

A proposition!

Definition: A proposition

We do not care if the statement is really true or not

Definition: A **proposition** is a statement that is true

or false.

only whether it makes sense to ask if it is true or false

Definition: A **proposition** is a statement that is true

or false.

 $\label{eq:Definition: A proposition} \textbf{Definition:} \ \ \textbf{A} \ \ \textbf{proposition} \ \ \textbf{is a statement that is true} \\ \text{or false.}$

"If you do $% \left(1\right) =\left(1\right) \left(1\right) =\left(1\right) \left(1\right)$

 $\label{eq:Definition: A proposition} \textbf{Definition:} \ \ \textbf{A} \ \ \textbf{proposition} \ \ \textbf{is a statement that is true} \\ \ \ \textbf{or false}.$

 $\ensuremath{\textbf{Definition:}}$ A $\ensuremath{\textbf{proposition}}$ is a statement that is true or false.

"If you do not attend the lectures regularly or you do not pay attention or you do not clear your doubts in time

"If you do not attend the lectures regularly or you do not pay attention or you do not clear your doubts in time then you will find this course very difficult."

"implies" operator:

"If you do not attend the lectures regularly or you do not pay attention or you do not clear your doubts in time then you will find this course very difficult."

"implies" operator: \rightarrow

"If you do not attend the lectures regularly or you do not pay attention or you do not clear your doubts in time then you will find this course very difficult."

"implies" operator: \rightarrow

Definition: A **proposition** is a statement that is true or false. "You do not pay attention or false."

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"implies" operator: \rightarrow "or" operator:

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"implies" operator: →
"or" operator: ∨

or false.

"If you do not attend the lectures regularly or you do

Definition: A **proposition** is a statement that is true

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"implies" operator: \rightarrow "or" operator: \vee "not" function:
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"If you do not attend the lectures regularly or you do not pay attention or you do not clear your doubts in time then you will find this course very difficult."

"implies" operator: \rightarrow "or" operator: \vee "not" function: \neg

or false. "If you do not attend the lectures regularly or you do

not pay attention or you do not clear your doubts in time then you will find this course very difficult."

"or" operator: ∨ "not" function:

"implies" operator: \rightarrow

¬ "You attend the lectures regularly" ∨ ¬ "you pay **Definition:** A **proposition** is a statement that is true attention" $\lor \neg$ "you clear your doubts in time" $\to \neg$ "you will find this course very easy"

or false.

"If you do not attend the lectures regularly or you do

Definition: A **proposition** is a statement that is true

not pay attention or you do not clear your doubts in time then you will find this course very difficult."

"implies" operator: \rightarrow "or" operator: \vee

"not" function: ¬

attention" $\lor \lnot$ "you clear your doubts in time" $\to \lnot$ "you will find this course very easy"

 \neg "You attend the lectures regularly" $\lor \neg$ "you pay

Definition: A **proposition** is a statement that is true or false. \neg "You attend the lectures regularly" $\lor \neg$ "you pay attention" $\lor \neg$ "you clear your doubts in time" $\to \neg$ "you will find this course very easy"

"If you do not attend the lectures regularly or you do not pay attention or you do not clear your doubts in time then you will find this course very difficult."

"or" operator: ∨
"not" function: ¬
"and" operator:

"implies" operator: \rightarrow

In fact, it can be written in terms of the other ones

 \neg "You attend the lectures regularly" $\lor \neg$ "you pay **Definition:** A **proposition** is a statement that is true or false. attention" $\lor \neg$ "you clear your doubts in time" $\to \neg$

"If you do not attend the lectures regularly or you do not pay attention or you do not clear your doubts in time then you will find this course very difficult."

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"you will find this course very easy"

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"If you do not attend the lectures regularly or you do not pay attention or you do not clear your doubts in time then you will find this course very difficult."

