



MACHAKOS UNIVERSITY

University Examinations for 2020/2021 Academic Year

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF COMPUTING AND INFORMATION TECHNOLOGY

FIRST YEAR SPECIAL/SUPPLEMENTARY EXAMINATION FOR

BACHELOR OF SCIENCE (INFORMATION TECHNOLOGY)

SIT 181/SIT 211: INTRODUCTION TO LOGICS

DATE: 26/3/2021

TIME: 8.30-10.30 AM

INSTRUCTION: Answer Question ONE and any other TWO Question

QUESTION ONE (30 MARKS) (COMPULSORY)

- a) Define the following terms (8 marks)
- Logic
 - Statement
 - Contradiction
 - 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 $(p \vee q) \wedge [(\neg p) \wedge (\neg q)]$ is a contradiction. (5 marks)
- e) State the 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. (10 marks)
- b) Use truth tables to check whether the following are tautologies, contradictions or neither.
- i. $p \wedge \sim (p \vee q)$
 - ii. $p \vee \sim (p \wedge q)$
 - iii. $(p \vee q) \vee [(\sim p) \wedge (\sim q)]$ (10 marks)

QUESTION THREE (20 MARKS)

- a) Simplify the following statements (10 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. (10 marks)
- (i) $p \rightarrow q \equiv (\sim q) \rightarrow (\sim p)$
 - (ii) $p \rightarrow q \equiv (\sim p) \vee q$
 - (iii) $(p \leftrightarrow \sim p) \equiv (q \leftrightarrow \sim q)$

QUESTION FOUR (20 MARKS)

Write each of the following in symbolic form, and then decide whether it is a tautology or not.

- a) If I am hungry and thirsty, then I am hungry.
- b) If it's not true that roses are red and violets are blue, then roses are not red and violets are not blue.
- c) For me to bring my umbrella it's necessary that it rain; therefore if it does not rain I will not bring my umbrella.
- d) For me to bring my umbrella it's necessary and sufficient that it rain; therefore if it does not rain I will not bring my umbrella.
- e) 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.

QUESTION FIVE (20 MARKS)

a) Prove each of the following valid arguments:

(6 marks)

i) $(p \vee r) \rightarrow \sim q$

ii). $\sim p \rightarrow (r \rightarrow \sim t)$

$p \vee r$

$\sim (r \rightarrow \sim t)$

$\therefore \sim q$

$\therefore p$

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."

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

c) Express the following in words:

(6 marks)

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

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

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