SECI1013: DISCRETE STRUCTURES

SESSION 2025/2026 – SEMESTER 1

ASSIGNMENT 1 (CHAPTER 1 –SET THEORY & LOGIC)

INSTRUCTIONS:

a. This assignment must be conducted in a group. Please clearly write the group members' names & matric numbers on the front page of the submission.
b. Solutions for each question must be readable and neatly written on plain A4 paper. Every step or calculation should be properly shown. Failure to do so will result in the rejection of the submission of the assignment.
c. This assignment consist of 6 questions (31 marks), contributing 5% of overall course marks.

Question 1 **[5 marks]**

Let U be the set Z of all integer numbers and let A, B, C are the subset of U. Given A=$\{x$ is a solution of $x^2 + x - 6 = 0\}$, B={-3,1,2,4} and C=$\{x \in Z | 2 \leq x < 5\}$. Compute :

a) A'
b) $(B - A) \cap C$.
c) $|P(B \cap C)|$

Question 2 **[6 marks]**

Let P,Q and R are sets, prove that $(((P \cup Q) \cap R)' \cup Q')' = Q \cap R$ by showing all laws that used.

Question 3 **[4 marks]**

There are 35 students in the art class and 57 students in the science class. Find the number of students who are either in art class or in science class.

a) When two classes meet at different hours and 12 students are enrolled in both activities. (2marks)
b) When two classes meet at the same hour (2 marks)

Question 1 **[5 marks]**

Let U be the set Z of all integer numbers and let A, B, C are the subset of U. Given A=$\{x$ is a solution of $x^2 + x - 6 = 0\}$, B=$\{-3,1,2,4\}$ and C=$\{x \in Z | 2 \leq x < 5\}$. Compute :

a) A'
b) $(B - A) \cap C$.
c) $|P(B \cap C)|$

$x^2+x-6=0$

$(x+3)(x-2)=0$

$x+3=0 \quad x-2=0$

$x=-3 \quad x=2$

$A=\{-3,2\}$

$B=\{-3,1,2,4\}$

$C=\{2,3,4\}$

$A'=\{x \in Z | x \neq -3 \text{ and } x \neq 2\}$ ✓

(a) $A'=\{\ldots,1,3,4,\ldots\}$ ✓

(b) $(B-A) \cap C$

$B \cap A'=\{1,4\}$

$(B \cap A') \cap C$

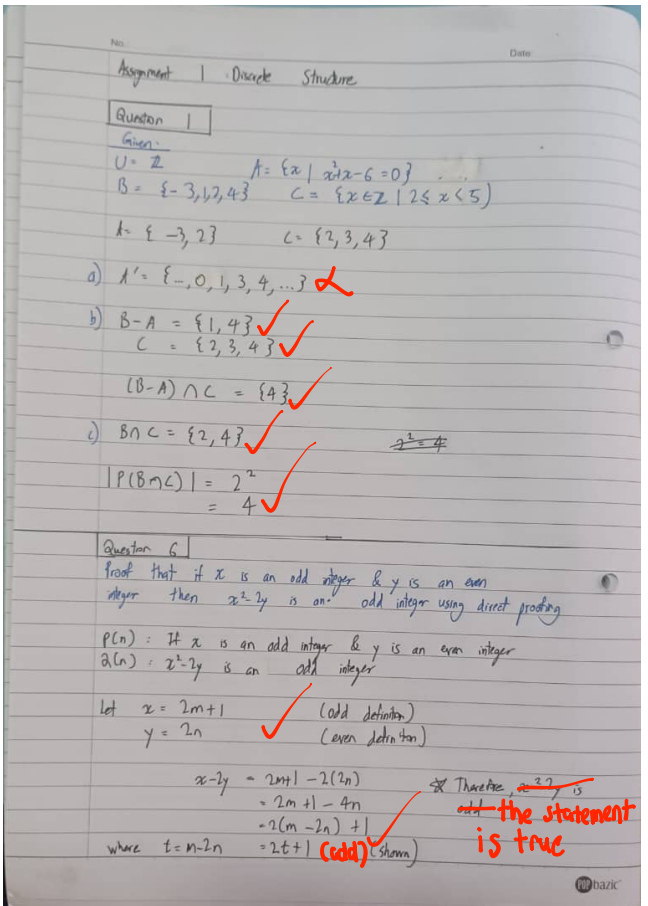
$=\{1,4\} \cap \{2,3,4\}$

$=\{4\}$ #

(c) $B \cap C=\{2,4\}$

$P|B \cap C| = 2^2$

$=4$



Assignment 1 : Discrete Structure

Question 1

Given:

$U = \mathbb{Z}$ $A = \{x | x^2+x-6=0\}$

$B = \{-3,1,2,4\}$ $C = \{x \in \mathbb{Z} | 2 \leq x < 5\}$

$A = \{-3,2\}$ $C = \{2,3,4\}$

a) $A' = \{\ldots,0,1,3,4,\ldots\}$ ✓

b) $B-A = \{1,4\}$ ✓
$C = \{2,3,4\}$ ✓

$(B-A) \cap C = \{4\}$ ✓

c) $B \cap C = \{2,4\}$ ✓ ~~$2^2=4$~~

$|P(B \cap C)| = 2^2$ ✓
$= 4$

Question 6

Proof that if x is an odd integer & y is an even integer then x^2-2y is an odd integer using direct proofing

P(n) : If x is an odd integer & y is an even integer

Q(n) : x^2-2y is an odd integer

let $x = 2m+1$ (odd definition)
$y = 2n$ (even definition)

$x-2y = 2m+1-2(2n)$
$= 2m+1-4n$
$= 2(m-2n)+1$
where $t = m-2n$ $= 2t+1$ (odd) (shown) ✓

* Therefore, ~~x^2-2y is odd~~ the statement is true

Question 2 **[6 marks]**

Let P,Q and R are sets, prove that $(((P \cup Q) \cap R)' \cup Q')' = Q \cap R$ by showing all laws that used.

LHS,

$((C P \cup Q) \cap R)' \cup Q')'$

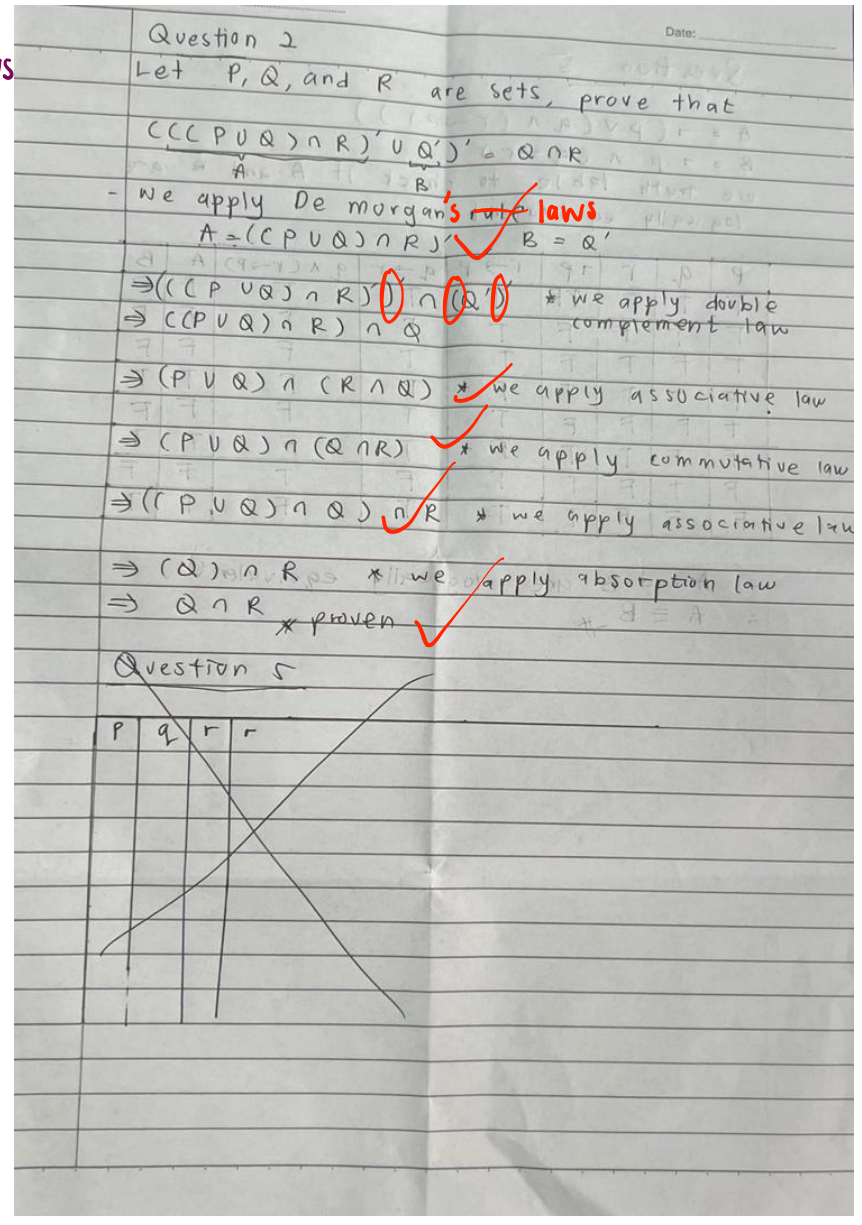
$= ((C P \cup Q) \cap R)'')' \cap (Q')''$ de Morgan's laws

