



**SECI1013: DISCRETE STRUCTURE**  
**SESSION 2022/2023 – SEMESTER 1**  
**ASSIGNMENT 1 (PART 1) – CHAPTER 1**

**INSTRUCTIONS:**

1. This assignment must be conducted in a group (**3 or 4 students**).  
Please clearly write the **group members name and matric number** in the front-page of the submission.
2. 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 rejection of the submission of assignment.
3. For submission, scan and combine all answer/solution sheets as one PDF file.  
Then only ONE group member needs to submit on behalf of the group via e-learning  
**(Due date : 28 October 2024)**

**QUESTIONS**

1. Let the universe be the set  $U = \{x \in \mathbb{Z}, 0 \leq x \leq 20\}$ ,  
 $A, B$ , and  $C$  denote the subsets of  $U$ ,  
 $A = \{p | p \in \text{prime numbers}, 0 \leq p \leq 20\}$ ,  
 $B = \{e | e \in \text{even numbers}, 10 \leq e \leq 20\}$ ,  
 $C = \{o | o \in \text{odd numbers}, 0 \leq o \leq 10\}$

Write down all possible outcomes with the following set operations:

- a.  $A \cap C \cup B$
- b.  $P(A \cap B \cup C)$
- c.  $A \setminus C$

Determine the cardinality of the following set:

- d.  $|A|, |B|, |C|$
- e.  $|P(A \cap C)|$

Answer the following set operations with True or False:

- f.  $B \subset C'$
- g.  $(A \cup B \cup C) \subseteq U$

2. Let  $A, B$ , and  $C$  denote the subsets of  $U$ ,  
then show the following set operations and statements are equal or not using properties of set/set identities or Venn diagram:
  - a.  $(A \setminus C') \cup (B \setminus C) = A \cup B$

b.  $(A \cap B) \cup (A \setminus B) = A$

3. Books in the university library are categorized into Social Science (S), Science & Technology (T) and Engineering (E). Alphabets a-g is used to catalogue books in category S, alphabets h-q for category T and the p-z for category E. However, alphabets o, u, x and i are excluded. Some alphabets are used more than once in different categories.

Determine the following sets.

- a) S, T, E
- b)  $S \times (T \cap E)$

4. Let  $A = \{a, \{a\}, b, \{a, b\}\}$ . State whether the following statement is TRUE or FALSE

- a)  $\{a\} \subseteq A$
- b)  $\{a, b\} \in A$

5. State whether  $Q \equiv R$  or not.

Show the truth table as the proof of your work for each of the following statements:

- a.  $Q = (p \wedge r) \vee (q \vee \neg r), R = (p \vee q) \vee \neg r$
- b.  $Q = (p \wedge r) \vee \neg(p \wedge \neg q), R = (p \wedge r) \rightarrow (q \vee r)$

6. Let  $D = \{1, 3, 5, 7, 8, 9\}$ . Decide whether each of the following statements is true for all elements of  $D$ . For each that are not, give a counterexample. That is, provide an element in  $D$  for which the statement is not true.

- a)  $x$  is even and  $x > 7$
- b)  $x$  is not odd and  $x \leq 7$

7. Let  $P(x)$  be the statement " $x$  can speak Arabic" and let  $Q(x)$  be the statement " $x$  knows computer language C++". Express the following sentence in term of  $P(x)$ ,  $Q(x)$ , quantifiers, and logical connectives. The domain for quantifiers consists of all students at your faculty.

There is a student at your faculty who can speak Arabic and who knows C++.

8. Prove the following theorem using direct proof method.

For all integers, if  $a$  is odd then  $a^2 - 3a$  is even

9.  $n^2$  is an odd integer then  $n$  is odd. Proof using contradiction proof method.