

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

COURSE CODE	: DGE 3113
COURSE	: DISCRETE MATHEMATICS
SEMESTER/SESSION	: 1 - 2021/2022
DURATION	: 3 HOURS

Instructions:

1. This booklet contains **6** 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 9 PRINTED PAGES INCLUDING COVER PAGE

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

QUESTION 1

Express the following number to the given bases:

- a) 157 to octal. (2 marks)
- b) 97 to binary. (2 marks)
- c) $(110101)_2$ to decimal. (2 marks)
- d) 1234 to hexadecimal. (2 marks)

QUESTION 2

Perform the computation of $2 - \left(\frac{4}{5} + \frac{1}{3}\right) \times \frac{5}{7}$,

- a) exactly, (1 mark)
- b) using four significant figures rounding-off, (1 mark)
- c) using five significant figures rounding-off, (1 mark)
- d) Compute the percent relative error in (b) and (c). (4 marks)

QUESTION 3

Let $A = \{2, 5, 7, 8, 9, 10\}$, $B = \{1, 3, 7, 9, 10\}$ and $C = \{2, 4, 6, 8, 10\}$. List out all elements of the following set.

- a) $(A \cap B) \cup C$ (2 marks)
- b) $A \cap (B \cup C)$ (2 marks)
- c) $A \cap B \cap C$ (2 marks)

QUESTION 4

a) Which of the following are statements and not statements?

i) The trains are always late. (1 mark)

ii) Welcome to the University College TATI! (1 mark)

iii) $20 - 3 = 12$ (1 mark)

iv) January is the first month of the year. (1 mark)

v) The earth is round. (1 mark)

b) Given A , B and C are propositions as below:

A : Ali comes to the party.

B : Bibi comes to the party.

C : Carlo comes to the party.

Express each of the following propositions in words.

i) $C \leftrightarrow \neg A \wedge \neg B$ (3 marks)

ii) $A \rightarrow B \wedge C$ (3 marks)

QUESTION 5

a) Construct a truth table for the compound proposition $(p \rightarrow q) \vee (\neg p \rightarrow r)$.

(5 marks)

b) Using truth table, show that $[(p \vee q) \wedge (p \rightarrow r) \wedge (q \rightarrow r)] \rightarrow r$ is a tautology.

(5 marks)

QUESTION 6

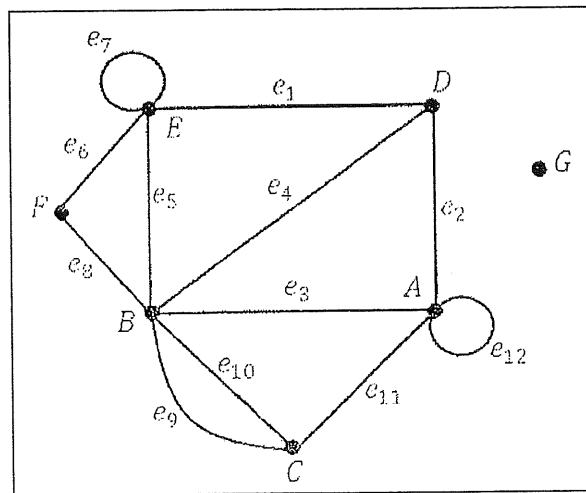


Figure 1

Based on Figure 1 above, find:

- the vertex set, (1 mark)
- the parallel edge, (1 mark)
- the loops, (2 marks)
- the degree of vertex A, B and E, (3 marks)
- the isolated vertices. (1 mark)

SECTION B (30 MARKS)**INSTRUCTION: ANSWER ALL QUESTIONS.****QUESTION 1**Given two functions, $f(x) = 2x - 5$ and $g(x) = 3x + 2$. Find:

- a) $(f \circ g)(x)$ (2 marks)
- b) $f^{-1}(x)$ (3 marks)
- c) $(g \circ f^{-1})(x)$ (4 marks)

QUESTION 2

Consider $A = \{a, b, c, d\}$ and its relation, R on A is

$$R = \{(a, a), (a, b), (a, c), (a, d), (b, a), (b, b), (c, a), (c, c), (d, a), (d, d)\}$$

- 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 3

- a) Find the number of permutations of the following words:
- i) PURPOSE (2 marks)
 - ii) MANILA (2 marks)
 - iii) FULFILL (2 marks)
- b) Six members of a committee of a school are to be selected from 6 male teachers, 4 female teachers and a male principal. Find the number of different committees that can be formed if:
- i) The principal is the chairman of the committee. (2 marks)
 - ii) There are exactly 2 females in the committee. (2 marks)
 - iii) There are not more than 4 males in the committee. (4 marks)

SECTION C (20 MARKS)**INSTRUCTION: ANSWER ALL QUESTIONS.****QUESTION 1**

Figure 2 shows the distances, in m, between six shops in a town. A bread distributor has to send breads to all the shops starting from shop *A* and finishing at shop *F*.

