INFORMATION TECHNOLOGY UNIVERSITY

Assignment # 01

Course Name	Discrete Structures (SE103T)
Course Instructor	Mr. Abdul Basit
Semester	Spring 2024
Teaching Assistant	Harmain Asghar

Student Name	
Student Roll No	

CLOs	Descriptions
1	Analyze mathematical arguments using propositional logic and rules of inference.
2	Apply set operations build sequences and compute summations.
3	Solve various computing problem using combinatorics, graphs and trees.

Marks Distribution						
Q1/15 **CLO-1**	**Q2/18** **CLO-1**	**Q3/10** **CLO-1**	**Q4/22** **CLO-1**	**Q5/10** **CLO-1**	**Q6/25** **CLO-1**	**Total/100**

Instructions:

1. This assignment will access your CLO-1 as per OBE.
2. Assignment will be accepted in both form hand written and soft form (both are mandatory).
3. All questions are required to be solved to get full marks.
4. You need to print the first page of the assignment and attach it on the front of your submission.
5. Solution of questions should be neat and precise otherwise will be marked direct zero.
6. In case of plagiarism, both parties will get zero marks in two assignments.
7. Consult the textbook for reference and help. Do not copy any content from the book without referring to it.

Question: 01 [5+5+5]

a. Prove that the statements ¬ (P→Q) and P ∧ ¬Q are logically equivalent without using truth tables.

b. Prove (p ∧ q) → (p ∨ q) ≡ T.

c. According to propositional logic is the following a tautology, a contradiction or a contingent? Proof by using table ¬(A ∧ (¬B))↔(A→B).

Question: 02 [6+6+6]

a. Show that ¬ (p ↔ q) and p ↔ ¬q are logically equivalent.

b. Show that each conditional statement is a tautology without using truth table.

(p ∧ q) → (p → q).

c. According to propositional logic is the following a tautology, a contradiction or a contingent? Proof by using truth table.

¬ (A∧(¬B))↔(A→B)

Question: 03 [5+5]

Show that the following are tautologies:

a. (a) P V (~P).
b. (b) (P V q) V [(~p) ∧ (~q)].

Question: 04 [12+10]

1. Make a truth table for the statement

a. (P∨Q) → (P∧Q).

b. ~ (p ∧ q) ∧ (~r).

2. Determine whether these bio-conditional are true or false (T stands for a tautology & F stands for a contradiction)?

a. $p \vee T$

b. $F \wedge p$

c. $\bar{T} \vee F$

d. 2+2=4 if and only if 1+1=2

e. 1+1=3 if and only moneys can fly.

Question: 05 [2+2+2+2+2]

What is negation of each of these propositions?

a. One Plus smartphone has at least 32GB of memory. ”
b. Every student in your class has taken a course in calculus.
c. There is a student in this class who has taken a course in calculus.
d. The summer is Maine is hot and summer.
e. There are 13 items in a baker’s dozen.

Question: 06 [8+12+5]

1. Evaluate each of these expressions.

   a. $1\ 1000 \wedge (0\ 1011 \vee 1\ 1011)$.
   b. $(0\ 1111 \wedge 10101) \vee 0\ 1000$.
   c. $(0\ 1010 \oplus 1\ 1011) \oplus 0\ 1000$.
   d. $(1\ 1011 \vee 0\ 1010) \wedge (1\ 0001 \vee 1\ 1011)$.

2. Construct a combinational circuit using inverters, OR gates, and AND gates that produces the output $(p \wedge \sim r) \vee (\sim q \wedge r)$ from input bits p, q, and r.

3. How can this English sentence be translated into a logical expression?

   “You can’t ride the roller coaster if you are under four feet tall unless you are older than 16 years old.”