UNIVERSITY COLLEGE TATI

UNIVERSITY COLLEGE TATI (UC TATI)

FINAL EXAMINATION QUESTION BOOKLET	
COURSE CODE	: DGE 3113
COURSE	: DISCRETE MATHEMATICS
SEMESTER/SESSION	: 2-2023/2024
DURATION	: 3 HOURS

Instructions:

1. This booklet contains **4** questions in SECTION A, **3** questions in SECTION B and **2** questions in SECTION C. Answer **ALL** questions.
2. All answers should be written in answer booklet.
3. Write legibly and draw sketches wherever required.
4. If in doubt, raise your hands and ask the invigilator.

DO NOT OPEN THIS BOOKLET UNTIL YOU ARE TOLD TO DO SO

THIS BOOKLET CONTAINS 6 PRINTED PAGES INCLUDING COVER PAGE

SECTION A (50 MARKS)

INSTRUCTION: ANSWER ALL QUESTIONS.

QUESTION 1

(a) Identify each of the following sentences whether it is a proposition or not proposition.

i. Today is Monday. (1 mark)

ii. $x^2+2x+1=0$ (1 mark)

iii. $3+2=6$ (1 mark)

iv. Close the door. (1 mark)

v. Please take off your shoes. (1 mark)

(b) Construct a truth table to determine whether the following statement is TRUE or FALSE.

i. $(\sim p \wedge q) \vee p$ (4 marks)

ii. $(p \vee q) \rightarrow (\sim q \wedge r)$ (6 marks)

QUESTION 2

(a) Find:

i. 37 mod 7 (2 marks)

ii. -19 div 3 (2 marks)

(b) Convert each of the following number to decimal number.

i. $(11101001)_2$ (2 marks)

ii. $(30751)_8$ (2 marks)

iii. $(35A12)_{16}$ (2 marks)

QUESTION 3

(a) Let $A=\{1,2,3\}$ and $B=\{1,2\}$. List the elements in $A\times B$, $B\times A$, $A\times A$ and $B\times B$. (4 marks)

(b) Given $A=\{1,2,3\}$ and $R=\{(1,1),(1,3),(2,2),(2,3),(3,1),(3,2)(3,3)\}$. Determine whether or not the binary relations R defined on the sets A are reflexive, symmetric or transitive. Explain why or why not? Is the relation an equivalence relation? (7 marks)

QUESTION 4

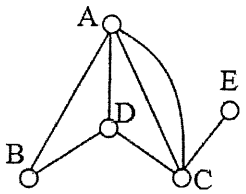

Figure 1

(a) Based on graph as shown in Figure 1, list:

i. the vertex set. (1 mark)

ii. the number of edges and vertices. (2 marks)

iii. the degree of each vertex. (2 marks)

iv. the total degree of the graph. (1 mark)

(b) Suppose a graph has vertices of degree 1,1,4,4, and 6. How many edges does the graph have? If possible draw the graph. (4 marks)

(c) Determine whether or not the graph in Figure 2 is bipartite. Give the bipartition sets or explain why the graph is not bipartite. (2 marks)

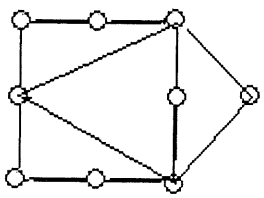

Figure 2

(d) Draw K_5. (2 marks)

SECTION B (30 MARKS)

INSTRUCTION: ANSWER ALL QUESTIONS.

QUESTION 1

(a) If $p \rightarrow q$ is false, determine the truth value of $\sim(p \vee q) \leftrightarrow \sim p$. Explain your answer. (5 marks)

(b) Proof that: "If n is an even integer, then n^2 is also even." (3 marks)

QUESTION 2

(a) Let $a = 95$ and $b = 255$. Find greatest common divisor (gcd) and least common divisor (lcm) for both integers a and b by using prime factorization. (4 marks)

(b) Let $X = \{x \in \mathbb{Z} \mid 0 < x \leq 5\}$, $Y = \{y \mid y(y+1)(y-2) = 0\}$ and $Z = \{1, 2, 3\}$.

i. List the elements in set X and Y. (4 marks)

ii. Find $X \cup Y$, $X \cup Y \cup Z$, $X \cap Y$, $X \cap Y \cup Z$, $X \setminus Y$, and $X \setminus (Y \setminus Z)$. (6 marks)

QUESTION 3

Given a truth table as shown in Table 1.

x	y	$f(x,y)$
0	0	0
0	1	1
1	0	1
1	1	1

Table 1

(a) Find the Boolean expression that represent the function $f(x,y)$. (2 marks)

(b) Construct a circuit from the function in (a). (2 marks)

(c) Minimize the function using Karnaugh maps. (4 marks)

SECTION C (20 MARKS)

INSTRUCTION: ANSWER ALL QUESTIONS.

QUESTION 1

Suppose that an automobile license plate has three letters followed by four digits.

(a) How many different license plates are possible? (2 marks)

(b) How many license plates could begin with A and end on 0? (2 marks)

(c) How many license plates begin with PQR? (2 marks)

(d) How many license plates are possible in which all the letters and digits are distinct? (2 marks)

(e) How many license plates could begin with AB and have all three letters and digits distinct? (2 marks)

(f) How many different license plates are possible if there is no letters O and the digits cannot start with zero (0)? (2 marks)

QUESTION 2

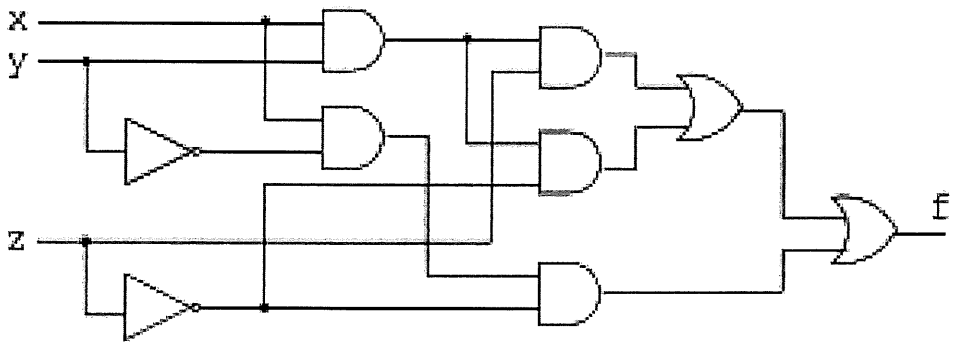

Figure 3

(a) Find the expression for the Boolean function f in Figure 3. (2 marks)

(b) Construct the truth table for the Boolean function in (a). (6 marks)

----------End of questions----------

FORMULA

1. $P(n,r) = \dfrac{n!}{(n-r)!}$

2. $C(n,r) = \dfrac{n!}{r!(n-r)!}$