



(University of Choice)

MASINDE MULIRO UNIVERSITY OF

SCIENCE AND TECHNOLOGY

(MMUST)

MAIN CAMPUS

UNIVERSITY EXAMINATIONS

SPECIAL/SUPPLEMENTARY EXAM

2021/2022 ACADEMIC YEAR

THIRD YEAR SECOND SEMESTER EXAMINATION

FOR THE DEGREE OF BACHELORS OF SCIENCE IN

(COMPUTER SCIENCE)

COURSE CODE: BCS 227

COURSE TITLE: LOGIC PROGRAMMING

DATE: MONDAY 01-08-2022

TIME: 2:00p.m-4:p.m

INSTRUCTIONS TO CANDIDATES:

ANSWER QUESTIONS ONE AND ANY OTHER TWO.

MMUST observes ZERO tolerance to examination cheating

Paper Consists of 4 Printed Pages. Please Turn Over

QUESTION ONE (COMPULSORY)**[30 MARKS]**

- a. Define the following concepts with an example in each case: **[4 marks]**
- Modus ponens
 - Modus Tollens
- b. Explain the difference between Imperative programming and declarative programming paradigm. Give at least 3 examples of programming languages in each paradigm. **[4 marks]**
- c. Represent the proposition $(\sim A \vee B) \rightarrow (C \wedge \sim B)$ by its truth table. **[4 marks]**
- d. Write the negation of the statement: $(\exists x)(\forall y) p(x, y)$. **[2 marks]**
- e. Briefly explain the difference between computation and deduction and explain the connection of the two to logic programming. **[4 marks]**
- f. To study logic programming means to study proofs. Explain why? **[3 marks]**
- g. Differentiate between: **Tautology, Contradiction and contingency.** **[3 marks]**
- h. **[The Kakamega Guardians]** you are walking in Kakamega and all of a sudden you find yourself in-front of three possible roads: The road on your left is paved with gold, the one in-front of you is paved with marble, while the one on your right is made of small stones. Each street is guarded by a guardian. You talk to the guardian and this is what they tell you:

The guardian of the gold street: *"This road will bring you straight to the center. Moreover, if the stones takes you to the center, then also the marble takes you to the center."*

The guardian of the marble street: *"Neither the gold nor the stone roads will take you to the center."*

The guardian of the stone street: *"Follow the gold and you will reach the center, follow the marble and you will be lost."*

- Using the appropriate notations, formalize the guardians' responses and write down its conjunction. **[4 marks]**
- Given that you know that all the guardians are liars, can you choose a road being sure that it will lead you to the center of the Bungoma Town? If this is the case which road will you choose? **[6 marks]**

QUESTION TWO**[20 MARKS]**

- a. Differentiate between propositional and predicate logic and explain any two limitations of propositional logic that can be overcome by predicate logic. **[6 marks]**

- b. To make the transition from inference rules to logic programming a particular strategy need to be imposed. Discuss the two fundamental strategies used by the Inference Engine. [6 marks]
- c. State the characteristics of Prolog programming language and discuss the elements of a logic language like Prolog. [8 marks]

QUESTION THREE

[20 MARKS]

- a. What kinds of knowledge can be represented in propositional logic? [2 marks]
- b. Explain how judgment and proofs are handled in logic programming. [2 marks]
- c. What is symbolic logic? Give the general pattern used in representing symbolic logic. and how is related to Modus Ponens and Modus Tollens. [5 marks]
- d. Express the following statements in predicate logic
- “Everybody must take a discrete mathematics course or be a computer science student”. [2 marks]
 - There is someone loved by everyone [2 marks]
- e. First Order Predicate Calculus is the basis of almost all knowledge representation and reasoning in every area of symbolic Artificial Intelligence (AI). Give at least four area of AI where this can be applied. [4 marks]
- f. Discuss the concept of conflict resolution and its implementation in predicate logic. [6 marks]

QUESTION FOUR

[20 MARKS]

- a) What is meant by "John owns the book" in a prolog notation. [3 marks]
- b) Using relevant examples explain the meaning of the following: [8 marks]
- Atom
 - Cut function
 - Fact
 - Rule
- a. You are provided with the information lung diseases. Study it and answer the questions that follow:

- **Tuberculosis** is a lung disease whose symptoms are persistent cough, constant fatigue, weight loss, loss of appetite, fever, coughing up blood, night sweats.
- **Pneumonia** is a disease whose symptoms are cough, fever, shaking chills, shortness of breath.

- **Byssinosis** is a disease whose symptoms are chest tightness, cough, wheezing.
- **Pertusis** is a disease whose symptoms are runny nose and mild fever.
- **Pneumoconiosis** is a disease whose symptoms are chronic cough and shortness of breath.

- i Write the prolog code to show how the diseases and their respective symptoms will be stored in the knowledge base. [5 marks]
- ii Write down a prolog query that will return the Symptoms for Pertusis. [2 marks]
- iii Explain how prolog compiler arrives at the solution of the (ii) query above. [2 marks]

QUESTION FIVE

[20 MARKS]

- a. Define the following concepts as used in the study of PROLOG: [3 marks]
 - i. Binding Variables
 - ii. Backtracking
 - iii. Instantiation
- b. Write down a rule that satisfies: john likes X:- X is_female, X owns Y, Y is_acat. [2 marks]
- c. Write a prolog program to reverse the elements of a list. [2 marks]
- d. Study the program below and write down the output for the query indicated. [2 marks]

```

loop(0).
loop(N):-N>0,write('The value is: '),write(N),nl,
M is N-1,iterate(M).
?- loop(5).
```
- e. Define and test a predicate which takes two arguments, both numbers, and calculates and outputs the following values: [4 marks]
 - i. Their sum
 - ii. The largest number
- f. Explain the requirements of a knowledge representation language. [3 Marks]
- g. Using examples explain the difference between Atomic formulas and Compound formulas as used in predicate logic [4 marks]