

Exercise Sheet 1

Exercise No. 01

For each of the following statements: Decide whether it is a **proposition** or not. If it is a proposition, indicate whether it is **True** or **False**. If it is not a proposition, explain why.

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|--|------------------------------|
| 1. 12 is an even number. | 6. Is the network connected? |
| 2. $x + 3 = 7$ | 7. $10 < 3$ |
| 3. Close the window. | 8. Stop the program! |
| 4. The program has finished execution. | 9. Oran is in Egypt. |
| 5. 5 is a prime number. | 10. $y > 0$ |

Exercise No. 02

Check whether the following sentences can be translated into propositional logic. If so, indicate for each sentence the corresponding propositional variables.

1. Imad enrolled in second year computer science.
2. ChatGPT is an AI text generator developed by OpenAI.
3. If I turn off the laptop then the stored data are lost.
4. Salim comes to the party if and only if Amine comes and Kamel does not come.
5. It is not true that Salim will come if Amine or Kamel comes.
6. Salim comes to the party on condition that Kamel does not come, but if Kamel comes, Amine does not come.
7. The server is not only running, but it is also connected to the network.
8. If Salim is brave and intelligent then John is not happy.
9. Ask a question.
10. In case of bad weather, or if too many participants are absent, the session will be postponed.
11. Computers facilitate administration but also teaching.
12. What is your email address?
13. Computers make administration easier and may or may not make teaching easier.
14. You did a really good job!
15. five plus two.
16. An empty battery is a sufficient condition for the laptop to turn off.
17. Installing the software is not a sufficient condition for it to run correctly.

Exercise No. 03

Put parentheses according to the connector precedence.

1. $p \wedge q \Rightarrow r \vee \neg s$

4. $\neg p \Rightarrow \neg q \wedge r$

2. $\neg p \vee \neg q \wedge r$

3. $\neg p \Leftrightarrow q$

5. $\neg p \Rightarrow \neg q \Leftrightarrow r$

Exercise No. 04

By interpreting p as “I leave”, q as “you stay”, and r as “there’s no one”, formalize the following formulas into natural language sentences:

$$p \wedge \neg q \Rightarrow r \quad \neg p \vee \neg q \Rightarrow \neg r$$

Exercise No. 05

Which of the following formulas are well-formed formulas?

1. $((p \Rightarrow q) \wedge \neg p) \Rightarrow \neg q$

4. $\neg(\leq (q \wedge p))$

2. $\neg(p \Rightarrow (q = p))$

5. $p - q$

3. pq

6. $(p \Rightarrow \neg q) \Leftrightarrow r$

Exercise No. 06

For each of the following formulas, draw a parsing tree, present their sub-formulas, and calculate the depth and complexity of each formula.

1. $(\neg p \vee q) \wedge (p \wedge \neg q)$

4. $((q \Rightarrow r) \wedge (r \Rightarrow s)) \Rightarrow (q \vee s)$

2. $(p \Rightarrow q) \Leftrightarrow (\neg p \Rightarrow \neg q)$

3. $[(p \Rightarrow q) \wedge \neg p] \Rightarrow \neg q$

5. $(\neg p \Rightarrow q \wedge r) \Leftrightarrow ((s \Rightarrow \neg p \wedge r) \Leftrightarrow \neg q \wedge s)$