The Open University of Sri Lanka

B. Sc. Degree Programme – Level 04

Final Examination 2005/2006

CSU 2280: Deductive Reasoning and PROLOG for Artificial Intelligence- **Paper I**

Duration: Two and half hours

Date: 13/11/2006 Time: 1.00 pm - 3.30 noon

Answer FOUR Questions ONLY.

Q1.

(a) *"Different people may have different views in classifying the reasoning process"*. What is the Jeffrey and Philip's (1995) classification?

(b) State the seven scientific reasoning techniques? Explain three of them by using appropriate examples.

(c) What is the most suitable reasoning technique for each of the following examples? Give reasons.

i. Find a Town in a map

ii. Diagnose Computer Hardware problems

Q2.

(a) Consider the following four statements:

S1: If the sun shines, then we go for a hike

S2: If we do not go for a hike, then we go to the museum.

S3: If we do not go to the museum, then the sun shines.

S4: If the sunshines or we do not go to the museum, then we go for a hike.

i. Translate the statements into propositional logic, using appropriate atomic propositions.

ii. Put the above propositional logic statements into truth tables, and decide what are tautologies.

(b) Using the representation

P(x) – x is a man F(x) –x is a failure

S(x)- x is a success and H(x,y) x hates y,

write the following sentences in predicate logic.

i. Some men hate all failures.

ii. None of the men hate any success.

Q3.

(a) State the three *clausal forms*?

(b) Every propositional formula can be transformed into an equivalent formula in Conjunctive Normal Form (CNF). What are the main steps in the algorithm that transforms such a formula into an equivalent CNF formula?

(b) Transform the following formulas into CNF.

i. $\neg(A \rightarrow (B \vee C)) \wedge (B \rightarrow (A \wedge C))$

ii. $(A \wedge (A \rightarrow B)) \rightarrow B$

Q4.

(a) Using your own words explain the meaning of the following logic formulas.

i. $\forall x P(x)$

ii. $\exists x P(x)$

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

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

(b) Write the following sentences using both propositional and predicate logic. Thus, explain the limitations of prepositional logic.

Man has two legs.

Bird has two legs.

Dog has a tail.

Rat has a tail.

(c) Using simple English, write the meaning of the following predicate logic statements.

i. $\forall x$ hardworking(x) $\wedge$ curious(x) $\rightarrow$ successful(x)

ii. $\forall x(\exists y$ animal(y) $\wedge$kill(x,y))$\rightarrow \neg$animallover(x)

(d) Write two real world predicates P(x,y) and Q(x,y) to hold the following property.

i. $\forall x \exists y P(x, y) \equiv \exists y \forall x P(x, y)$

Q5.

(a) In the context of AI explain why Prolog is very popular than the other programming languages? Explain briefly.

(b) What are the differences between Prolog data types and other standared procedural programming language data types?

(c) Kumari is a girl. She has three brothers. Kamal is the elder brother and Ruvan and Sunil are younger to kumari. Kumari's father is Somapala and her mother is Kamala. Premadasa and Seelawathi are Somapal's father and mother respectively.

i. Create Prolog clauses *male/1, female/1, brother/2* and *parent/2* to store the above information.

ii. Based on the above Prolog clauses, define the relations mother(X,Y), father(X,Y), grandmother(X,Y) and grandfather(X,Y).
Hint: brother(X,Y) means "X is a brother of Y".

Q6.

A man is traveling with a goat, a wolf and a cabbage. They come to a river and the man wishes to get across the river with the goat, the wolf and the cabbage. There is a rowing boat on the bank of the river, but there is room only for one other thing on the boat as well as the man. If the wolf is left alone with the goat, wolf will eat goat, and if the goat is left alone with the cabbage, he will eat the cabbage.

a. Define a prolog predicate *state/4* to identify the start location of the man, goat, wolf and cabbage in the west side of the river.

b. Define a prolog predicate *state/4* to identify the final location of the man, goat, wolf and cabbage in the east side of the river.

c. Define an unsafe condition using not/1 prolog predicate.
   i. wolf and goat in the same side but others are not yet.
   ii. goat and cabbage in the same side but others are not yet.

d. Create move/2 Prolog predicate to implement the following steps.
   i. man takes wolf
   ii. man takes goat
   iii. man takes cabbage
   iv. man takes self

e. What is the purpose of the following prolog predicate.

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move(state(F,W,G,C), state(F,W,G,C)) :- fail.
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f. How do you run this simulation in the console window?