"or" operator: ∨ "not" function: ¬ "and" operator: \(\)

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attention" $\lor \neg$ "you clear your doubts in time" $\to \neg$ "you will find this course very easy"

"If you do not attend the lectures regularly or you do not pay attention or you do not clear your doubts in time then you will find this course very difficult."

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"not" function: ¬
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"implies" operator: \rightarrow

 \neg ("You attend the lectures regularly" \land "you pay attention" \land "you clear your doubts in time") \rightarrow \neg "you will find this course very easy"

"If you do not attend the lectures regularly or you do not pay attention or you do not clear your doubts in time then you will find this course very difficult."

"or" operator: ∨
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"if and only if" operator:

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Variables: A, B, C, \ldots ,

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"if and only if" operator: ↔

"implies" operator: \rightarrow

Variables: A, B, C, \ldots, P, Q, R

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"If you do not attend the lectures regularly or you do not pay attention or you do not clear your doubts in time then you will find this course very difficult."

"or" operator: ∨
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"if and only if" operator: $\ \leftrightarrow$

Variables: $A, B, C, \ldots, P, Q, R, \ldots, A_1, A_2, \ldots$

 \neg ("You attend the lectures regularly" \wedge "you pay attention" \wedge "you clear your doubts in time") \rightarrow "you will find this course very easy"

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"If you do not attend the lectures regularly or you do not pay attention or you do not clear your doubts in time then you will find this course very difficult."
"implies" operator: →

"or" operator: ∨
"not" function: ¬
"and" operator: ∧
"if and only if" operator: ↔

Variables: $A, B, C, ..., P, Q, R, ..., A_1, A_2, ...$

Example:

 \neg ("You attend the lectures regularly" \wedge "you pay attention" \wedge "you clear your doubts in time") \rightarrow \neg "you will find this course very easy"

or false. "If you do not attend the lectures regularly or you do

Definition: A **proposition** is a statement that is true

not pay attention or you do not clear your doubts in time then you will find this course very difficult."

"not" function: "and" operator: ∧ "if and only if" operator: \leftrightarrow

"implies" operator: \rightarrow "or" operator: ∨

Example:

Variables: $A, B, C, \ldots, P, Q, R, \ldots, A_1, A_2, \ldots$

P := "You attend the courses regularly"

¬ ("You attend the lectures regularly" ∧ "you pay attention" \land "you clear your doubts in time") $\rightarrow \neg$ "vou will find this course very easy"

or false. "If you do not attend the lectures regularly or you do not pay attention or you do not clear your doubts in

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"if and only if" operator: \leftrightarrow

Variables: $A, B, C, \ldots, P, Q, R, \ldots, A_1, A_2, \ldots$

P := "You attend the courses regularly"

Q := "You pay attention"

"implies" operator: \rightarrow "or" operator: ∨ "not" function: "and" operator: \(\)

Example:

¬ ("You attend the lectures regularly" ∧ "you pay attention" \wedge "you clear your doubts in time") $\rightarrow \neg$ "vou will find this course very easy"

Definition: A **proposition** is a statement that is true or false. "If you do not attend the lectures regularly or you do not pay attention or you do not clear your doubts in time then you will find this course very difficult." "implies" operator: \rightarrow

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Example:

"or" operator: ∨ "not" function: "and" operator: \(\)

P := "You attend the courses regularly" Q := "You pay attention" R := "You clear your doubts in time"

¬ ("You attend the lectures regularly" ∧ "you pay attention" \wedge "you clear your doubts in time") $\rightarrow \neg$ "vou will find this course very easy"

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"If you do not attend the lectures regularly or you do not pay attention or you do not clear your doubts in time then you will find this course very difficult."

