Trainers Support

Algorithmic Thinking

# Algorithmic Thinking for Migrants Teachers Education

2021-1-EL01-KA210-ADU-000035033

## HANDOUT #1

## TITLE: LOGICAL THINKING

ΙΔΡΥΜΑ ΚΡΑΤΙΚΩΝ ΥΠΟΤΡΟΦΙΩΝ IKY

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# LESSON #1 - LOGICAL THINKING



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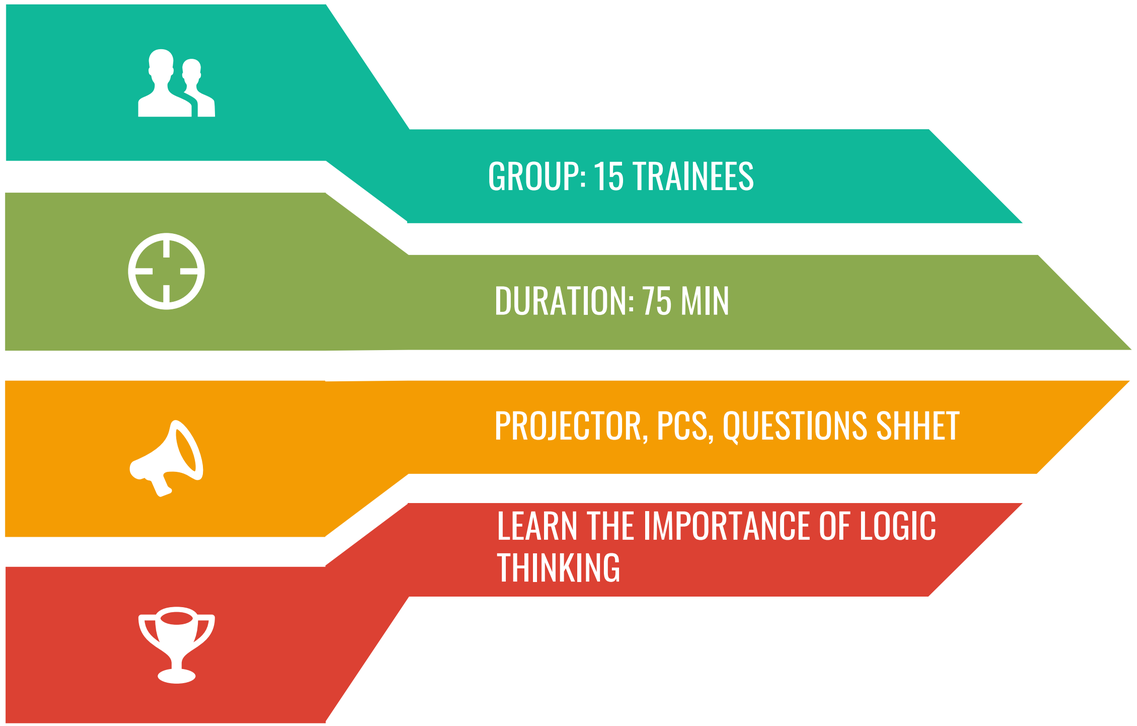
## LESSON REQUIREMENTS

