (20 Marks)**

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

(ii) Briefly describe the A\* heuristic. **(2 Marks)**

(iii) Explain the limitation of the greedy BestFS technique as compared to the A\* search technique. **(1 Marks)**

(b) (i) Write a prolog program that lets the user input a number and then output its square. This processing should repeat until the user inputs s to stop. **(3 Marks)**

(ii) Write the output of the following Prolog Program.

compute:- nl, R is 2, func(R,0).

func(5,Q):- write(Q).

func(R,T):- X is (R+T), Y is (R+1), func(Y,X).

(3 Marks)

(c) Consider a 6-puzzle problem described below.

The puzzle consists of six 'tiles' whereby four of them have numbers, and the value inside a tile can be slid into an adjacent tile (on its left, right, top, or down) that has no number. The problem is to reach the goal state from the initial state, both of which are as shown below.

Note also that each step costs value 1.

**Initial State**

4	1
	2
3	

**Goal state**

1	2
4	3

**Required:** Using the heuristic function  $f(n)=h(n)$  where  $h(n)$  is the number of tiles of node  $n$  that are in the wrong position (compared to the goal), find the best steps to reach the goal (show the tree). (8 marks)

**Question 4 (20 Marks)**

(a) (i) What intelligence do Natural Language Processing (NLP) programs borrow from human beings? Describe two aspects of the intelligence. (3 Marks)

(ii) Explain three areas where NLP could be popularly applied in Kenya. (3 Marks)

(b) (i) Explain the difference between syntax errors and semantic errors in NLP. For each error, give an English sentence with the error. (3 Marks)

(ii) Explain why the following sentences could be ambiguous in NLP.

(I) Can you come here.

(II) Ann hit Mary because of her failure to understand.

(III) Let me drive the point home.

(3 Marks)

- (c) Write a single NLP program that will return each of the following sentences as syntactically correct when each is parsed. **(8 Marks)**

cats track mice	cat tracks mice	the cats track mice
the cat tracks the mouse	the cat tracks mouse	track mice
track the mice	track	

**Question 5 (20 Marks)**

- (a) Expert systems are designed to give expertise advise in various areas of applications. Describe the following areas showing the expertise that is being computerized.
- (i) Medical diagnostic systems
  - (ii) Weather forecasting systems **(6 Marks)**
- (b) Explain six components of a typical expert system. **(6 Marks)**
- (c) Consider the following knowledgebase for a medical expert system of a research organization. It stores details of diseases, medicines recommended for the diseases and the patients who have suffered from the diseases.

```
/* LIST DISEASE NAME, THE CAUSE OF THE DISEASE, WHETHER ITS
CONTAGIOUS OR NOT, AND THE USUAL SPEED OF AFFECTING PATIENT
(EITHER low, fast or very fast) */
disease(cholera, bacteria, contagious, very_fast).
disease(malaria, parasite, contagious, fast).
disease(diabetes, hereditary, non_contagious, slow).
disease(hypertension, hereditary, non_contagious, slow).
```

```
/*LIST MEDICINES OF EACH DISEASE (DISEASE NAME, MEDICINE NAME) */
disease_medicine(malaria, medA).
disease_medicine(malaria, medB).
disease_medicine(malaria, medC).
disease_medicine(cholera, medD).
disease_medicine(cholera, medE).
disease_medicine(hypertension, medF).
disease_medicine(hypertension, medG).
disease_medicine(diabetes, medH).
disease_medicine(diabetes, medI).
```

/\* LIST NUMBER OF PATIENTS SUFFERING FROM EACH DISEASE IN EACH AREA \*/

area(eldoret, hypertension, 65).

area(eldoret, malaria, 20).

area (eldoret, diabetes, 26).

area (kisumu, hypertension, 126).

area (kisumu, malaria, 550).

area (nairobi, diabetes, 86).

### **Questions**

- (i) (I) Write a rule to input the name of a disease and output all medicines of the disease.  
  
(II) Write a rule to input a disease name and output all the areas with the disease as well as the number of patients. **(4 Marks)**
- (ii) Design rules for the following:
  - (I) **very urgent(Med)** that specifies that a medicine **Med** is very urgent i.e. its meant for a contagious disease that also spreads very fast.
  - (II) **urgent avail(Med, Area)** that specifies that a medicine **Med** should be urgently availed in area **Area** i.e. if the medicine is recommended for a disease which has more than 100 patients in the area. **(4 Marks)**