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Variables: $A, B, C, \ldots, P, Q, R, \ldots, A_1, A_2, \ldots$

Example: P := "You attend the courses regularly"

"and" operator: \(\)

"if and only if" operator: \leftrightarrow

Q := "You pay attention" R := "You clear your doubts in time" S := "You will find this course easy"

attention" \land "you clear your doubts in time") $\rightarrow \neg$ "you will find this course very easy"

¬ ("You attend the lectures regularly" ∧ "you pay

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Variables: $A, B, C, \ldots, P, Q, R, \ldots, A_1, A_2, \ldots$

Example:

P := "You attend the courses regularly"

Q := "You place your doubts in time"

R:= "You clear your doubts in time"

S:= "You will find this course easy"

 $\neg (P \land Q \land R) \to \neg S$

 \neg ("You attend the lectures regularly" \wedge "you pay attention" \wedge "you clear your doubts in time") \rightarrow "you will find this course very easy"

Using these interpretations we get this expression

Definition: A **proposition** is a statement that is true or false. "If you do not attend the lectures regularly or you do not pay attention or you do not clear your doubts in time then you will find this course very difficult." "implies" operator: \rightarrow "or" operator: ∨ "not" function: "and" operator: \(\) "if and only if" operator: \leftrightarrow Variables: $A, B, C, \ldots, P, Q, R, \ldots, A_1, A_2, \ldots$ Example:

 \neg ("You attend the lectures regularly" \wedge "you pay attention" \wedge "you clear your doubts in time") \to ¬ "you will find this course very easy" $\neg P$

P := "You attend the courses regularly"

Q:= "You pay attention"

R := "You clear your doubts in time"

S:= "You will find this course easy"

 $\neg (P \land Q \land R) \rightarrow \neg S$

But we know that the following expression is also equivalent

S := "You will find this course easy"

 $\neg (P \land Q \land R) \rightarrow \neg S$

 $\neg P \lor \neg Q$

¬ ("You attend the lectures regularly" ∧ "you pay

attention" \wedge "you clear your doubts in time") $\rightarrow \neg$

"vou will find this course very easy"

S := "You will find this course easy"

 $\neg (P \land Q \land R) \rightarrow \neg S$

 $\neg P \lor \neg Q \lor \neg R$

¬ ("You attend the lectures regularly" ∧ "you pay

attention" \wedge "you clear your doubts in time") $\rightarrow \neg$

"vou will find this course very easy"

attention" \wedge "you clear your doubts in time") $\rightarrow \neg$ "vou will find this course very easy" $\neg P \lor \neg Q \lor \neg R \to \neg S$

¬ ("You attend the lectures regularly" ∧ "you pay

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"If you do not attend the lectures regularly or you do not pay attention or you do not clear your doubts in time then you will find this course very difficult."

"or" operator: ∨
"not" function: ¬
"and" operator: ∧
"if and only if" operator: ↔

"implies" operator: \rightarrow

Variables: $A, B, C, \ldots, P, Q, R, \ldots, A_1, A_2, \ldots$

Example:

P := "You attend the courses regularly"

Q:= "You pay attention"

R := "You clear your doubts in time"

S:= "You will find this course easy"

 $\neg (P \land Q \land R) \rightarrow \neg S$

e easy

→

¬ ("You attend the lectures regularly" ∧ "you pay

attention" \wedge "you clear your doubts in time") $\rightarrow \neg$

"vou will find this course very easy"

¬ "You attend the lectures regularly"

 $\neg P \lor \neg Q \lor \neg R \to \neg S$

In natural language, it translates to this sentence

Definition: A **proposition** is a statement that is true or false. "If you do not attend the lectures regularly or you do not pay attention or you do not clear your doubts in time then you will find this course very difficult." "implies" operator: \rightarrow "or" operator: ∨ "not" function: "and" operator: \(\) "if and only if" operator: \leftrightarrow Variables: $A, B, C, \ldots, P, Q, R, \ldots, A_1, A_2, \ldots$

Example: P := "You attend the courses regularly"

Q := "You pay attention" R := "You clear your doubts in time" S := "You will find this course easy"

