MURANG'A UNIVERSITY OF TECHNOLOGY

SCHOOL OF COMPUTING AND INFORMATION TECHNOLOGY

DEPARTMENT OFCOMPUTER SCIENCE

UNIVERSITY ORDINARY EXAMINATION

2020/2021ACADEMIC YEAR

FIRST YEAR **FIRST** SEMESTER EXAMINATION FOR BACHELOR OF SCIENCE IN SOFTWARE ENGINEERING

SCS 102– DISCRETE STRUCTURES

DURATION:2 HOURS

Instructions to candidates:

1. Answer question One and Any Other Two questions.
2. Mobile phones are not allowed in the examination room.
3. You are not allowed to write on this examination question paper.

SECTION A: ANSWER ALL QUESTIONS IN THIS SECTION

QUESTION ONE (30 MARKS)

a) If $P \subset Q$, then what is $P \cap Q$? Illustrate your answer with examples. (5 marks)

b) Explain the difference between **propositional logic** and **predicate logic** giving suitable examples. (4 marks)

c) Show that $P \rightarrow Q \Leftrightarrow \neg P \vee Q$.

d) Given the following tables, show the domain range and relation. (6 marks)

x	-14	-18	-30	9	6
y	-8	22	33	-10	5

e) Show that $(P \rightarrow Q) \vee (Q \rightarrow P)$ is a tautology. (5 marks)

f) Consider four sets P, Q, R and S such that

$P \cap Q \neq \emptyset, P \cap R \neq \emptyset, P \cap S = \emptyset, R \cap S = \emptyset, P \cap Q \cap R = \emptyset$, draw a diagram to visualize this operation. (5 marks)

SECTION B – ANSWER ANY TWO QUESTIONS IN THIS SECTION

QUESTION TWO (20 MARKS)

a) Convert the following predicate logic statements into their corresponding English statements. (8 marks)

i. $\forall_{\boldsymbol{x}}(A_x \rightarrow B_x)$

ii. $\exists_x(A_x \wedge B_x)$

iii. $\exists_x(A_x \wedge \neg B_x)$

iv. $\forall_x(A_x \leftrightarrow B_x)$

b) Answer the following

i. What is a recursive algorithm? (2 marks)

ii. Generate a recursive algorithm that generates factorials (6 marks)

c) Ina class of 100 students, 35 like science and 45 like math. How many like either of them and how many like neither? (4 marks)

QUESTION THREE (20 MARKS)

a) With the aid of a suitable example, explain the meaning of the phrase "ambiguous statements"? (4 marks)

b) Show that the statement $(P \vee Q) \wedge ((\neg P) \wedge (\neg Q))$ (6 marks)

c) Three runners June, Stella and Ken registered for three races as follows, June registered for 100m and 200 m, Stella registered for 100m and Ken registered for 400m. There was a fourth runner named Steve who did not register for any race. Identify the relations involved in this case and use a table to present them. (6 marks)

d) Given that the set $\mathbb{U} = \{1, 2, 3, 4, 5, 6, 7, 8, 9\}$, $A = \{1, 2, 3, 4\}$ and $B = \{3, 4, 5, 6, 7, 8, 9\}$, perform the following operations:

i. $A \cup B$ (2 marks)

ii. B^{cc} (2 marks)

QUESTION FOUR (20 MARKS)

a) Explain why recursive algorithms need a **recursive case** and a **base case**. (6 marks)

b) Give a recursive algorithm that can be used to generate Fibonacci numbers, clearly explaining how it works. (10 marks)

c) Write the inverse of the mapping. (4 marks)