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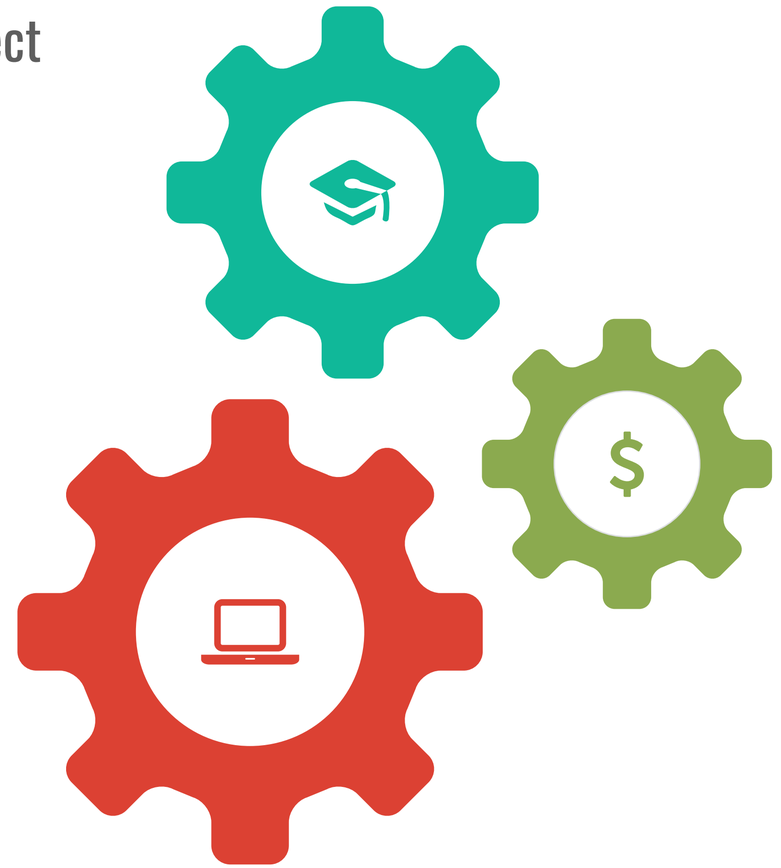
## WHAT IS LOGIC???

Put simply, logic is a system used for distinguishing between correct and incorrect arguments. By '**argument**', I'm not referring to two people in a shouting match. I mean the philosophical idea of an argument;

***namely a chain of reasoning that ends up in a conclusion***.



Example:

- Yannis is a man
- All men are mortal
- Therefore, Yannis is mortal



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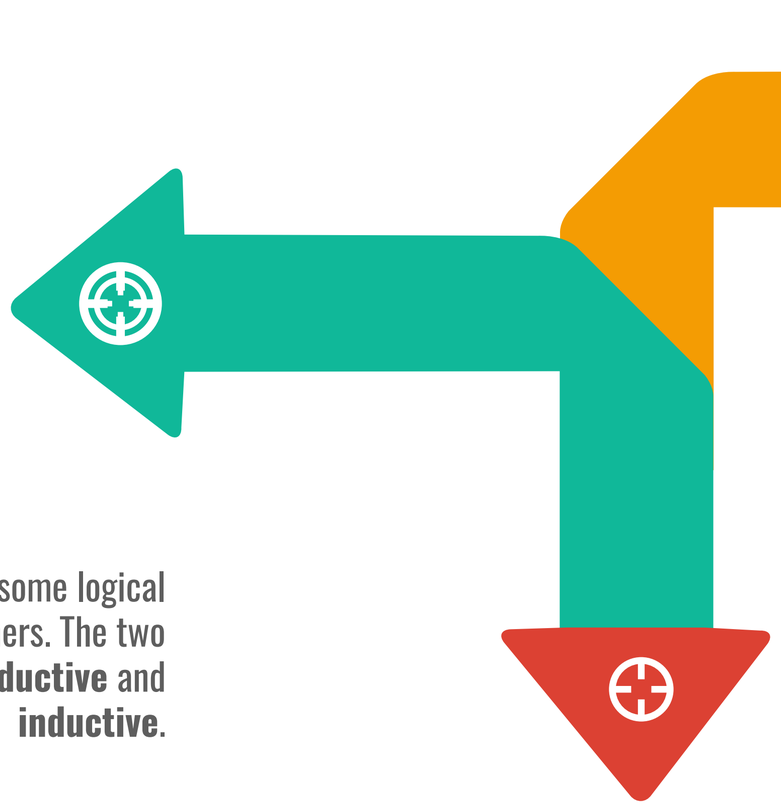
## INDUCTIVE VS DEDUCTIVE ARGUMENTS



It's important to realize that some logical arguments are stronger than others. The two best-known categories are **deductive** and **inductive**.

### FAILURE #1

First, one of its premises could turn out to be false.
For example:

1. Claire is a dog.
2. All dogs are brown.
3. Therefore, Claire is brown.

### FAILURE #2

The second way a deductive argument fails is when the conclusion doesn't necessarily follow from the premises.
For example:

1. All tennis balls are round.
2. The Earth is round.
3. Therefore, the Earth is a tennis ball.



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## BOOLEAN LOGIC

Boolean logic is a form of logic that deals with statements having one of only two values: **true or false (usually).**

Different corresponding values could be used in other contexts: 1 or 0 for example, on or off, black or white.