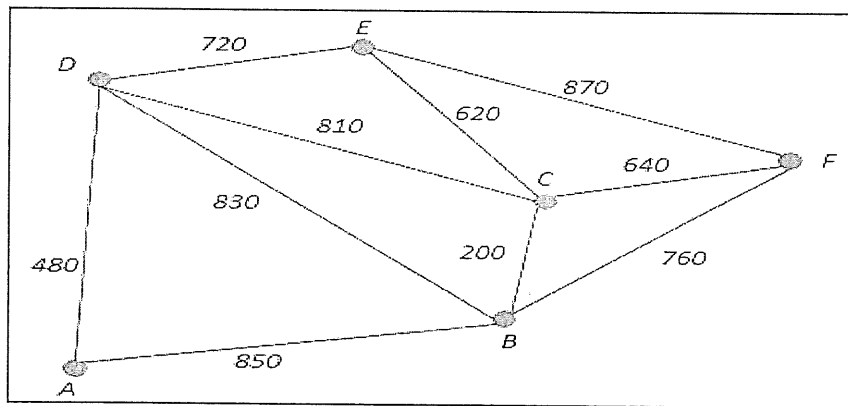


Figure 2

- a) State the shortest route the bread distributor can take from shop *A* to shop *F* with the condition all the shops are visited once only.

(3 marks)

- b) Based on (a), calculate the distance, in km, of the shortest route.

(2 marks)

QUESTION 2

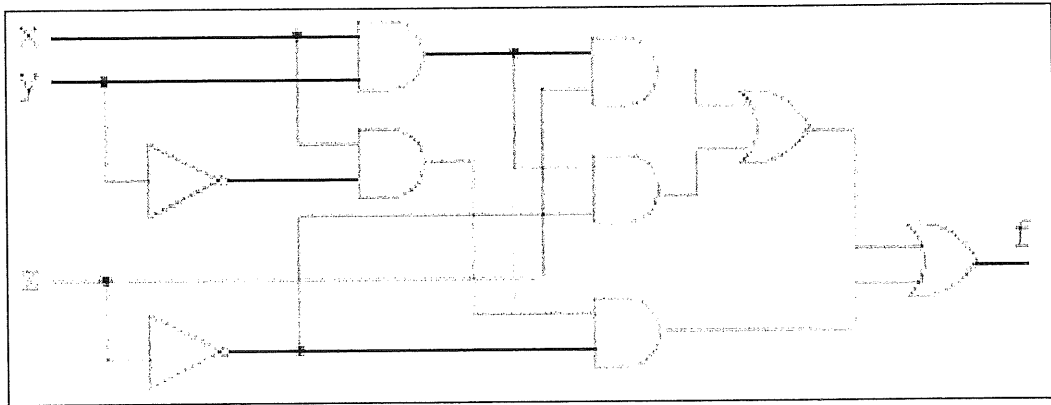


Figure 3

- Find the expression for the Boolean function in Figure 3. (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 QUESTIONS -----

FORMULA

$$\text{Absolute Error} = |\text{Exact} - \text{Approximate}|$$

$$\text{Percent Relative Error} = \left| \frac{\text{Exact} - \text{Approximate}}{\text{Exact}} \right| \times 100\%$$

Permutation with Repetition:

$$n^r$$

Permutation without Repetition:

$${}^n P_n = n!$$

$${}^n P_r = \frac{n!}{(n-r)!}$$

$$\frac{n!}{a!b!c!\dots}$$

Combination with Repetition:

$$C(n, r) = \frac{(n+r-1)!}{r!(n-1)!}$$

Combination without Repetition:

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

Boolean Sum:

$$1+1=1$$

$$1+0=1$$

$$0+1=1$$

$$0+0=0$$

Boolean Product:

$$1 \cdot 1 = 1$$

$$1 \cdot 0 = 0$$

$$0 \cdot 1 = 0$$

$$0 \cdot 0 = 0$$

Complement:

$$\bar{0} = 1$$

$$\bar{1} = 0$$

