

**UNIVERSITY COLLEGE TATI (UC TATI)****FINAL EXAMINATION QUESTION BOOKLET**

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| COURSE CODE | : DGE 3113 |
| COURSE | : DISCRETE MATHEMATICS |
| SEMESTER/SESSION | : 1-2023/2024 |
| DURATION | : 3 HOURS |

Instructions:

1. This booklet contains **5** 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 the answer booklet.
3. Write legibly and draw sketches whenever required.
4. If in doubt, raise your hand and ask the invigilator.

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

THIS BOOKLET CONTAINS 7 PRINTED PAGES INCLUDING COVER PAGE

SECTION A (50 MARKS)**INSTRUCTION: ANSWER ALL QUESTIONS.****QUESTION 1**

- a) Determine whether the following sentences are propositions or not.
- $4 + x = 5$. (1 mark)
 - Kemaman is a district in Kelantan. (1 mark)
 - Read the question carefully. (1 mark)
- b) Given set $U = \{10, 15, 17, 25, 30, 37, 50, 55, 60, 65, 70\}$, $A = \{15, 17, 30, 37, 60\}$, $B = \{15, 17, 50, 55, 65, 70\}$ and $C = \{10, 17, 25, 37\}$. List out all elements of the following set:
- $A \cap C$ (1 mark)
 - $A - B$ (1 mark)
 - $A \cap B \cap C$ (1 mark)
 - $(A \cup B)' \cap C$ (2 marks)
- c) Find the inverse function, $f^{-1}(x)$ for each of the following function:
- $f(x) = -x^5 - 7$ (4 marks)
 - $f(x) = \frac{x}{x-1}$ (4 marks)

QUESTION 2

Convert each of the following:

- 4532 to its equivalent octal number. (3 marks)
- $135AB_{16}$ to decimal number. (2 marks)
- 73_8 to its equivalent binary number. (3 marks)

QUESTION 3

- a) Find the number of permutation of the word CODES. (2 marks)
- b) How many ways can prizes be awarded in Mathematics, Science and English subjects in a class contains 25 pupils if no pupil can win more than one prize? (2 marks)

QUESTION 4

Construct a truth table for the following compound proposition.

- a) $(p \rightarrow q) \vee (\neg p \rightarrow r)$ (6 marks)
- b) $[(p \vee q) \wedge (p \rightarrow r) \wedge (q \rightarrow r)] \rightarrow r$ (8 marks)

QUESTION 5

- a) Construct a logic truth table for the Boolean function $F(x, y, z) = \bar{x} \bar{y} \bar{z} + xyz$. (4 marks)
- b) Draw a logic gates circuit for $F(x, y, z) = (\bar{x} + z)(y + \bar{z})$. (4 marks)

SECTION B (30 MARKS)**INSTRUCTION: ANSWER ALL QUESTIONS.****QUESTION 1**

Consider $X = \{1, 2, 3, 4\}$ and its relation, R on X is

$$R = \{(1,1), (2,2), (3,3), (1,3), (1,4), (2,1), (2,3), (2,4), (3,1), (3,4)\}.$$

- a) Is the relation reflexive? Explain your answer. (2 marks)
- b) Is the relation symmetric? Explain your answer. (2 marks)
- c) Is the relation transitive? Explain your answer. (2 marks)
- d) Is the relation is an equivalence relation? (1 mark)

QUESTION 2

- a) The 18 volunteers consist of 5 people from Perak, 6 people from Selangor and 7 people from Terengganu. How many ways are there to form a committee with 7 people if:
 - i. it must consist of 2 people from Perak, 2 people from Selangor and 3 people from Terengganu. (2 marks)
 - ii. it must include exactly 5 people from Terengganu. (4 marks)
- b) A coin is flipped eight times where each flip comes up either heads or tails. How many possible outcomes are there in total? (2 marks)

QUESTION 3

- a) Suppose a graph, G has vertices of degree 1,2,2,3,3,5.
- How many edges does the graph have? (2 marks)
 - If possible, draw the graph. If not possible, explain your answer. (3 marks)
- b) Draw a binary tree to represent the expression $x + ((xy + x) / y)$. (3 marks)
- c) Based on the weighted graph in Figure 1:

