Exercises 1.2: Propositional logic

1. Calculate the result of the following expression:
   $((10 > 3 + 4) \vee (3 * 2 <= 2)) \wedge \neg((4! = 3) \vee (5 == 5))$

2. Which of the following expressions is equivalent to $\neg(a! = 3 \vee a == 5)$?
   a. $a == 3 \vee a! = 5$
   b. $a! = 3 \wedge a == 5$
   c. $a! = 3 \vee a == 5$
   d. None of the above

3. Consider the following problem:
   A, B and C are the three only finalists in a quiz show. After a few days competing with each other, the last day finally arrived. At this time, A wins if A's score is greater than B's and also greater than C's. B wins only if A's score is not greater than B and B's is greater than C's. Finally, C wins only if A's score is greater than B's but not greater than C's or if A's score is not greater than B and B's score is not greater than C.
   Which of the following logical expressions describes the scores of A, B and C if C is the winner?
   a. $(a < b < c) \vee ((a > b) \wedge (a > c))$
   b. $(a < b) \wedge (b < c)$
   c. $((a > b) \wedge (a <= c)) \vee ((a <= b) \wedge (b <= c))$
   d. None of the above

4. Represent with logic variables the following sentences. Then, apply the NOT operator to all of them and find equivalent sentences by applying De Morgan's Laws.
   a. Luke is Darth Vader's son and has a high level of midichlorians. But, he hasn't been seduced by the dark side.
   b. Morgan is a pirate and Morgan is a mathematician.
   c. Morgan is a pirate or Morgan is a mathematician.
   d. The temperature is higher than 20 and the pressure is lower than 10.
   e. The temperature is higher than 20 or temperature is lower than 5 and the pressure is higher than 10.

5. Write the following expressions in logical language.
   a. You want to grant a special discount to any client buying books over 100 euros or over 50 euros if one of them is a Computer Science book. Let's use the names *money*, and *CS* to represent the previous information.

b. You allow your children to watch TV if it is Friday from 17h00 to 21h00, Saturday or Sunday until 19h00 or if tomorrow is holiday. Anyway, they should have had good behavior. Let's use the names *day*, *hour*, *tomorrow* and *behavior* to represent the previous information.