THE OPEN UNIVERSITY OF SRI LANKA
B.Sc DEGREE PROGRAMME: LEVEL 05
FINAL EXAMINATION: SEMESTER 2 - 2013/2014
CPU3243: PRINCIPLES AND TECHNIQUES OF ARTIFICIAL INTELLIGENCE

DURATION: **THREE HOURS** (3 HOURS)

DATE: 23rd **November, 2014** | TIME: **1.30 p.m. – 4.30 p.m.**

Answer FOUR Questions ONLY.

Q1.

a) Briefly explain what is meant by **reasoning**.

b) What are the seven types of **reasoning techniques**? Explain each of them using an example.

c) ABC is an AI based software development company in Sri Lanka. They are planning to develop an e-medical system to give medical assistance for the users. This system also provides facilities to channel doctors online.

    i. Which reasoning technique(s) can be used to develop the above system?

    ii. What is the reasoning technique that cannot be used to solve the above problem? Justify your answer.

d) Explain the most suitable reasoning technique that can be used to solve each of the following problems.

    i. Develop a computer program to find the students' z-score using the given A/L result sheet.

    ii. Develop an automated airline reservation system.

    iii. Develop a 'help system' to identify human desires.

Q2.

a) What are **syllogisms**? Explain briefly.

b) Briefly explain the terms, **tautology**, **contradiction**, **model assignment** and **counter example** by means of suitable examples.

c) Which of the following formulae is a tautology? Use truth tables to justify your answer.

    i. $[P \wedge (P \to Q)] \to Q$

    ii. $\big((P \vee Q) \wedge (\neg P \vee R)\big) \to (Q \vee R)$

d) Translate the following Propositional Logic statements into English language statements.

    i. $A \leftrightarrow (B \lor C)$

    ii. $\neg(P \lor Q) \land \neg(P \to Q)$

e) Briefly explain the **conjunctive normal form** and the **disjunctive normal form**.

f) Convert the following formulas into conjunctive normal form.

    i. $A \lor (B \leftrightarrow C)$

    ii. $(P \lor \neg Q) \to R$

    iii. $(A \lor B) \to (C \to D)$

Q3.

a) What is the difference between **propositional logic** and **predicate logic**?

b) Explain how predicate logic could address the limitations of propositional logic.

c) Use the following two statements (S1 and S2) and the claim (C1) to answer the question (i).

S1: If the airport is closed and the weather is bad, then either we cannot go on the trip

S2: It is not the case that, if we do not go on the trip then the weather is bad

C1: Either the weather is good then we go on the trip

Translate S1, S2, and C1 into propositional logic using appropriate atomic propositions.

    i.   Is C1 is a valid claim? Justify your answer.
       (**Hint:** *If C1 is valid, then* $(S1 \cap S2) \to C1$ *becomes a tautology*)

d) What is meant by **prenex normal form**?

e) Transform the following formulas into prenex normal form.

    i. $(\forall x)A(x) \to (\exists x)B(x)$

    ii. $\forall x \left(\forall y \left(\forall z \big(A(x,y,z) \land B(y)\big) \to \big(\forall x C(x,z)\big) \right) \right)$

   iii. $\exists x \left(A(x) \land \forall y \big(B(y) \to C(x,y)\big) \right)$

Q4.

a) Describe three (03) differences between **neural networks** and **conventional computers**.

b) Define the following neural networks in your own words. Give one example for each one.

    i. Single layer feed forward neural network

    ii. Multi layer feed forward neural network

    iii. Recurrent neural network

c) Briefly describe what is meant by **firing rule**.

d) Train a neural network to recognize the following patterns I and U. The associated patterns are as follows.

Answer the following questions (i) and (ii).

    i. Clearly draw generalized truth tables after training the above patterns.

   ii. Recognize the following patterns using the trained neural network.

        a.

        b.

        c.
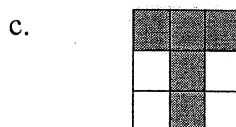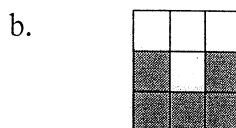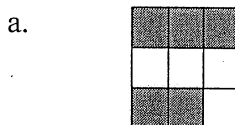
Q5.

    a)   Define an **intelligent agent**. Give two (02) examples for an intelligent agent.

    b)   Define the following terms of an intelligent agent.

        i.   Percept

        ii.   Percept sequence

        iii.   Agent function

        iv.   Agent program

    c)   What is meant by a **PEAS description** of an agent?

    d)   Present the PEAS description of the following automated agents.

        i.   Taxi driver

        ii.   Medical diagnosis system

    e)   What is the difference between a **table driven program** and **simple reflex agent**?

Q6.

    a)   What are the differences between **PROLOG** and **other programming languages**?

    b)   Briefly explain the following terms in the context of PROLOG.

        i.   Data and facts

        ii.   Predicates and rules

    c)   Consider the relationship diagram given below.
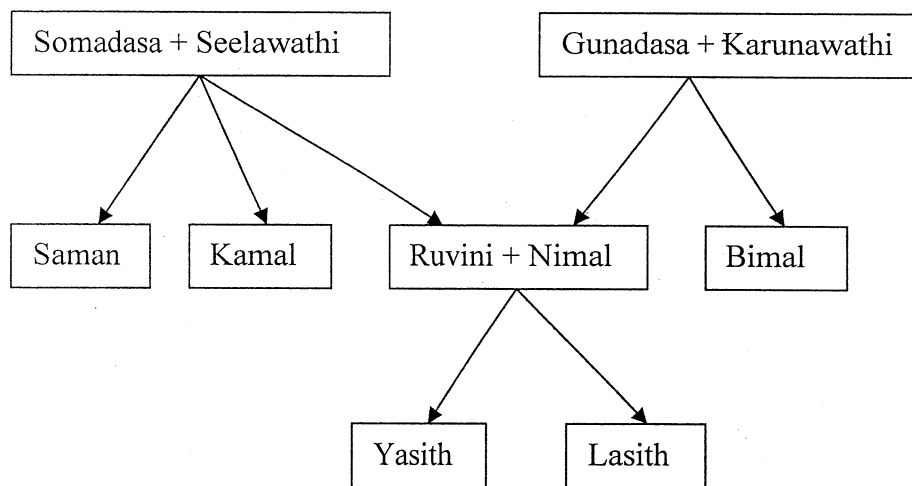
i. Create the following PROLOG rules.

```
parent/2,    mother/2,    farther/2,    grandfather/2    and
grandmother/2
```

(Assume that, all these rules have the standard meanings as their names imply.)

ii. Explain how PROLOG would answer the following queries.

a. `?- mother(X, Saman).`

b. `?- grandmother(Seelawathi, Yasith).`

iii. Create a rule named `aboutme/2` that gives the possible relation related to a given person.
(**Hint:** *Your predicate should give at least the following information*)

```
?- aboutme(Yasith)
    Saman is a male
    Mother is Ruvini
    Father is Nimal
    Grand father is Somadasa
```