Umm Al-Qura University

College of Computing

Department of Computer and Network Engineering

CEN0601: Discrete Models

Assignment #2

Term: Fall 2025

Rules for Submitting Homework Assignments:

. Use a text editor to compose your answer to this assignment .

. Accepted file formats are PDF and DOC.

. Homework is only accepted on the due date in the designated assignment on Blackboard (No late submissions are accepted).

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Question 1

Suppose that A = {2, 4, 6}, B = {2, 6}, C = {4, 6}, and D = {4, 6, 8}.

a) Find A ∪ B, A ∪ C, and A ∩ D.

b) Determine which of these statements are true: B ⊆ A, C ⊆ A, B ⊂ D, C ⊂ D.

Answer:

a) A ∪ B = {2,4,6}, A ∪ C = {2,4,6}, A ∩ D = {4,6}.

b) B⊆A: True, C⊆A: True, B⊂D: False, C⊂D: True.

Question 2

Let A = {a, b, c, d} and B = {y, z}. Find:

a) A × B.

b) B × A.

Answer:

a) A×B = {(a,y),(a,z),(b,y),(b,z),(c,y),(c,z),(d,y),(d,z)}.

b) B×A = {(y,a),(y,b),(y,c),(y,d),(z,a),(z,b),(z,c),(z,d)}.

Question 3

Find the sets A and B if $A - B = \{1, 5, 7, 8\}$, $B - A = \{2, 10\}$, and $A \cap B = \{3, 6, 9\}$.

Answer:

$A = (A-B) \cup (A \cap B) = \{1,3,5,6,7,8,9\}$.

$B = (B-A) \cup (A \cap B) = \{2,3,6,9,10\}$.

Question 4

Let A, B, and C be sets. Use the membership table to show that:

$\neg(A \cup B) \cap \neg(B \cup C) \cap \neg(A \cup C) = \neg A \cap \neg B \cap \neg C$

Solution (Membership Table):

A	B	C	¬(A∪B)	¬(B∪C)	¬(A∪C)	¬(A ∪ B) ∩ ¬(B ∪ C) ∩ ¬(A ∪ C)	¬A∩¬B∩¬C
0	0	0	1	1	1	1	1
0	0	1	1	0	0	0	0
0	1	0	0	0	1	0	0
0	1	1	0	0	0	0	0
1	0	0	0	1	0	0	0
1	0	1	0	0	0	0	0
1	1	0	0	0	0	0	0
1	1	1	0	0	0	0	0

Observation: The LHS and RHS columns are identical for all values of A, B, and C, which proves the identity holds true.

Question 5

Determine which of each of these functions from set {a, b, c, d} to itself is one-to-one, onto, or one-to-one correspondence. Mention whether each function is invertible. If invertible, find its inverse.

a) f(a)=b, f(b)=a, f(c)=c, f(d)=d

b) f(a)=b, f(b)=b, f(c)=d, f(d)=c

c) f(a)=d, f(b)=b, f(c)=c, f(d)=d

Answer:

a) One-to-one and onto → bijective → invertible. Inverse: $f^{-1}=f$.

b) Not one-to-one, not onto → not invertible.

c) Not one-to-one, not onto → not invertible.

Question 6

Find the following compositions of the two functions:

$f(x) = (x + 1)/x$, $g(x) = x^2$.

a) $(f \circ g)(x)$ b) $(f \circ f)(x)$ c) $(g \circ f)(x)$ d) $(g \circ g)(x)$

Answer:

a) $(f \circ g)(x) = f(x^2) = (x^2 + 1)/x^2$.

b) $(f \circ f)(x) = f((x + 1)/x) = (2x + 1)/(x + 1)$.

c) $(g \circ f)(x) = g((x + 1)/x) = ((x + 1)/x)^2 = (x + 1)^2/x^2$.

d) $(g \circ g)(x) = g(x^2) = x^4$.