

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 = 02 part 02 (propositional logic : semantics)

Conjunctive and disjunctive normal forms with conversion algorithms

Exercise 01:

Given the following logical expressions, determine if they are in CNF, DNF

1. $(A \vee B) \wedge (C \vee D)$
2. $A \wedge (B \vee C) \wedge (D)$
3. $(A \wedge B) \vee (C \wedge D)$
4. $(A \vee B) \wedge (C)$
5. $A \vee (B \wedge C)$

Exercise 02:

Using the conversion algorithm, find the disjunctive normal forms

- a. $(A \vee B \vee C) \wedge (C \vee \neg A)$
- b. $(A \vee B) \wedge (C \vee D)$
- c. $\neg((A \vee B) \rightarrow C)$
- d. $A \wedge (B \vee C)$
- e. $(A \vee B) \wedge C$
- f. $\neg A \vee (B \wedge C)$

Exercise 03:

Using the conversion algorithm, find the conjunctive normal forms

- a. $(A \vee B) \rightarrow (C \wedge D)$
- b. $(A \vee (\neg B \wedge (C \vee (\neg D \wedge E))))$
- c. $A \leftrightarrow (B \wedge \neg C)$
- d. $A \vee (B \wedge C)$
- e. $(A \wedge B) \vee C$
- f. $A \rightarrow (B \vee C)$
- g. $\neg(A \vee B)$

Exercise 04:

1. demonstrate that the following formula is valid :

$$F = (a \wedge \neg b) \vee (\neg a \wedge \neg (b \vee c)) \vee (\neg c \wedge b) \vee (b \wedge c \wedge a) \vee (c \wedge \neg a).$$

2. Deduce (without proof) what can be said about the validity of the following formula A:

$$A = (a \rightarrow b) \wedge (\neg a \rightarrow (b \vee c)) \wedge (\neg c \rightarrow \neg b) \wedge ((b \wedge c) \rightarrow \neg a) \wedge (c \rightarrow a).$$