



MACHAKOS UNIVERSITY

University Examinations for 2021/2022

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF COMPUTING AND INFORMATION TECHNOLOGY

SECOND YEAR SECOND SEMESTER EXAMINATION FOR

BACHELOR OF SCIENCE (INFORMATION TECHNOLOGY)

SIT 226: LOGIC PROGRAMMING

DATE: 9/12/2021

TIME: 2.00-4.00 PM

INSTRUCTIONS: Answer Question ONE and any other TWO Questions

QUESTION ONE (COMPULSORY) (30 MARKS)

- a) Define a logic gate. (2 marks)
- b) Using logical symbols, transistor circuits and truth tables for each, describe the following logic gates.
 - i. OR gate. (3 marks)
 - ii. AND gate. (3 marks)
 - iii. NOT gate. (3 marks)
- c) Write the logical diagram for the following mathematical expression. (2 marks)

$$X = [D + (A + B)C].E$$

- d) Show the universality of NOR and NAND gates by
 - i. Representing a single OR gate using NAND gates (3 marks)
 - ii. Representing a single AND gate using NOR gates (3 marks)
- e) Translate the following sentence into proposition logic (3 marks)
If Jonah doesn't use a boat, he will not be able to fish in the deep sea and therefore he won't catch the big fish
- f) Explain four application areas of logic. (8 marks)

QUESTION TWO (20 MARKS)

- a) Using an example in each case, describe the following logic programming terms.
- i. Imperative programming. (4 marks)
 - ii. descriptive programming. (4 marks)
- b) Explain three advantages of logic programs. (6 marks)
- c) Consider the following sentence.
- An elephant is bigger than a horse. A horse is bigger than a goat.***
- i. Translate the above sentence into a set of first order logic formula. (3 marks)
 - ii. Write a prolog program consisting of two facts and two rules to represent the above sentence (3 marks)

QUESTION THREE (20 MARKS)

- a) Define the following terms
- i. Propositional logic. (2 marks)
 - ii. Predicate logic. (2 marks)
 - iii. Explain three reasons why predicate logic is preferred to propositional logic. (6 marks)
- b) Translate the following into propositional logic. (4 marks)
- If James does not go to school, then mercy will not get time to wash and James will litter the compound.*
- c) Translate the following into First-order predicate logic (6 marks)
- i. *Someone walks and someone talks.*
 - ii. *Everyone loves everyone.*
 - iii. *Everyone who Mary loves loves someone who is happy.*

QUESTION FOUR (20 MARKS)

- a) Show how the following laws are applied in propositional logic.
- i. Identity law (2 marks)
 - ii. Double negation law (2 marks)
 - iii. Demorgan's law (4 marks)
- b) Apply the logic laws to reduce the following expression. $(P \vee F) \wedge (Q \vee T)$ (4 marks).
- c) What is a tautology (2 marks)
- d) Show $(\neg(P \wedge Q) \wedge Q)$ is logically equivalent to $(\neg P \wedge Q)$. (6 marks)

QUESTION FIVE (20 MARKS)

- a) Describe 4 rules that apply in karnaugh maps in the simplification of expressions that group together adjacent cells containing ones. (8 marks)
- b) Consider the truth table shown below.

A	B	C	F
0	0	0	0
0	0	1	0
0	1	0	1
0	1	1	0
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	0

- i. Generate a k-map representing the above truth table. (6 marks)
- ii. Using variables, A, B and C, write a function that represents the above truth table from the k-map generated in (i) above. (6 marks)