

## Tutorial 1 – Propositional Logic

### Exercise 1:

Write the semantics (i.e. truth table) for the following logical conjunctions: negation, conjunction, disjunction, implication, equivalence, and XOR, NAND, NOR.

### Exercise 2: Formalize into the propositional logic:

- It's raining or dark.
- Either the sun is shining or it's dark.
- If it's dark, it's night.
- It's raining and dark outside, this night won't be short.
- If my account improves, I'll go for a beer.
- Only if my account improves, I'll go for a beer.
- A natural number is even if it's an integer divisible by two.
- It's not true that two is both even and odd.
- If 6 is even, then it's not a prime number.



**Exercise 3:** Determine the truth function using the table, decide whether the formula is satisfiable, tautology or contradiction. If the formula is satisfiable, determine all its models.

- $(p \wedge \neg q) \supset (\neg p \supset (q \vee p))$
- $[(p \vee \neg q) \wedge \neg(p \wedge q)] \supset (\neg p \vee q)$
- $(p \supset q) \equiv (p \wedge \neg q)$
- $(p \supset q) \equiv (\neg q \supset \neg p)$
- $[(p \vee \neg(p \wedge q)) \supset (\neg p \vee q \vee p)] \supset (p \equiv q)$

### Exercise 4:

Formalize and decide, using a truth table, whether the argument is valid (i.e., for each evaluation in which the assumptions are true, the conclusion is also true).

- If I can choose, I'll choose the iPhone.  
I can choose.  
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I'll choose the iPhone.
- If I can choose, I'll choose iPhone.  
I can't choose.  
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I don't choose iPhone.
- If I can choose, I'll choose the iPhone.  
I can't choose.

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I'll get a Huawei.

- d) Either I play football or I play the piano.  
I won't play the piano.

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I'll play football.

- e) The sun's not shining or I'm wearing sunglasses.  
The sun's not shining.

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I don't wear sunglasses.

- f) She's in class or wandering around the school.  
If he's in class, he's a model student.

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If he's not a model student, then he's wandering around the school.

- g) It is not true that the student knows Java and C++. The student doesn't know Java.

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The student doesn't know C++.

- h) The sun is shining and it's raining.  
It's not raining.

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I'm drinking beer.