**Larbi Ben Mh'idi University Oum el Boughi**
**Academic Year: 2023/2024**
**Department of Computer Science**
**Second Year L.M.D-Computer Science**
**Module: Mathematical Logic**
**Module Coordinator: Dr. Boussaha K.**

## TD Series No. = 01

### Exercise 1

Let (P), (Q), and (R) be three propositions. Give the negation of:
a) (P) and (not(Q) or (R))
b) ((P) and (Q)) $\Rightarrow$ (R)

### Exercise 2

Let P   P: "It is raining."
Negate the statements:
 a) P
 b) (P∧Q) where Q: "I have an umbrella."

### Exercise 3

Among the following assertions, which are true, which are false, and why?
1. (2 < 3) and (2 divides 4)
2. (2 < 3) and (2 divides 5)
3. (2 < 3) or (2 divides 5)
4. (2 < 3) and not(2 divides 5)
5. not(2 < 3) or (2 divides 5)

### Exercise 4

Evaluate the truth value of the expression (P$\Rightarrow$Q)∧(Q$\Rightarrow$R) for the following values:
P=T,Q=T,R=F

### Exercise 5

Let the propositions (P) "I have my driver's license" and (Q) "I am over 18 years old."
Are the propositions (P) $\Rightarrow$ (Q) and (Q) $\Rightarrow$ (P) true?
What can we conclude?

## Exercise 6

1. Show that the formula $(\alpha \wedge \beta) \Rightarrow \gamma$ is logically equivalent to the formula $\alpha \Rightarrow (\beta \Rightarrow \gamma)$, where $\alpha$, $\beta$, and $\gamma$ are any propositional variables.
2. Consider the formula $E = ((A \wedge B \wedge C) \Rightarrow (A \leftrightarrow (\neg B \vee C)))$, in which A, B, and C are propositional variables.
   Determine a formula logically equivalent to E, written without any other connector symbols than $\Rightarrow$ and $\leftrightarrow$.

## Exercise 7:

Let A, B, and C be three assertions. For each of the following assertions:
Write its negation.
1. (A) and (not(B) or (R))
2. ((A) and (B)) $\Rightarrow$ (C)
3. (A and not(B))
4. (A or not(B))
5. (A or (B and C))
6. (A and (B and C))
7. (A $\Rightarrow$ not(B))
8. (A $\Rightarrow$ (B))
9. (not(A or B) $\Rightarrow$ C)
10. ((A and B) $\Rightarrow$ not(C))

## Exercise 8:
Construct the truth tables for the following formulas:
1. $\neg p \Rightarrow p \vee q$
2. $\neg p \vee \neg q$
3. $(P \vee Q) \wedge \neg R$

## Exercise 9
If P: "I will study," Q: "I will pass," and R: "I will celebrate," write the compound statement and determine its truth value for P=T,Q=F,R=T
**Statement:** "If I study, then I will pass, and if I pass, then I will celebrate."