



KENYATTA UNIVERSITY
UNIVERSITY EXAMINATIONS 2010/2011
INSTITUTE OF OPEN LEARNING
EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE IN INFORMATION TECHNOLOGY
SIT 211: LOGIC PROGRAMMING

DATE: Wednesday 2nd February, 2011

TIME: 4.30 p.m. – 6.30 p.m.

INSTRUCTIONS

Answer any three questions

QUESTION ONE

- (a) Formalize the following sentences of natural language as formulas of predicate logic:
- (i) Every natural number has a successor. (2 marks)
 - (ii) Nothing is better than taking a nap. (2 marks)
 - (iii) There is no such thing as negative integers. (2 marks)
 - (iv) The names have been changed to protect the innocent. (2 marks)
 - (v) Logic plays an important role in all areas of computer science. (2 marks)
 - (vi) If your shoes are brown then your belt is brown. Your shoes are brown so your belt is too. (4 marks)
- (b) Describe the following terms as used in Logic Programming giving examples.
- (i) Proposition
 - (ii) Clause
 - (iii) Atom
- 2 marks each)

QUESTION TWO

Use recursion or definition in terms of *append* or other relations to define the following relations on lists:

- (a) *prefix*(a,b) if list a is a prefix of list b. Example: *prefix*(1:2:nil, 1:2:3:4:nil).
- (b) *suffix*(a,b) if list a is a suffix of list b. Example: *suffix*(3:4:nil, 1:2:3:4:nil).
- (c) *segment*(a,b) if list a is a contiguous segment of list b. Example: *segment*(2:3:nil, 1:2:3:4:nil).
- (d) *sublist*(a,b) if list a is a sub-list (not necessarily contiguous) of list b. Example: *sublist*(1:3:nil, 1:2:3:4:nil).
- (e) *delete*(a,x,b) if list b is the result of deleting a single occurrence of x from list a. Example: *delete*(3:1:4:2:nil, 4, 3:1:2:nil).

QUESTION THREE

A deluxe motel suite has two bedrooms, the motel should be designed using the following 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.
- (a) Design a prolog program to determine directions that the doors and windows may take. (15 marks)
- (b) How many solutions are there? (5 marks)

QUESTION FOUR

The staff of an office run a coffee club, and they have set up a database containing the following relations:

- *manager*(name), which is true if name is a manager.
- *bill*(name,number,amount), which is true if name has been sent a bill numbered number for amount.
- *paid*(number,amount,date), which is true if a payment of amount was made on date for the bill numbered number.

Define views that answer the following questions:

- (a) Which managers have been sent a bill for less than ten pounds? (5 Marks)
- (b) Who has been sent more than one bill? (5 Marks)
- (c) Who has made a payment that is less than the amount of their bill? (5 Marks)
- (d) Who has received a bill and either not paid it at all, or not paid it before February 1st? (5 Marks)

QUESTION FIVE

- (a) Show using a truth table that the conclusion

valuable :- *metal* , *yellow* , *heavy*. (1)

follows from the two premises

valuable :- *gold* , *heavy*. (2)

and

gold :- *metal* , *yellow*. (3) (10 marks)

- (b) Prove by structural induction that if the variable x does not appear in the term t then $t[X \leftarrow u] = t$. (10 marks)