(Knowledge for Development)

KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS
2019/2020 ACADEMIC YEAR

END OF SEMESTER EXAMINATIONS
YEAR TWO SEMESTER ONE

FOR THE DEGREE OF BACHELOR OF SCIENCE
COMPUTER SCIENCE

COURSE CODE : CSC 227

COURSE TITLE : LOGIC PROGRAMMING

DATE: 17/02/2021 TIME: 08:00 .M – 11:00 A.M

INSTRUCTIONS:

ANSWER QUESTIONS ONE AND ANY OTHER TWO.

QUESTION ONE [COMPULSORY] [30 MARKS]

a. Describe application of prolog in the following areas

I. Automated reasoning [2 marks]

II. Intelligent database retrieve [2 marks]

III. Expert system. [2 marks]

b. Describe the characteristics of prolog. [6 marks]

c. Explain the steps followed to achieve resolution. [6 marks]

d. Answer the following true/false. [8 Marks]

(a) $\forall x P(x) \Leftrightarrow \neg \exists x \neg P(x)$

(b) $\exists x P(x) \Leftrightarrow \neg \forall x P(x)$

(c) $\forall x \exists y P(x, y) \Leftrightarrow \exists y \forall x P(x, y)$

(d) $\exists !_x p(x) \Leftrightarrow \exists_x (p(x) \wedge \forall_y ((x \neq y) \longrightarrow \neg p(y)))$

e. State and explain the DE Morgan's law of logic. [4 marks]

QUESTION TWO [20 MARKS]

a. Explain the following:

I. Unification [2 marks]

II. Modus ponens [2 marks]

III. Goals [2 marks]

IV. Fact [2 marks]

b. Explain various steps followed in converting a sentence to conjunctive normal form. Give an example. [4 marks]

c. Describe how logic programming can be applied in the big four Agenda [8 marks]

QUESTION THREE [20 MARKS]

a. Explain how one can Convert a sentences to conjunctive normal form. [6 marks]

b. Write appropriate PROLOG code that shows the following concept;

I. Backtracking [4 marks]

II. Cut function. [4 marks]

c. State and explain the Two types of Cut function used in PROLOG [6 marks]

QUESTION FOUR [20 MARKS]

a. Discuss the FOUR variation of implication giving an example for each case. [8 marks]

b. Given the iProlog database and rules shown below, what is the output of the Prolog query that follows?

```
child_of(mary, steve).
child_of(mary, anne).
child_of(alice, anne).
child_of(alice, steve).
child_of(jane, steve).
child_of(leslie, steve).
female(mary).
female(alice).
female(jane).

sisters(Person1, Person2) :-
   child_of(Person1, Parent1), child_of(Person1, Parent2),
   not(Parent1 = Parent2),
   child_of(Person2, Parent1), child_of(Person2, Parent2),
   female(Person1), female(Person2), not(Person1 = Person2).
```

Query:

```
sisters(Sis1, Sis2)?
```

[12 marks]

QUESTION FIVE [20 MARKS]

a. Does the following Prolog query succeed? If not, explain why not. If so, what bindings will be reported?

?- believes(X, likes(mary, pizza)) = believes(frank, likes(Y, pizza)). [2 marks]

b. Consider the predicate C(x, y) = "x is enrolled in the class y",where x takes values in the domain S = {students}, and y takes values in the domain D = {courses}. Express each statement by an English sentence.

I. $\exists\, x \in S,\ C(x, MH1812)$.

II. $\exists\, y \in D,\ C(Carol, y)$.

III. $\exists\, x \in S,\ (C(x, MH1812) \wedge C(x, CZ2002))$.

IV. $\exists\, x \in S,\ \exists\, x0 \in S,\ \forall y \in D,\ ((x\ 6{=}\ x\ 0) \wedge (C(x, y) \leftrightarrow C(x0, y)))$. [8 marks]

c. Consider the following Prolog program:

```
[1] parent(john, sally).
[2] parent(jim, mike).
[3] parent(carol, john).
[4] parent(carol, sue).
[5] parent(sally, jim).
[6] parent(jim, bob).
[7] sibling(X, Y) :- parent(Z, Y), parent(Z, X), X \== Y.
[8] malelist([john, jim, mike, bob]).
[9] femalelist([sally, carol, sue]).
[10] mother(U, V) :- parent(U, V), female(U).
[11] father(U, V) :- parent(U, V), male(U).
[12] brother(U, V) :- sibling(U, V), male(U).
[13] sister(U, V) :- sibling(U, V), female(u).
```

Show what happens in solving the goal below. You may assume (for now) that goals of the form "male(X)." or "female(X)." become appropriately solved. Show the rule applied, the goal list, and the variable bindings after each application of a rule or fact (or, for instance, after solving a `male(X).' goal). Indicate backtracking should any be required.

?- brother(X, mike).

[10 marks]