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**UNIVERSITY EXAMINATIONS
2022/2023 ACADEMIC YEAR**

**END OF SEMESTER EXAMINATIONS
SECOND YEAR SECOND SEMESTER**

**FOR THE DEGREE IN
(COMPUTER SCIENCE)**

COURSE CODE: CSC 227

COURSE TITLE: LOGIC PROGRAMMING

DATE: 17/04/2023

TIME: 9.00 A.M. -11.00 A.M.

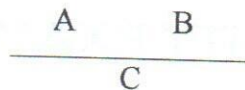
INSTRUCTIONS TO CANDIDATES

ANSWER QUESTION ONE AND ANY OTHER TWO QUESTIONS

QUESTION ONE (COMPULSORY)

[30 MARKS]

- a. State two main levels of a programming language. [2 marks]
- b. What kinds of knowledge can be represented in propositional logic? [1 marks]
- c. By defining the aspects of logic, differentiate between **logic** and **logic programming**. [3 marks]
- d. Explain why Logic Programming is important and powerful. [3 marks]
- e. Briefly explain the difference between computation and deduction and explain the connection of the two to logic programming. [3 marks]
- f. What is symbolic logic? Using relevant arguments give a general pattern used in representing symbolic logic. [3 marks]
- g. Explain the meaning of the following. [2 marks]



- h. Using relevant arguments, differentiate between Modus Ponens and Modus Tollens using relevant arguments. [4 marks]
- i. Explain how lists are handled in prolog [2 marks]
- j. Write a prolog program or database of facts and rules that:
 - i. Concatenate two lists [2 marks]
 - ii. Find the total cost of list of items [5 marks]

QUESTION TWO

[20 MARKS]

- a. What is the role of a **don't care** symbol (**_**) in prolog programming. [1 marks]
- b. Using a prolog syntax or statement, explain:
 - i. Conjunction of goals in a query [2 marks]
 - ii. Disjunction of a goal in a query [2 marks]
 - iii. Backtracking process. [2 marks]
- c. State any two common fallacies in logic reasoning. [2 marks]
- d. Explain the connection between computation and deduction reasoning. [3 marks]
- e. Discuss the concept of conflict resolution and its implementation in predicate logic. [4 marks]
- f. Simulate the output of the following goals. [4 marks]

- ?- X is Y+1, Y=3.
- ?- X=:=3+2.
- ?- X is between (101,120).
- ?- 4+1=:=3+2.

QUESTION THREE

[20 MARKS]

- a. What is the relationship between judgment and proof? **[2 marks]**
- b. Explain, using appropriate illustrations the following system inference strategies.
 - i. Goal driven system/backward chaining **[2 marks]**
 - ii. Data driven system/forward chaining **[2 marks]**
- c. In the context of propositional logic and predicate calculus, explain the meaning of :
 - i. Alphabets **[2 marks]**
 - ii. Well-formed-formulas (wffs) **[2 marks]**
 - iii. Atomic formula **[2 marks]**
- d. Explain condition under which the cut operator or function (!) can be used. **[2 marks]**
- e. Explain the meaning of the following operator by giving a prolog syntax.
 - i. = : = **[2 marks]**
 - ii. =\= **[2 marks]**
 - iii. !n. **[2 marks]**

QUESTION FOUR

[20 MARKS]

- a. Explain various characteristics of a prolog program **[3 marks]**
- b. Prolog syntax is based on part of predicate calculus known as the Horn Clause. Explain the meaning of Horn clause using relevant illustrations. **[2 marks]**
- c. Explain how the following processes are handled in logic programming.
 - i. Resolution **[2 marks]**
 - ii. Unification **[2 marks]**
 - iii. Instantiation **[2 marks]**
- d. Consider the prolog program bellow.

```
sum :- readint(X), readint(Y), sum is X+Y, write(sum), !n.
```

- i. Write an appropriate goal or query for the program and simulate its output(s). [2 marks]
- e. By differentiating between tail recursion and non-tail recursion, explain how recursion is handled in prolog programs. [3 marks]
- f. Write a program to find the power of any number using tail recursion. [4 marks]

QUESTION FIVE

[20 MARKS]

- a. Using appropriate syntax, explain the following elements of a prolog program.
 - i. Fact [2 marks]
 - ii. Rule [2 marks]
 - iii. Query [2 marks]
- b. Consider the prolog program below that finds the factorial of a positive integer number (N).

```
% Domain: I=Integer
% Predicate: fact (N, F).
% clauses:
fact(0,1).
fact(1,1).
fact(N, F):- N1 is N-1, fact(N1, F1), F is N*F1.
```

- i. Explain how the above program will be consulted. [2 marks]
- ii. Write a query or a goal that will output the factorial of a number 6. [2 marks]
- iii. Explain how the prolog compiler will arrive on the output stated in (ii) above. [2 marks]
- iv. Can this program allows backtracking process? Explain. [2 marks]
- c. Explain the meaning of **ontology engineering** and **ontology language** [2 marks]
- d. Discuss briefly any **FOUR** types of reasoning systems as used in logic programming. [4 marks]