

BOWEN UNIVERSITY, IWO
COLLEGE OF COMPUTING AND COMMUNICATION STUDIES
COMPUTER SCIENCE PROGRAMME
B.Sc. FIRST SEMESTER PROGRAMME EXAMINATION 2023/2024 SESSION
COURSE CODE: CSC 207/SEN 203 COURSE TITLE: Elementary Discrete Structures
COURSE CREDIT: 3 DATE: 26/01/2024 TIME ALLOWED: 2HRS 30 MINS
INSTRUCTION: Answer Any Four (4) Questions. Write Very Clearly

QUESTION ONE

(a). Explain what you understand by set and state the methods used in specifying set with examples. **(4 marks)**

(b). Define what you understand by Equivalent Sets hence establish that the following pairs of finite sets below are equivalent

i) Let $A = \{1,2,3,4,5\}$ and $B = \{a,e,i,o,u\}$

ii) $Y = \{\text{English Alphabets}\}$ and $X = \{1,2,3,4,5,6,7,8,9,10,11,12,13, 14,\dots,26\}$

iii) $P = \{\phi\}$ and $M = \{1\}$.

(8 marks)

(c) An investigation of the sporting interests of 100 sports students gave the following information: 50 played football, 43 played squash, 45 played basketball, 12 played football and squash, 13 played squash and basketball, 15 played basketball and football while 5 played all the three games. Using the Venn – Euler diagram, examine the consistency of the data by finding the following:

i) The Number of Students who played football only

ii) The Number of Students who played squash only

iii) The Number of Students who played basketball only.

iv) The Total Number of Students who played all the three games.

(13 marks)

QUESTION TWO

(ai). State what you understand by a Venn- Euler and hence show the relationship between the sets of elements where $E = \{1,2,3,4,5,\dots,11\}$ and $F = \{50,51,52,53,\dots,100\}$. **(5 marks)**

aii). Determine the elements of the following when

$A = \{1, 2, 3, 4\}$, $B = \{3, 4, 5, 6, 7\}$, $C = \{2, 3, 8, 9\}$. Hence, find the following

i) $A \cup B$

(1 mark)

ii) $A \cup C$

(1mark)

iii) $B \cup C$

(1 mark)

iv) $A \cap B$

(1 mark)

v) $A \cap C$

(1 mark)

vi) $B \cap C$

(1 mark)

(b). State and prove the Binomial theorem of the expression ${}^n C_r$. Hence use the binomial

theorem to find the value of $\frac{1}{\sqrt{0.98}}$ correct to 4 places of decimal.

(8 marks)

(c). Define Transpose of a Matrix and show that $(A + B)' = A' + B'$ Where

$$A = \begin{pmatrix} 1 & -1 & 2 \\ 3 & 1 & 4 \\ 2 & 3 & 0 \end{pmatrix} \quad B = \begin{pmatrix} 3 & 0 & 5 \\ 2 & 1 & 3 \\ 0 & -7 & -7 \end{pmatrix}. \quad (6 \text{ marks})$$

QUESTION THREE

(a) Define Logic or Preposition and Using the basic logical operations, consider the following four statements and draw the truth/false table using the variables p and q.

- (i) Bowen have eight colleges in its undergraduate studies and $5+3 = 8$
- (ii) Bowen University, Iwo is located in Lagos and $4+3 = 9$
- (iii) God loves the whole world and $4+4 = 7$
- (iv) Dr. Ayo Olanloye is the Head of Programme of Computer Science and $2+2 = 4$

(10 marks)

(b) Suppose C is a collection of relations S on a set A and let T be the intersection of the relation S, that is $T = \cap (S : S \in C)$.

Hence, prove the following axioms

- i. if every S is symmetric, then T is symmetric. (1.5 marks)
- ii. if every S is transitive, then T is transitive. (1.5 marks)

(c) What do you understand by a subset and explain the partition of S below with respect to the given collections of subsets of $S = \{1, 2, \dots, 8, 9\}$ and the partitions of S are:

- (i) $[\{1, 3, 5\}, \{2, 6\}, \{4, 8, 9\}]$
- (ii) $[\{1, 3, 5\}, \{2, 4, 6, 8\}, \{5, 7, 9\}]$
- (iii) $[\{1, 3, 5\}, \{2, 4, 6, 8\}, \{7, 9\}]$

(5 marks)

(d) Prove by mathematical induction that $8^n - 1$ is a multiple of 7 and state the three main steps involve. (7marks)

QUESTION FOUR

(a) With an example, give a formal description of a graph.

What are the conditions for two graphs G1 and G2 to be homeomorphic? (5marks)

(b) What is the output of a graph traversal?

Distinguish between two main graph traversal algorithms known to you. (5marks)

(c) Define the following terms: -

- i. Groups. (2marks)
- ii. Permutation. (2marks)
- iii. Combinations. (2marks)
- iv. Homomorphism. (2marks).