 $\neg (P \land Q \land R) \rightarrow \neg S$

attention" \wedge "you clear your doubts in time") $\rightarrow \neg$ "vou will find this course very easy"

¬ ("You attend the lectures regularly" ∧ "you pay

¬ "You attend the lectures regularly" ∨ ¬ "you pay

 $\neg P \lor \neg Q \lor \neg R \to \neg S$

attention"

Definition: A **proposition** is a statement that is true or false. "If you do not attend the lectures regularly or you do not pay attention or you do not clear your doubts in time then you will find this course very difficult." "implies" operator: \rightarrow "or" operator: ∨ "not" function: "and" operator: \(\) "if and only if" operator: \leftrightarrow Variables: $A, B, C, \ldots, P, Q, R, \ldots, A_1, A_2, \ldots$

and see: 11, 2, 0, ..., 1, 4, 10, ..., 111, 112, ...

Example: P := "You attend the courses regularly"

Q := "You pay attention" R := "You clear your doubts in time" S := "You will find this course easy"

 $\neg (P \land Q \land R) \rightarrow \neg S$

attention" \land "you clear your doubts in time") $\rightarrow \neg$ "you will find this course very easy" $\neg P \lor \neg Q \lor \neg R \to \neg S$ \neg "You attend the lectures regularly" $\lor \neg$ "you pay attention" $\lor \neg$ "you clear your doubts in time"

¬ ("You attend the lectures regularly" ∧ "you pay

attention" \wedge "you clear your doubts in time") $\rightarrow \neg$ "vou will find this course very easy" $\neg P \lor \neg Q \lor \neg R \to \neg S$ ¬ "You attend the lectures regularly" ∨ ¬ "you pay attention" $\vee \neg$ "you clear your doubts in time" $\rightarrow \neg$ "you will find this course very easy"

¬ ("You attend the lectures regularly" ∧ "you pay

Definition: A **proposition** is a statement that is true or false. "If you do not attend the lectures regularly or you do not pay attention or you do not clear your doubts in time then you will find this course very difficult." "implies" operator: \rightarrow "or" operator: ∨ "not" function: "and" operator: \(\) "if and only if" operator: \leftrightarrow Variables: $A, B, C, \ldots, P, Q, R, \ldots, A_1, A_2, \ldots$ Example: P := "You attend the courses regularly" Q := "You pay attention"

R := "You clear your doubts in time" S := "You will find this course easy"

 $\neg (P \land Q \land R) \rightarrow \neg S$

 $\neg P \lor \neg Q \lor \neg R \to \neg S$ $\neg \text{ "You attend the lectures regularly"} \lor \neg \text{ "you pay attention"} \lor \neg \text{ "you clear your doubts in time"} \to \neg$

S

"you will find this course very easy"

"vou will find this course very easy"

¬ ("You attend the lectures regularly" ∧ "you pay

attention" \wedge "you clear your doubts in time") $\rightarrow \neg$

We will later see that we can always rewrite a the previous logical expression as this

"vou will find this course very easy" $\neg P \lor \neg Q \lor \neg R \to \neg S$ ¬ "You attend the lectures regularly" ∨ ¬ "you pay attention" $\vee \neg$ "you clear your doubts in time" $\rightarrow \neg$ "you will find this course very easy" $S \to P$

¬ ("You attend the lectures regularly" ∧ "you pay

attention" \wedge "you clear your doubts in time") $\rightarrow \neg$

attention" \wedge "you clear your doubts in time") $\rightarrow \neg$ "vou will find this course very easy" $\neg P \lor \neg Q \lor \neg R \to \neg S$ ¬ "You attend the lectures regularly" ∨ ¬ "you pay attention" $\vee \neg$ "you clear your doubts in time" $\rightarrow \neg$ "you will find this course very easy" $S \to P \wedge Q$

¬ ("You attend the lectures regularly" ∧ "you pay

attention" \wedge "you clear your doubts in time") $\rightarrow \neg$ "vou will find this course very easy" $\neg P \lor \neg Q \lor \neg R \to \neg S$ ¬ "You attend the lectures regularly" ∨ ¬ "you pay attention" $\vee \neg$ "you clear your doubts in time" $\rightarrow \neg$ "you will find this course very easy" $S \to P \land Q \land R$

¬ ("You attend the lectures regularly" ∧ "you pay

Definition: A **proposition** is a statement that is true or false.

