KENYATTA UNIVERSITY
UNIVERSITY EXAMINATIONS 2009/2010
INSTITUTIONAL BASED PROGRAMMES (APRIL SESSION)
EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE
(COMPUTER SCIENCE)

SCT 208:   ARTIFICIAL INTELLIGENCE

DATE: Friday 3rd September 2010   TIME: 8.00a.m – 10.00a.m

INSTRUCTIONS

Attempt Question ONE and ANY other TWO

Question One

a)   Define the following terms.   [3marks]

      i)   Training data set:

      ii)   Robotics

      iii)   Artificial Immune systems

b)   Write down the *energy function* of a discrete Hopfield net, explaining the terms

      used.   [3marks]

c)   A-4-input neuron has weights 1, 2, 3 and 4. The transformer function is linear

      with the constant of proportionality being equal to 2. The inputs are 4, 10, 5 and

      20 respectively.

      The output will be: [4marks]

d)   Differentiate *predicate logic and proportional logic as used in AI.* [3marks]

e)   A forth year student decided to base his final year IS project on AI. He visits a

      gym and realizes there are machines that are used to exercise for running (Cadios

      as referred by trainers). He thinks of coming up with a machine that can

      measure running speed, incline, effort and hear beat. He comes up with a model

      system and presents to a panel of lecturers. On lecturer recommends that the

      students changes his domain area to a normal application program and NOT in

      domain of AI. Explain why.   [3marks]

f)   According to psychologist, the **Tabular rasa** view- contends that babies are a 'blank tablet .. on which the record of experience is gradually impressed'. Explain how this understanding can aid in machine learning.   [2marks]

g)   Translate the following from English to FOL. You are not allowed to use uniqueness quantifier!. Use only the predicates *Student(x), Takes (x,y)* meaning student *x* take course y, *Fails(x,y)* meaning student *x* fails course *y*.

   i)   Not all students take both Spanish and AI   [1mark]

   ii)   Only one student failed Spanish.   [1marks]

Question Two

a)   AI is a multi-facet of disciplines. Briefly discuss FOUR of the disciplines within AI.   [8marks]

b)   Consider the following six training examples, where each example has three attributes: color, shape and size. Color has three possible values, red, green and blue. Shape has two possible values; square and round. Size has to possible values: big and small.   [12marks]

Example	Color	Shape	Size	Class
1	red	square	big	+
2	blue	square	big	+
3	red	round	small	-
4	green	square	small	-
5	red	round	big	+
6	green	square	big	-

Question Three

a)   Translate the following sentences into predicate logic. You are not allowed to use uniqueness quantifier!. Use predicate F(x, y) to state "x can fool y". You can assume that the Universe of objects is a set of all people in the world.

   i)   Everybody can fool somebody.   [1marks)

   ii)   There is not one who can fool everybody.   [2marks]

iii)   Everybody can be fooled by somebody.   [2marks]

iv)   No one can fool him or herself.   [2marks]

b)   Suppose that an agent is running biological experiments on mice. The purpose of experiments is to test a new drug. The agent feed mice with the drug and looks at their reaction.

Let R be a variable representing 3 mutually exclusive and exhaustive types of reaction that agent observes that on mice-"sleepiness", "itchiness" and "hyperactivity", i.e. there are 3 and only 3 possible values for R to take and any mouse can only have one type of reaction.

The agent is trying to figure out how the state of health of mice depends on the observed reaction. Let H be the variable representing 2 possible states of health mice after experiment is done: "Health" and "ill" i.e. H take 2 values "health" and "ill". The joint probability table for R and H after the experiment was done on the population of mice available in the lab is:

	Sleepiness	itchiness	hyperactivity
health	0.05	0.05	0.3
ill	0.2	0.4	0.0

Answer the following questions:

i)   Is a mouse more likely to be health or ill?   [3marks]

ii)   What is the probability that a mouse is ill given that it is hyperactive?   [3marks]

c)   Translate the following sentence in the KB above into the first order logic. Assume that the universe of objects are all people. You only need to use the following predicates.

i)   **Male(x)**   [1mark]

ii)   **Female(x)**   [1mark]

iii) **Has_Child(x)**   [1mark]

iv) **Mother(x)**   [1mark]

v)   **Has_Son(x)**   [1mark]

d)   In searching, Recursive Best First Search and Iterative Lengthening Depth First Search are similar. Give FOUR characteristics that make these searching techniques similar.   [2marks]

Question Four

a)   Decision Trees are often cited as being to greedy, since it computes the information gain of all remaining eligible attributes and then selects (in the absence of ties) only the attribute with the highest gain. Suggest a strategy that will yield good trees but that isn't strictly greedy.   [2marks]

b)   How are NNs related to statistical methods?   [2marks]

c)   In the context of neural networks, what is the purpose of an energy function and how is it used to achieve this goal?   [2marks]

d)   Differentiate between fuzzy logic and neural networks application. [4marks]

e)   Differentiate between supervised and unsupervised learning methods in Neural Nets.   [2marks]

f)   A learning theory may be divided into the following parts:

1)   A hypothesis space;

2)   A representation for hypotheses

3)   A preference criterion over hypotheses, independent of the data

4)   A measure of how well a given hypothesis fits given data

5)   A search strategy to find a good hypothesis for a given data set

For the machine learning method of your choice, explain what each of these is. (For certain methods, some of these are degenerate.)   [8marks]

Question Five

a)   Discuss Backpropagation used in neural networks.   [4marks]

b)   Show your understanding of data mining by discuss an area where can be applied.

c)   Discuss TWO areas where Expert Systems can be used.   [8marks