



MACHAKOS UNIVERSITY

University Examinations for 2022/2023

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF COMPUTING AND INFORMATION TECHNOLOGY

FIRST YEAR SECOND SEMESTER EXAMINATION FOR

BACHELOR OF SCIENCE IN INFORMATION TECHNOLOGY

SIT 181: INTRODUCTION TO LOGICS

DATE: 11/4/2023

TIME: 2:00 – 4:00 PM

INSTRUCTIONS

This Paper consists of FIVE questions

Answer question ONE and any other TWO questions in this paper

QUESTION ONE (30 MARKS) (COMPULSORY)

- a) Explain the following terms (8 marks)
 - (i) Logic
 - (ii) Statement
 - (iii) Contradiction
 - (iv) Tautology
- b) Use the truth table method to decide whether the statement $(P \vee r) \vee \sim P \wedge q$ is a tautology. (7 marks)
- c) Use the truth table method to decide whether the following pair of statement form is logically equivalent: $\neg(p \wedge q)$ and $(\neg p \vee \neg q)$. (6 marks)
- d) Show that the statement $(p \vee q) \wedge [(\sim p) \wedge (\sim q)]$ is a contradiction. (5 marks)
- e) State Four features of logically valid statements (4 marks)

QUESTION TWO (20 MARKS)

- a) Assume that it is true that "Polly sings well," it is false that "Quentin writes well," and it is true that "Rita is good at math." Determine the truth of each of the following statements. (10 marks)
- (i) Polly sings well and Quentin writes well.
 - (ii) Polly sings poorly and Quentin writes well.
 - (iii) Either Polly sings well and Quentin writes poorly, or Rita is good at math.
 - (iv) Either Polly signs well or Quentin writes well, or Rita is good at math.
 - (v) Polly sings well, and either Quentin writes well or Rita is good at math.
- b) Use truth tables to check whether the following are tautologies, contradictions or neither. (10 marks)
- (i) $p \wedge \sim (p \vee q)$
 - (ii) $p \vee \sim (p \wedge q)$
 - (iii) $(p \vee q) \vee [(\sim p) \wedge (\sim q)]$

QUESTION THREE (20 MARKS)

- a) Simplify the following statements (9 marks)
- i) $p \wedge \sim (\sim q)$
 - ii) $\sim ([p \wedge (\sim q)] \wedge r)$
 - iii) $p \vee [\sim (\sim p \wedge q)]$
- b) Use truth tables to demonstrate the following equivalences. (9 marks)
- (i) $p \rightarrow q \equiv (\sim q) \rightarrow (\sim p)$
 - (ii) $p \rightarrow q \equiv (\sim p) \vee q$
 - (iii) $(p \leftrightarrow \sim p) \equiv (q \leftrightarrow \sim q)$
- c) Distinguish statement from proposition as used in logics (2 marks)

QUESTION FOUR (20 MARKS)

- a) Write each of the following in symbolic form, and then decide whether it is a tautology or not.
- (i) If it's not true that roses are red and violets are blue, then roses are not red and violets are not blue. (4 marks)
 - (ii) For me to bring my umbrella it's necessary that it rain; therefore if it does not rain I will not bring my umbrella. (4 marks)
 - (iii) For me to pass math it is sufficient that I have a good teacher; therefore, I will either have a good teacher or I will not pass math. (4 marks)

b) Translate the following statements into words. (8 marks)

(i) $\forall x[Rx \rightarrow Sx]$; R = "is a raindrop," S = "makes a splash."

(ii) $\exists z[Dz \wedge Wz]$; D = "is a dog," W = "whimpers."

(iii) $\forall x[Dx \rightarrow \sim Wx]$; D = "is a dog," W = "whimpers."

iv) $\exists z, y[Cz \wedge Cy \wedge Wz \wedge \sim Wy]$; C = "is a cat," W = "whimpers"

QUESTION FIVE (20 MARKS)

a) Convert the following symbolic statements to words: (6 marks)

(i) $p \wedge (\sim r)$

(ii) $p \vee (r \wedge (\sim q))$

(iii) $q \vee (\sim q)$

b) State Four fallacies of ambiguity (4 marks)

c) Distinguish Inductive arguments from Deductive arguments (4 marks)

d) Prove each of the following valid arguments (6 marks)

(i) $(p \vee r) \rightarrow \sim q$
i) $\frac{p \vee r}{\therefore \sim q}$

ii) $\sim p \rightarrow (r \rightarrow \sim t)$
 $\sim(r \rightarrow \sim t)$
 $\frac{\quad}{\therefore p}$