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
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TD Series No. = 02 part 01 (propositional logic : syntax)

Exercise 01: transform the following sentences in propositional logic

1. If it rains, then the picnic will be canceled.
2. The cake is delicious and the coffee is hot.
3. Either the store is open or the store is closed
4. If I study hard, I will pass the exam
5. The weather is nice, but I have to work
6. If it is my birthday, then I will have a party unless it rains
7. I will go for a walk if and only if the weather is nice
8. Not all birds can fly
9. It is either raining or snowing

Exercise 02: the same question

Let p be the proposition 'X estimates Y' and q be the proposition 'Y estimates X

1. **Sentence**: "X estimates Y but Y does not return his esteem."
2. **Sentence**: "X and Y esteem each other."
3. **Sentence**: "X and Y hate each other."
4. **Sentence**: "Y is esteemed by X but X is hated by Y."
5. **Sentence**: "X and Y do not hate each other."

Exercise 3:

By associating the elementary statements: 'Paul is a student,' 'Quentin is a student,' and 'Rene is a student' with the propositions p, q, and r, respectively; associate each of the following sentences with the propositional formula that seems to correspond semantically:

1. Paul and Quentin are students.
2. Paul or Quentin is a student.
3. Exactly one of Paul and Quentin is a student.
4. Neither Paul nor Rene are students.
5. At least one of the three is not a student.
6. Only one among the three is not a student.
7. Exactly two among the three are students.
8. If Paul is a student, then Quentin is a student.
9. If Paul is a student, then Quentin is a student; otherwise, Quentin is not a student.

10. Paul is a student if and only if Rene is.
11. That Rene is a student is a necessary condition for Paul to be one.
12. That Rene is a student is a sufficient condition for Paul to be one.
13. That Rene is a student is a necessary and sufficient condition for Paul to be one.
14. Paul is a student only if exactly one of the other two is.
15. If Paul is a student, then at least one of the other two is not."

Exercise 4

Let p and q be two propositional variables meaning respectively “it is cold” and “it is raining”. Write a simple sentence corresponding to each of the following formulae:
1. ¬p,

2. p ∧ q,

3. p ∨ q,

4. q ∨ ¬p,

5. ¬p ∧ ¬q,

6. ¬¬q

Exercise 5:

Let p and q be two propositional variables such that p represents the proposition “the child knows how to read” and q represents the proposition “the child knows how to write”. Translate the following formulae into natural language sentences:

1. (p∧q),
2. (p∧¬q),
3. (q⟶p),
4. (¬p∨¬q),
5. (p⟶¬q),
6. ¬ ¬(p∧q)

Exercise 6:

Three tourists each make a statement:

- **1st tourist**: "We visited the Bardo Museum and the Essay Garden but not the Museum of Fine Arts."
- **2nd tourist**: "We visited the Museum of Fine Arts and the Essay Garden but not the Bardo."
- **3rd tourist**: "We visited the Bardo and the Museum of Fine Arts but not the Essay Garden "

Knowing that each tourist lies once and only once in their statement, what did they actually visit?