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UNIVERSITY REGULAR EXAMINATIONS

2013 /2014 ACADEMIC YEAR

2ND YEAR 2ND SEMESTER EXAMINATIONS

(MAIN EXAMINATION) - REGULAR

FOR THE DEGREE OF

BACHELOR OF SCIENCE IN COMPUTER SCIENCE

COURSE CODE: CSC 225

COURSE TITLE: LOGIC PROGRAMMING

DATE: 15TH APRIL, 2014 **TIME:** 2:00P.M. – 5:00P.M.

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) GNU Prolog uses several stacks to execute a Prolog program. Each stack has a static size and cannot be dynamically increased during the execution. For each stack there is a default size but the user can define a new size by setting an environment variable. When a GNU Prolog program is run it first consults these variables and if they are not defined uses the default sizes. State these stacks with their default size and the name of their associated environment variable. (12 marks)

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

i. Predicate
ii. Proposition
iii. Logic reasoning

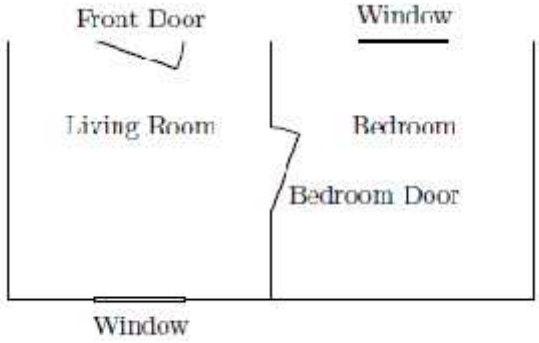
(c) Logic programming languages like prolog and Lisp are declarative as opposed to other HLL languages like Pascal and C which are imperative. Explain why this is so. (4 marks)

(d) (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)

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

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. (6 marks)

(b) (i) Write a program that finds the lists X and Y such that the concatenation of X and Y is [a,b]. (4 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 THREE

(a) (i) Briefly explain how results are derived from logic programs (3 marks)
(ii) Explain how logic programming systems solve goals (3 marks)
(iii) Provide precisely logic procedures on what happens when a computer executes a logic program. (6 marks)

(b) Let $P(x, y, \ldots, z)$ be a predicate.

Then: $\neg(\forall x, y, \ldots, z)P(x, y, \ldots, z) \Leftrightarrow (\exists x \vee \exists y \vee \ldots \vee \exists z)\neg P(x, y, \ldots, z)$ hence provide the negation of this elemental predicate. (4 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) 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)

QUESTION FIVE

(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)