# Logical Connectives and Propositions

## Conjunction (AND - ∧)

Meaning: Both conditions must be true for the whole statement to be true.

Keywords/Phrases:

- And

- But

- Nevertheless

- Yet

- Although

- However

- Moreover

- Furthermore

- Even though

Example Propositions:

- (p ∧ q): "You get an A on the final and you do every exercise in the book."

- (p ∧ q): "You get an A on the final but you don't understand the material."

- (p ∧ q): "You get an A on the final, nevertheless you still feel unprepared."

- (p ∧ q): "You get an A on the final, yet you didn't study much."

- (p ∧ q): "You get an A on the final, although you missed some classes."

- (p ∧ q): "You get an A on the final, however, it doesn't count towards your grade."

- (p ∧ q): "You get an A on the final, moreover, you win a scholarship."

- (p ∧ q): "You get an A on the final, furthermore, you help others study."

- (p ∧ q): "You get an A on the final, even though you didn't sleep well."

## Disjunction (OR - ∨)

Meaning: At least one condition must be true for the whole statement to be true.

Keywords/Phrases:

- Or

- Either...or

- Alternatively

- Unless

- At least one of

- One of the following

Example Propositions:

- (p ∨ q): "You either get an A on the final or do every exercise in the book."

- (p ∨ q): "You can either study hard or hope for an easy test."

- (p ∨ q): "You can work on your project today; alternatively, you can finish it tomorrow."

- (p ∨ q): "You won't pass the class unless you submit all assignments."

- (p ∨ q): "At least one of you or your partner needs to attend the meeting."

- (p ∨ q): "One of the following must be true: you get an A on the final or you complete all exercises."

## Negation (NOT - ¬)

Meaning: Reverses the truth value of the proposition.

Keywords/Phrases:

- Not

- It is not the case that

- No

- Neither

- Nor

- Without

- Fails to

- Never

Example Propositions:

- (¬p): "You do not get an A on the final."

- (¬p): "It is not the case that you get an A on the final."

- (¬p): "No one got an A on the final."

- (¬p ∧ ¬q): "Neither you nor your friend got an A on the final."

- (¬p): "You get an A on the final without studying."

- (¬p): "You fail to get an A on the final."

- (¬p): "You never get an A on the final."

## Conditional (IMPLIES - →)

Meaning: If one statement is true, it implies the truth of the other.

Keywords/Phrases:

- If...then

- Implies

- Leads to

- As long as

- Therefore

- Consequently

- On the condition that

- Provided that

- Suffices to show

- Only if

Example Propositions:

- (p → r): "If you get an A on the final, then you get an A in the class."

- (p → r): "Getting an A on the final implies you studied hard."

- (p → r): "Your effort leads to getting an A on the final."

- (p → r): "As long as you study, you will get an A on the final."

- (p → r): "You studied hard; therefore, you get an A on the final."

- (p → r): "You didn't study; consequently, you didn't get an A on the final."

- (p → r): "You can get an A on the final on the condition that you complete all assignments."

- (p → r): "You will pass the class provided that you get an A on the final."

- (p → r): "Your hard work suffices to show that you deserve an A on the final."

- (p → r): "You get an A on the final only if you studied."

## Biconditional (IFF - ↔)

Meaning: Both conditions must either be true together or false together.

Keywords/Phrases:

- If and only if

- Exactly when

- Necessary and sufficient

- Equivalently

- Just in case

Example Propositions:

- (r ↔ (p ∨ q)): "You get an A in this class if and only if you either get an A on the final or do every exercise in the book."

- (r ↔ (p ∨ q)): "You succeed exactly when you put in the effort."

- (r ↔ (p ∨ q)): "Your participation is necessary and sufficient for the project’s success."

- (r ↔ (p ∨ q)): "Passing the test equivalently means you understood the material."

- (r ↔ (p ∨ q)): "You get a reward just in case you complete all tasks."

## Necessary Condition

Meaning: For one event to happen, the other must happen.

Keywords/Phrases:

- Necessary for

- Must be

- Required for

- Depends on

Example Propositions:

- (r → p): "To get an A in this class, it is necessary for you to get an A on the final."

- (r → p): "You must be diligent to succeed in this course."

- (r → p): "Completing all assignments is required for passing the class."

- (r → p): "Your success depends on your effort."