**Examples**

1. Messi is a football player (true)
2. Italy is bigger than Greece (true)
3. Greece and Italy have no coastline (false)

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## PROPOSITIONS

Statements in Boolean logic are also known as **propositions**, which have several basic properties.

### Properties

First, a proposition can only have one value at any one time. There is no way to express levels of certainty. True means true; false means false.

Second, propositions must have clear and unambiguous meaning. For example, a statement like: *'It is travelling fast',* can certainly be evaluated as either true or false.

Third, it's possible to combine individual propositions to make more complex ones. For example, *'Jenny is wearing the shirt and the shirt is red.'* This is helpful because we often want to evaluate several statements before reaching a conclusion. We make compound propositions by connecting single propositions together using **logical operators**.



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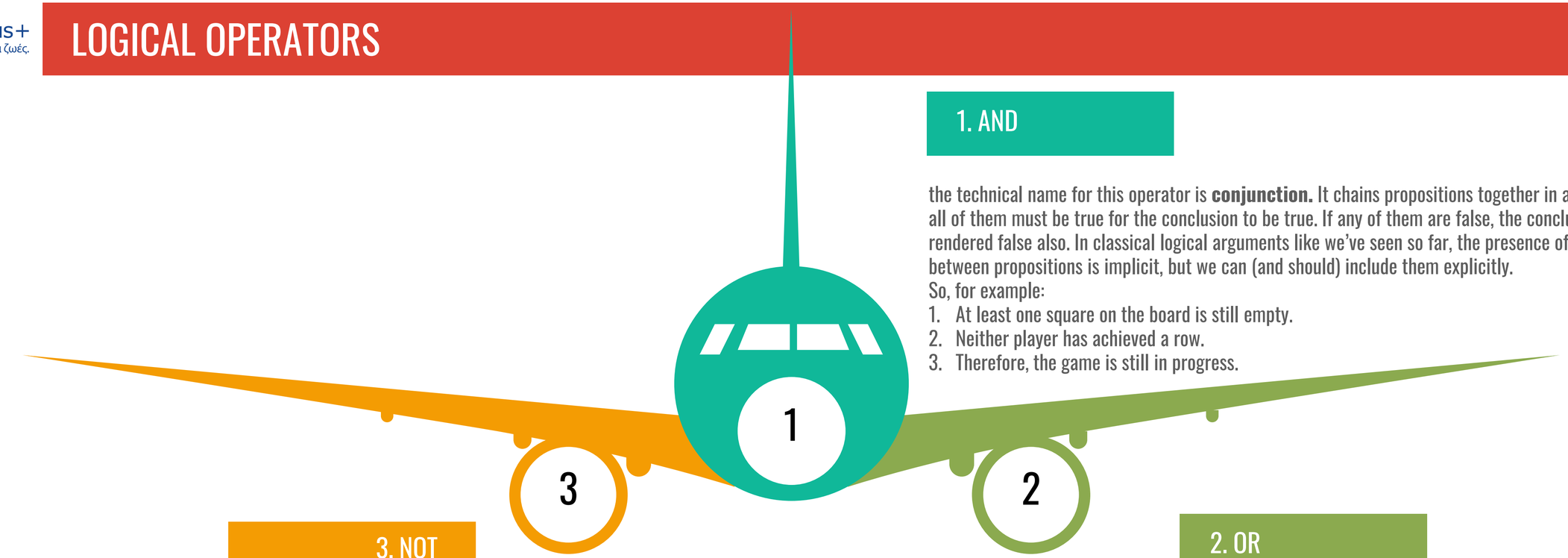
## LOGICAL OPERATORS




### 1. AND

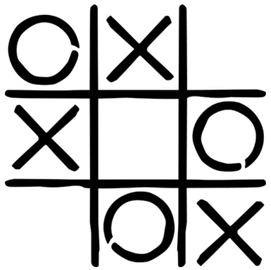
the technical name for this operator is **conjunction.** It chains propositions together in a way that all of them must be true for the conclusion to be true. If any of them are false, the conclusion is rendered false also. In classical logical arguments like we've seen so far, the presence of AND between propositions is implicit, but we can (and should) include them explicitly.
So, for example:

1. At least one square on the board is still empty.
2. Neither player has achieved a row.
3. Therefore, the game is still in progress.

