



# MACHAKOS UNIVERSITY

University Examinations for 2020/2021 Academic Year

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF COMPUTING AND INFORMATION TECHNOLOGY

FIRST YEAR SECOND SEMESTER EXAMINATION FOR  
BACHELOR OF SCIENCE (INFORMATION TECHNOLOGY)

SIT181: INTRODUCTION TO LOGIC FOR IT

DATE: 22/6/2021

TIME: 2.00-4.00 PM

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## INSTRUCTIONS

Answer question ONE and any other TWO questions.

### QUESTION ONE (30 MARKS)

- a) Define Logic as used in computer science (2 marks)
- b) Draw the truth the table for the following  
$$p \wedge (q \vee r)$$
 (4 marks)
- c) Explain the fallacies committed by the following arguments:-
- The position open in the accounting department should be given to Frank Kamau. Frank has six hungry children to feed, and his wife desperately needs an operation to save her eyesight. (2 marks)
  - Evan Okoth, who works in Nairobi bottlers, argues persuasively in favor of increasing the minimum wage. But this is exactly what you would expect. Evans is paid the minimum wage, and if the minimum wage is increased, then her own salary will go up. Obviously Evans' arguments are worthless. (2 marks)
  - The school board argues that our schools are in desperate need of repair. But the real reason our students are falling behind is that they spend too much time with their

- computers. Becoming educated means a lot more than learning how to point and click. The school board should send a letter to the parents urging them to monitor their kids' computer time. (2 marks)
- iv. Whoever thrusts a knife into another person should be arrested. But surgeons do precisely this when operating. Therefore, surgeons should be arrested. (2 marks)
- v. You should read Irving Stones latest novel right away. It is sold over a million copies, and practically everyone in the east African region is talking about it. (2 marks)
- d) Explain whether the following are valid or invalid using all the three syllogism rules
- i. Some great scientists are famous. No TV stars are great scientists. So, some TV stars are not famous. (2 marks)
- ii. Some books written by Kant are not great books. For no great books are books that put their readers to sleep. But some books written by Kant are books that put their readers to sleep. (2 marks)
- iii. No humans are animals. All members of homosapiens are animals. Therefore, no humans are members of homosapiens. (2 marks)
- iv. All values that can be quantified are important values. No human emotions are values that can be quantified. Consequently, no human emotions are important values (2 marks)
- e) Use DeMorgan's Law to write the *negation* of the following statement, simplifying it so that only simple statements are negated: "Calvin is not home or Ben is at the movies." (6 marks)

## QUESTION TWO (20 MARKS)

- a) Define the following terms as used in logic..
- i. Argument (2 marks)
- ii. Disjunction (2 marks)
- iii. Tautology (2 marks)
- iv. Contradiction (2 marks)
- v. Contingency (2 marks)

- b) In a village, there is only one barber who shaves all those, and those only who do not shave themselves. The question is does the barber shave himself? Use symbolic logic to show that the answer leads to a contradiction. (6 marks)
- c) Construct a truth table for the formula  $\neg P \wedge (P \rightarrow Q)$  (4 marks)

### QUESTION THREE (20 MARKS)

- a) Write the following sentences in predicate calculus, using appropriate predicates:
- All big houses are expensive. (4 marks)
  - Any small apartment costs less than any big house. (4 marks)
  - There is only one red house. (4 marks)
- b) Construct a truth table for  $(P \rightarrow Q) \wedge (Q \rightarrow R)$  (4 marks)
- c) Show that  $(P \rightarrow Q) \vee (Q \rightarrow P)$  is a tautology. (4 marks)

### QUESTION FOUR (20 MARKS)

- a) Show that  $(p \rightarrow q) \wedge (q \rightarrow p)$  is logically equivalent to  $p \leftrightarrow q$  (4 marks)
- b) Draw the truth the table for the following  
 $p \wedge (q \vee r)$  (5 marks)
- c) Decide the truth value of the following propositions:
- $\exists x \forall y P(x, y)$ , (2 marks)
  - $\exists x \forall y P(y, x)$ , (2 marks)
  - $\forall x \exists y P(x, y)$ , (2 marks)
  - $\forall x \exists y P(y, x)$ , (2 marks)
- d) Determine whether the following argument is valid: (3 marks)

$$\begin{array}{l}
 p \rightarrow r \\
 q \rightarrow r \neg(p \vee q) \\
 \hline
 \therefore \neg r
 \end{array}$$

### QUESTION FIVE (20 MARKS)

- a) Using your own appropriate sentences, translate the following symbols to English statements.
- i.  $\forall X (a(X) \Leftrightarrow b(X))$  (2 marks)
  - ii.  $\forall X (a(X) \Rightarrow \sim b(X))$  (2 marks)
  - iii.  $\exists X (a(X) \& b(X))$  (2 marks)
  - iv.  $\forall X (a(X) \Leftrightarrow b(X))$  (2 marks)
  - v.  $\forall X (a(X) \Leftrightarrow b(X))$  (2 marks)
- b) Name the form of each of the following categorical statements (A, E, I, or O). Identify the subject and predicate terms in each case, then state the quantity and quality of the statements.
- i. All hungry cannibals are dangerous people. (2 marks)
  - ii. No Kambas are Nairobians. (2 marks)
  - iii. Some diamonds are not valuable objects. (2 marks)
  - iv. No green vegetables are minerals. (2 marks)
  - v. Some outlaws are heroes. (2 marks)
  - vi. All equilateral triangles are geometrical figures. (2 marks)