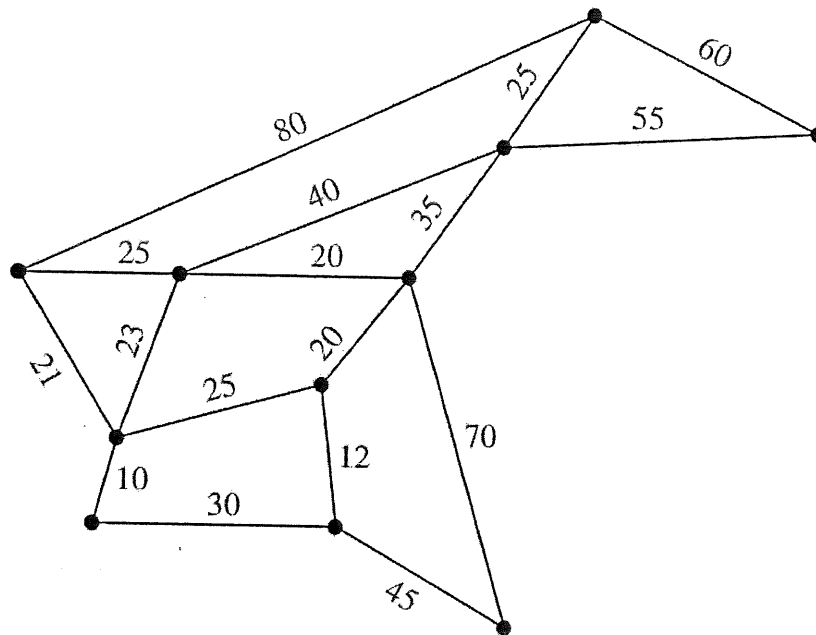


Figure 1

- Draw the Minimal Spanning Tree using Kruskal's Algorithm. (5 marks)
- Calculate the minimum total weight. (2 marks)

SECTION C (20 MARKS)

INSTRUCTION: ANSWER ALL QUESTIONS.

QUESTION 1

Use a proof by contraposition to show that if $3n^2 + 4n + 3$ is even, then n is odd.

(5 marks)

QUESTION 2

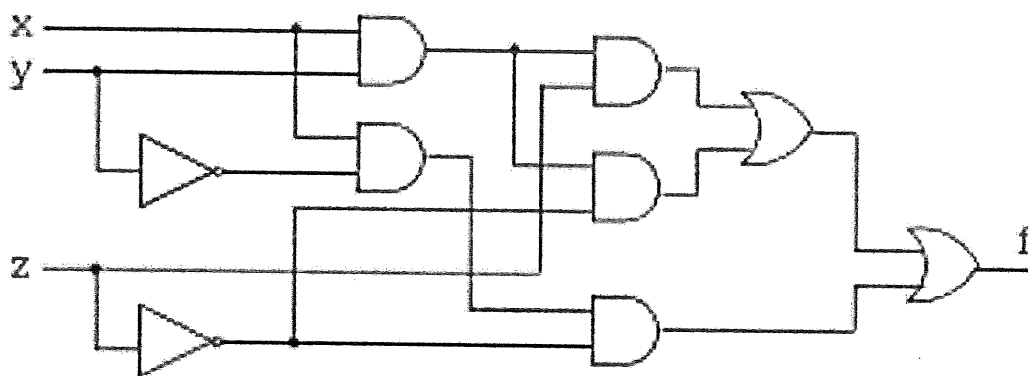


Figure 2

- Find the expression for the Boolean function in Figure 2. (2 marks)
- Construct the truth table for the output. (4 marks)
- Simplified the Boolean function by using Karnaugh Maps. (5 marks)
- Sketch the circuit for the simplified function. (4 marks)

----- End of question -----

FORMULA

Permutation: ${}^n P_n = n!$, ${}^n P_r = \frac{n!}{(n-r)!}$

Combination: ${}^n C_r = \frac{n!}{r!(n-r)!}$

Complement: $\bar{0} = 1$, $\bar{1} = 0$, $0 = F$, $1 = T$

Boolean Sum: $1+1=1$, $1+0=1$, $0+1=1$, $0+0=0$

Boolean Product: $1 \cdot 1 = 1$, $1 \cdot 0 = 0$, $0 \cdot 1 = 0$, $0 \cdot 0 = 0$

| Truth Table | | | | | | |
|-------------|-----|----------|--------------|------------|-------------------|-----------------------|
| p | q | $\neg p$ | $p \wedge q$ | $p \vee q$ | $p \rightarrow q$ | $p \leftrightarrow q$ |
| T | T | F | T | T | T | T |
| T | F | F | F | T | F | F |
| F | T | T | F | T | T | F |
| F | F | T | F | F | T | T |

