The Open University of Sri Lanka

B.Sc. Degree Programme-Level-04

Department of Mathematics and Computer Science

Final Examination- 2012/2013

Computer Science

CSU2280-DEDUCTIVE REASONING AND PROLOG FOR ARTIFICIAL INTELLIGENCE

Duration: Three Hours

Date: 15.06.2013	Time: 1.00pm-4.00pm

Answer Four Questions Only

01.(a) Define the following terms :

(i) a Model assignment

(ii) a Counter example

(iii) a Tautology

(iv)a Contradiction

(b) Let p and q be two statements . Use the truth tables to determine whether each of the following statement is tautology, contradiction or contingency.

(i) $[\sim q \cap (p \rightarrow q)\ ] \rightarrow p$

(ii) $(p \cap \sim q) \cup (q \cap \sim p)$

(iii) $p \cap (p \rightarrow q) \cap \sim q$

(c) Let p be "It is cold" and let q be "It is raining". Give a simple verbal sentence which describes each of the following statements:

(i) $\sim p$
(ii) $p \cap q$
(iii) $p \cup q$
(iv) $q \cup \sim p$

02. (a) Define the term "Reasoning".

(b) Explain how Dynamic reasoning relates to deterministic and non-deterministic reasoning.

(c) Using appropriate examples ,describe the following terms

(i)Deductive reasoning

(ii)Abductive reasoning

(iii)Inductive reasoning

03. (a) Explain how Prolog answers queries.

(b) Consider the following Prolog Programme.

```
Parent(sunil,sarath).
Parent(sarath,saman).
Parent(sujatha,saman).
Parent(saman,jagath).
Parent(sujatha,nimal).
Parent(jagath,thilak).
```

Write Prolog code to find:

(i) a brother of a given person
(ii) a wife of a given person

and also provide two example queries, which can be answered as "yes" by Prolog when using the above code.

(c) Write a recursive procedure ancestor/2 and how Prolog answers the query step-by-step

```
?- ancestor(sunil,thilak).
```

04. (a) A part of a Prolog program developed to concatenate two lists leaving the result as a third list, is given below.

Conc([XIL1],L2,[XIL3]):- CONC ([L1,L2,L3]).

Complete the above program and describe step-by-step how Prolog answers the following queries.

(i) conc([a], [b,c],[a,b,c].
(ii) conc([p,q],[r],X).

(b) Without changing the declarative meaning of the complete programme in part (a), reconstruct the above programme in such a way that it has a different procedural meaning and cannot answer the query conc([p,q],[r],X).

(c) Extend the program in Part (a) to display all possible sub-lists of a given list.

05. (a) What are the limitations of using propositional logic. Describe how these limitations are overcome by Predicate logic.

(b) Explain the meaning of the following predicate logic formulae.

(i) $\forall x P(x)$

(ii) $\exists$Yp(y)

(iii) $\forall x \exists y$ P(x,y)

(iv)$\exists y \forall x$ P(x,y)

(c) The following predicate logic formulae are used to represent the sentences: *All farmers are hardworking and Some Sri Lankans are lazy.*

$\forall x F(x) \cap H(x)$

$\exists x S(x) \rightarrow L(x)$

Are these formulae are correct or incorrect? Justify your answer.

06.(a) *"Resolution is a much more powerful way of inferencing than use of inference rules"* Do you agree with this statement? Justify your answer.

(b) Briefly explain the following terms.

(i) Skolemisation

(ii) Unification

(iii) Horn Clause

(c)What are the steps for converting predicates into CNF?

(d) Convert the following predicate logic formula into CNF.

$$\forall x\ (P(x) \rightarrow Q\ (x) \cap R(x))$$