### 3. NOT

the technical name for this operator is **negation**. This operator doesn't chain propositions together itself, rather it modifies a single proposition. Specifically, it flips the truth value.
For example:
If a square is not occupied, then a player may add their symbol to that square.

GAME: NOUGHTS AND CROSSES



### 2. OR

the technical name for this operator is **disjunction**. This operator chains propositions together in a way that at least one of them must be true for the conclusion to be true also. The only way that the conclusion is falsified is if all propositions are false.

For example:
If player 1 achieves a row or player 2 achieves a row, then the game is over.



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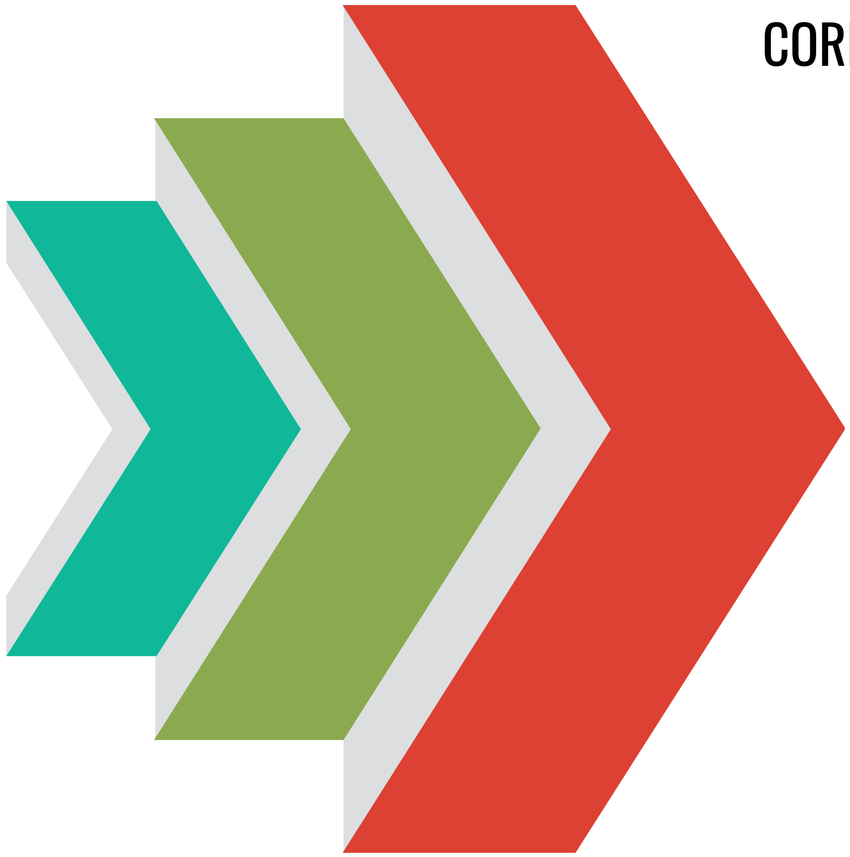
## ACTIVITY #1.1

Trainer shares a sheet with true/false propositions. Trainers, fill in the sheet for 10’ and at the end they all together discuss the results. The discussion follows last 10 minutes.



## CORE SKILLS DEVELOPED

- Problem solving skills
- Reasoning skills
- Environmental skills
- Technical skills
- Time management skills

## TIMING

20 min

## REQUIRED TOOLS

PC, projector, sheet

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PANE, J. F. ET AL. (2001) STUDYING THE LANGUAGE AND STRUCTURE IN NON-PROGRAMMER'S SOLUTIONS TO PROGRAMMING PROBLEMS. *INTERNATIONAL JOURNAL OF HUMAN-COMPUTER STUDIES*, 54 (2). 237.

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