



KENYATTA UNIVERSITY

EXAMINATION FOR THE DIPLOMA IN (INFORMATION TECHNOLOGY)

SIT 028: INTRODUCTION TO LOGIC

2ND SEMESTER 2023/2024

TIME: 2HOURS

INSTRUCTIONS: Attempt question ONE and any other TWO questions

QUESTION ONE

a) Define the following terms

- i) Contingency (1 mark)
- ii) Tautology (1 mark)
- iii) Proposition (1 mark)

b) Consider the following propositions:

p: All dogs are fierce

q: Spiders hate algebra

Write the compound proposition symbolized by:

- i) $\neg p \rightarrow q$ (2 marks)
- ii) $\neg p \leftrightarrow \neg q$ (2 marks)
- iii) $\neg (p \wedge q)$ (2 marks)

c) Use the truth table method to verify whether the following formulas are valid, satisfiable or unsatisfiable:

- i) $p \vee q \wedge p \rightarrow r \wedge q \wedge q \rightarrow \neg r \wedge p$ (3 marks)
- ii) $p \vee q \wedge \neg q \wedge \neg p$ (3 marks)

- d) Give the parenthesized version of the following compound sentences and in each case determine whether it is a tautology, contradiction or a contingency.
- i) $p \rightarrow q \leftrightarrow \neg q \rightarrow \neg p$ (4 marks)
- ii) $\neg p \vee p \leftrightarrow q$ (4 marks)
- e) Let S = it is sunny, C = camping is fun, H = the homework is done, and M = mathematics is easy. Translate the following proposition into the most natural equivalent statement in English. Try to make the sentence as simple and as natural as possible.
- $(M \rightarrow H) \wedge (S \rightarrow C)$ (4 marks)
- f) Explain what you understand by logical equivalence. Determine whether the following are logically equivalent. $(p \rightarrow q) \wedge (q \rightarrow p)$, $(p \leftrightarrow q)$ (5 marks)

QUESTION TWO

- a) Let p be the proposition 'Kenya University is along Thika Superhighway' and q be 'I'll go to USA'. Write the following propositions symbolically.
- i) If Kenya university is along Thika Superhighway, I'll go to USA. (2 marks)
- ii) Kenya university is along Thika Superhighway or I'll go to USA, but not both. (2 marks)
- iii) If and only Kenya university is not along Thika Superhighway then I'll go to USA. (2 marks)
- b) Consider the two propositions:
- p : John is rich.
- Q : John is dishonest
- Under what circumstances is the compound proposition 'If John is honest then he is not rich' false? (4 marks)
- c) Show that $(p \leftrightarrow q) \wedge q$ logical entails p . Give reason for your answer. (4 marks)
- d) Test the validity of the following arguments
- i) James is either a policeman or a footballer. If he is a policeman then he has a big feet. James hasn't got a big feet so he is a footballer. (3 marks)

- ii) I shall be a lawyer or a banker (but not both). If I become a lawyer then I shall never be rich. Therefore I shall be rich only if I become a banker. (3 marks)

QUESTION THREE

- a) Given the conditional original statement “ If the sky is blue, then it is not raining.” Determine the following,
- i) The converse of the original (2 marks)
 - ii) The inverse of the original (2 marks)
 - iii) The contrapositive of the original (2 marks)
 - iv) Show that the original conditional statement is logically equivalent to its contrapositive (2 marks)
- b) Verify whether the following sentence is valid: (4 marks)
- “If I'll go to a cinema then I'll take a bus, or if I'll take a bus then I'll go to a cinema”.
- c) Show whether the following implications are TRUE or FALSE
- i) If $3=4$, then I am a penguin (2 marks)
 - ii) If this exam is introduction to logic, then I am a student at Mathematics Department (2 marks)
 - iii) If all dogs are fierce, then Kenya is not in East Africa (2 marks)
 - iv) If blue is not a colour, then Dr. Ruto is the president of United States of America (2marks)

QUESTION FOUR

- a) Read the following sentences carefully. Giving reasons for your answer, indicate in each case whether the sentence is a proposition or not. What are the truth values of those that are propositions?
- i) Read the sentence carefully. (2 marks)
 - ii) $4 + x = 5$ (2 marks)

- iii) That's fantastic! (2 marks)
- iv) Johannesburg is the capital city of Zimbabwe. (2 marks)
- v) I am a penguin (2 marks)
- vi) The moon is made of green cheese (2 marks)

b) Write each of these sentences in the form of "if p, then q" in English.

- i) It is necessary to wash the boss's car to be promoted. (2 marks)
- ii) A sufficient condition for the warranty to be good is that you bought the computer less than a year ago. (2 marks)
- iii) Willy gets caught whenever he cheats. (2 marks)

c) Write the following into predicate logic

- i) Every student loves music (1 mark)
- ii) Some students love music (1 mark)

QUESTION FIVE

a) Indicate whether the statement is a simple or a compound statement. If it is a compound statement, indicate whether it is a negation, conjunction, disjunction, conditional, or biconditional by using both the word and its appropriate symbol.

- i) The animal is a mammal if and only if it nurses its young. (3 marks)
- ii) The team leader has decided to take a vacation. (3 marks)
- iii) It is false that whales are fish and bats are birds. (3 marks)

b) For each question, assume that the given proposition is true, perform the required inference, and state the resultant proposition and its truth value.

- i) What is the contrary of "All joggers are escapists"? (1 mark)
- ii) What is the contradictory of "Some tillers are not Snappers"? (1 mark)
- iii) What is the subaltern of "No logic teachers are exciting persons"? (1 mark)
- iv) What is the subaltern of "No disco music is acid rock"? (1 mark)
- v) What is the superaltern of "Some funny cars are dragsters"? (1 mark)

c) Given the truth assignment i as $p^i=0$, $q^i=1$ and $r^i=1$. Using evaluation method, determine whether the following sentences satisfy i and give explanation for your answer.

i) $(p \vee q) \wedge \neg \neg (\neg q \vee r)$

(3 marks)

ii) $(p \rightarrow q) \wedge (q \rightarrow r)$

(3 marks)