(d) Explain the term experimental probability. What is its major weakness? (4marks)

e). Compute the following below:

(i) $\frac{13!}{1!}$ (ii) $\frac{7!}{10!}$

(5 marks)

QUESTION Five

- ai) Explain the terms: sample space and independent events.
ii) Five girls and three boys put their names in a box. One name is picked out at random. Without replacing the first name, a second is picked out at random. What is the probability that both names are girls?

(7marks)

(b) The sum of the degrees of the vertices of a graph G is equal to twice the number of edges in G. Verify this theorem for graph G1 of Figure 1.

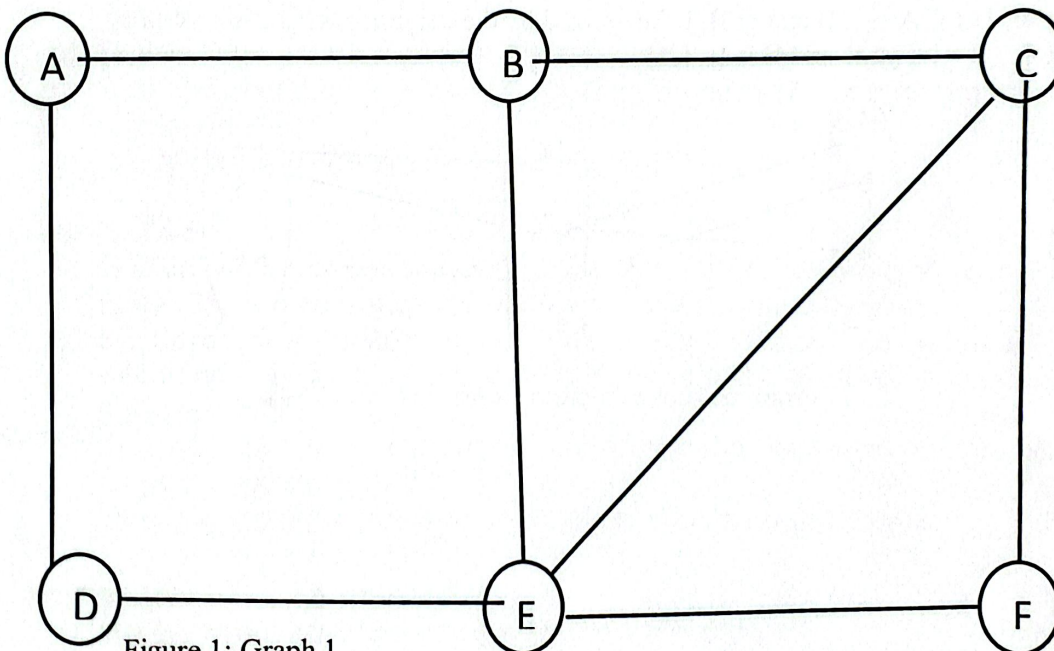


Figure 1: Graph 1

(7marks)

- c) Given that matrix A is an r by s matrix and B is an s by t matrix. What is the order of matrix C where C is the product of matrices A and B?

Given matrix $A = \begin{bmatrix} 2 & -1 \\ 4 & 3 \end{bmatrix}$ and $B = \begin{bmatrix} -1 & 1 \\ -2 & -4 \end{bmatrix}$

Find the product of matrices A and B.

(6marks)

- d) Briefly state the differences between Directed graph and undirected graph

(5marks)

QUESTION SIX

- (ai) Prove that matrix E is skew symmetric, where

$$E = \begin{bmatrix} 0 & -2 \\ 2 & 0 \end{bmatrix}$$

(iii) Given matrix $C = \begin{bmatrix} 1 & 3 \\ 5 & 17 \end{bmatrix}$ and $D = \begin{bmatrix} 3 & 6 \\ 6 & 18 \end{bmatrix}$

Show that $|CD| = |A/B|$.

(9.5marks)

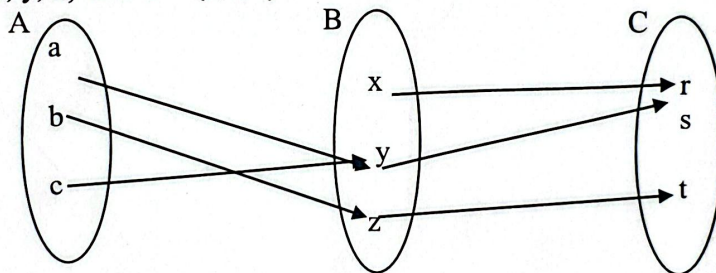
(b) Explain the terms: random experiment and mutually exclusive events.

A number is chosen at random from the set $\{2, 4, 6, \dots, 20\}$. Find the probability that it is a factor of 18 or a multiple of 5.

(8marks)

(ci) List 3 methods of representing a graph.

ii) Let $f: A \rightarrow B$ and $g: B \rightarrow C$ be defined by the diagrams where $A = \{a, b, c\}$, $B = \{x, y, z\}$ and $C = \{r, s, t\}$



From the above diagram Compute (gof): $A \rightarrow C$

(7.5marks)