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UNIVERSITY REGULAR EXAMINATIONS

2ND SEMESTER 2012 /2013 ACADEMIC YEAR

FOR THE DEGREE OF

BACHELOR OF SCIENCE IN COMPUTER SCIENCE

COURSE CODE: CSC 225

COURSE TITLE: LOGIC PROGRAMMING

DATE: 23rd August 2013 **TIME:** 2.00pm – 5.00pm

INSTRUCTIONS TO CANDIDATES

- Answer questions one and any two questions only
- Question one carries 30 marks and the other questions carry 20 marks each.

QUESTION ONE

(a) Define the following terms as used in logic programming; (3 marks)

i. Predicate
ii. Proposition
iii. Logic reasoning

(b) Logic programming languages like prolog and Lisp are declarative as opposed to other HLL languages like Pascal and C which are imperative. Explain why this is so. (4 marks)

(c) (i) What is the result of executing the following goal? (3 marks)
:- maximum(X,nil).
(ii) What solutions would a prolog system display for the goal?
#:- maximum (X, 3:1:3:2:nil) (4 marks)

(d) (i) Differentiate between Inference and Entailment (2 marks)
(ii) Briefly state and explain one common rule of inference (2 marks)

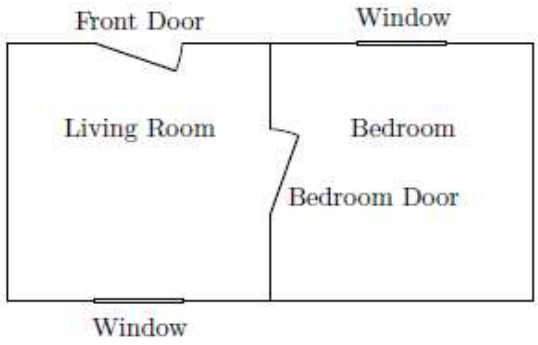
(e) (i) Write a program that finds the lists X and Y such that the concatenation of X and Y is [a,b). (6 marks)

(ii) show that $p \Rightarrow (q \Rightarrow (r \Rightarrow s))$ is equivalent to $(p \wedge q \wedge r) \Rightarrow s$ (6 marks)

(iii) Write a query (program) that will generate the average of two values, the square root of their products and finally determine which value is larger among the input values. (4marks)

QUESTION TWO

(a) Provide a logic program that will help an architect in designing motel suite, assuming that the client has already decided that each suite will have two rooms, a lounge and a bedroom, and its floor plan will be something like below;



The program must determine the directions in which the doors and windows may face, following these guidelines:
1. The lounge window should be opposite the front door to create a feeling of space.
2. The bedroom door should be in one of the walls at right angles to the front door to provide a little privacy.
3. The bedroom window should be in one of the walls adjacent to the bedroom door.
4. The bedroom window should face East to catch the morning light. (8 marks)

(b) A deluxe motel suite has two bedrooms, but must otherwise obey the design rules listed in (a) above. Show how to modify the design program for use in designing luxury suites. How many solutions to the problem are there? How many can reasonably be built? (12 marks)

QUESTION THREE

(a) (i) Briefly explain how results are derived from logic programs (2 marks)
(ii) Explain how logic programming systems solve goals (2 marks)
(iii) Provide precisely logic procedures on what happens when a computer executes a logic program. (6 marks)

(b) Explain whether the following combinations yield Boolean formula;

(i) $p \Rightarrow (\neg q \wedge (s \wedge \neg r))$

(ii) ® $p\neg)qsr\ (\vee\neg\ \vee$ (6 marks)

(c) Write the following statements in logic and identify the predicate (s) from each statement.
(i) MissPiggy is Plump
(ii) Kermit's voice is highpitched (4 marks)

QUESTION FOUR

(a) Identify the fundamental components of logic and briefly explain their functions. (6 marks)

(b) (i) Differentiate between the terms atom and model as used in logic programming. (2 marks)
(ii) Identify and explain the most common operators that are used to construct more complex sentences from atoms. (8 marks)

(iii) Show that: $p \wedge (p \Rightarrow q) \models q$ without use of truth table. (4 marks)

QUESTION FIVE

(a) Show using a truth table that the conclusion: *valuable* :− *metal* , *yellow*, *heavy,* follows from the two premises *valuable* :− *gold*, *heavy*. And *gold* :− *metal* , *yellow*. (8 marks)

(b) Explain the following terms as used in logic programming;
(i) unification (2 marks)
(ii) Soundness (2 marks)
(iii) Completeness (2 marks)
(iv) Decidability (2 marks)
(v) Semi-decidability (2 marks)
(vi) Resolution (2 marks)