$= (P \cup Q) \cap R \cap Q$ double complement laws

$= Q \cap (P \cup Q) \cap R$ commutative laws

$= Q \cap R$ Absorption laws

(shown)



Question 2

Let P, Q, and R are sets, prove that

$(((P \cup Q) \cap R)' \cup Q')' = Q \cap R$

- we apply De morgan's laws

$A = ((P \cup Q) \cap R)'$ $B = Q'$

$\Rightarrow (((P \cup Q) \cap R)'')' \cap (Q')''$ * we apply double complement law

$\Rightarrow ((P \cup Q) \cap R) \cap Q$

$\Rightarrow (P \cup Q) \cap (R \cap Q)$ * we apply associative law

$\Rightarrow (P \cup Q) \cap (Q \cap R)$ * we apply commutative law

$\Rightarrow ((P \cup Q) \cap Q) \cap R$ * we apply associative law

$\Rightarrow (Q) \cap R$ * we apply absorption law

$\Rightarrow Q \cap R$ * proven

Question 5

p	q	r	r

Question 3 **[4 marks]**

There are 35 students in the art class and 57 students in the science class. Find the number of students who are either in art class or in science class.

a) When two classes meet at different hours and 12 students are enrolled in both activities. (2marks)

b) When two classes meet at the same hour (2 marks)

$A = 35$

$S = 57$

(a) $A \cap S = 12$ ✓

$O.A = 23$

$O.S = 45$

$AUS = 80$

(b) $A \cap S = 0$ ✓

$O.A = 35$

$O.S = 57$

$AUS = 92$

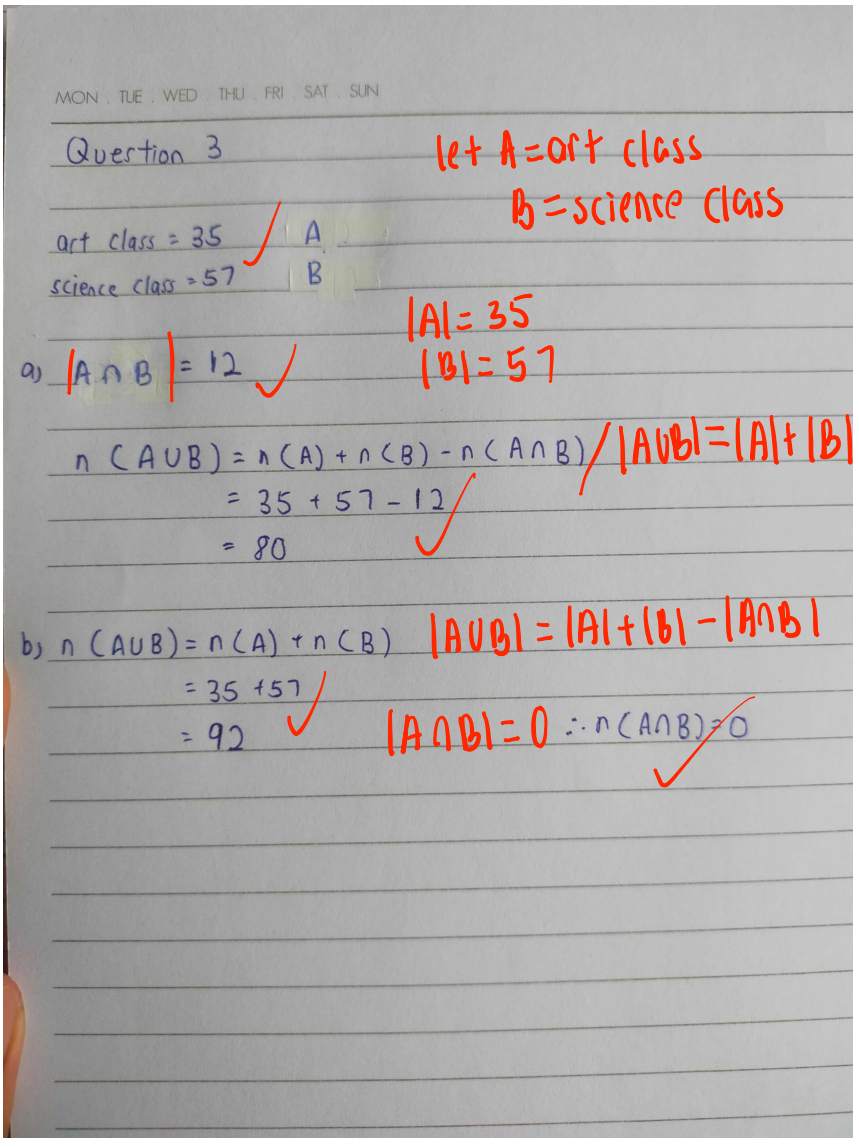
A = set of:

B = set of:

$|A| = 35$

$|B| = 57$

$|A \cup B| = |A| + |B| - |A \cap B|$



MON TUE WED THU FRI SAT SUN

Question 3

let A = art class

B = science class

art class = 35 ✓ A

science class = 57 B

$|A| = 35$

$|B| = 57$

a) $|A \cap B| = 12$ ✓

$n(A \cup B) = n(A) + n(B) - n(A \cap B)$ / $|A \cup B| = |A| + |B| - |A \cap B|$

$= 35 + 57 - 12$ ✓

$= 80$

b) $n(A \cup B) = n(A) + n(B)$ $|A \cup B| = |A| + |B| - |A \cap B|$

$= 35 + 57$ ✓

$= 92$

$|A \cap B| = 0 \therefore n(A \cap B) = 0$ ✓

Question 4 **[6 marks]**

Consider the statement:

"**If you try hard and you have a talent then you will get rich**"

a) Translate the statement into logic symbols. Use p, q and r to represent the propositions. Clearly state which statement is p, q and r.
b) Suppose you found out that the statement was a lie even you try hard. What can you conclude?
c) If you are rich but you do not try hard or have talent. Was the statement true or false? Support your conclusion.

Question 5 **[5 marks]**

Use truth table to check if the compound propositions A and B are logically equivalent.

$$A = \neg(p \vee \big(q \wedge (\mathrm{r} \rightarrow p)\big))$$

$$B = \neg p \wedge (q \rightarrow r)$$

Question 6 **[5 marks]**

Proof that if x is an odd integer and y is an even integer then $x^2 - 2y$ is an odd integer using direct proofing

Question 4 **[6 marks]**

Consider the statement:

"If you try hard and you have a talent then you will get rich"

a) Translate the statement into logic symbols. Use p, q and r to represent the propositions. Clearly state which statement is p, q and r.
b) Suppose you found out that the statement was a lie even you try hard. What can you conclude?
c) If you are rich but you do not try hard or have talent. Was the statement true or false? Support your conclusion.

(a) let p = Try hard
q = You have a talent
r = You will get rich

$(p \wedge q) \rightarrow r$

(b)

p	q	r	$p \wedge q$	$p \wedge q \rightarrow r$
T	T	T	T	T
T	T	F	T	F
T	F	T	F	T
T	F	F	F	T
F	T	T	F	T
F	T	F	F	T
F	F	T	F	T
F	F	F	F	T

Conclude: The statement is false because
Even if you try hard and have talent, there are people who will not get rich.

False

$(p \wedge q) \rightarrow r$
F

(c) $r \rightarrow (p \vee q)$

p	q	r	$(p \vee q)$	$r \rightarrow (p \vee q)$
F	F	T	F	F

The statement is false.

$(p \wedge q) \rightarrow r$
$(F \wedge F) \rightarrow T$
$F \rightarrow T$

Question 5 **[5 marks]**

Use truth table to check if the compound propositions A and B are logically equivalent.

$$A = \neg(p \vee (q \wedge (r \rightarrow p)))$$

$$B = \neg p \wedge (q \rightarrow r)$$

p	q	r	¬p	r → p	q → r	q ∧ (r → p)	p ∨ (q ∧ (r → p))	A	B
T	T	T	F	T	T	T	T	F	F
T	T	F	F	T	F	T	T	F	F
T	F	T	F	T	T	F	T	F	F
T	F	F	F	T	T	F	T	F	F
F	T	T	T	F	T	F	F	T	T
F	T	F	T	T	F	T	T	F	F
F	F	T	T	F	T	F	F	T	T
F	F	F	T	T	T	F	F	T	T

✓

$A \equiv B$

A and B are logically equivalent

Question 6 **[5 marks]**

Proof that if x is an odd integer and y is an even integer then $x^2 - 2y$ is an odd integer using direct proofing

P(x) = x is an odd integer and y is an even integer

Q(x) = $x^2 - 2y$ an odd integer

let $x = 2a+1$

$y = 2b$

$$x^2 - 2y = (2a+1)^2 - 2(2b)$$

$$= 4a^2 + 4a + 1 - 4b$$

$$= 2(2a^2 + 2a - 2b) + 1$$

$$= 2(2a^2 + 2a - 2b) + 1 \quad (\text{odd})$$

let $2a^2 + 2a - 2b = t$

$x^2 - 2y = 2t + 1$ (odd) ✓

The statement is true ✓