"If you do not attend the lectures regularly or you do not pay attention or you do not clear your doubts in time then you will find this course very difficult."

"or" operator: ∨ "not" function: "and" operator: \(\)

"implies" operator: \rightarrow

"if and only if" operator:

Variables: $A, B, C, \ldots, P, Q, R, \ldots, A_1, A_2, \ldots$

Example:

P := "You attend the courses regularly" Q := "You pay attention"

R := "You clear your doubts in time"

S := "You will find this course easy"

 $\neg (P \land Q \land R) \rightarrow \neg S$

 $S \to P \land Q \land R$ "If you find this course easy.

 $\neg P \lor \neg Q \lor \neg R \to \neg S$

¬ ("You attend the lectures regularly" ∧ "you pay

attention" \wedge "you clear your doubts in time") $\rightarrow \neg$

 \neg "You attend the lectures regularly" $\lor \neg$ "you pay

attention" $\vee \neg$ "you clear your doubts in time" $\rightarrow \neg$

"vou will find this course very easy"

"you will find this course very easy"

In natural language, it is this

attention" \wedge "you clear your doubts in time") $\rightarrow \neg$ "you will find this course very easy" o $\neg P \vee \neg Q \vee \neg R \rightarrow \neg S \\ \neg \text{ "You attend the lectures regularly" } \vee \neg \text{ "you pay attention" } \vee \neg \text{ "you clear your doubts in time" } \rightarrow \neg \text{ "you will find this course very easy"}$ $S \rightarrow P \wedge Q \wedge R$

¬ ("You attend the lectures regularly" ∧ "you pay

"If you find this course easy, then it implies you attend the lectures regularly,

S := "You will find this course easy"

 $\neg (P \land Q \land R) \rightarrow \neg S$

attention" \wedge "you clear your doubts in time") $\rightarrow \neg$ "you will find this course very easy" $\neg P \vee \neg Q \vee \neg R \rightarrow \neg S$ \neg "You attend the lectures regularly" $\vee \neg$ "you pay attention" $\vee \neg$ "you clear your doubts in time" $\rightarrow \neg$ "you will find this course very easy"

¬ ("You attend the lectures regularly" ∧ "you pay

 $S \to P \land Q \land R$ "If you find this course easy, then it implies you attend the lectures regularly, pay attention,

 $\neg P \vee \neg Q \vee \neg R \to \neg S$ $\neg \text{ "You attend the lectures regularly"} \vee \neg \text{ "you pay attention"} \vee \neg \text{ "you clear your doubts in time"} \to \neg \text{ "you will find this course very easy"}$ $S \to P \wedge Q \wedge R$

¬ ("You attend the lectures regularly" ∧ "you pay

attention" \wedge "you clear your doubts in time") $\rightarrow \neg$

"vou will find this course very easy"

"If you find this course easy, then it implies you attend the lectures regularly, pay attention, and clear your doubts in time" **Definition:** A **proposition** is a statement that is true or false.

"If you do not attend the lectures regularly or you do

Variables: $A, B, C, \ldots, P, Q, R, \ldots, A_1, A_2, \ldots$

not pay attention or you do not clear your doubts in time then you will find this course very difficult."

"implies" operator: \rightarrow "or" operator: \vee "not" function: \neg

"and" operator: ∧

"if and only if" operator:

Example:

Example

P:= "You attend the courses regularly"

Q := "You plant your doubts in time"

R := "You clear your doubts in time"

S := "You will find this course easy"

 $\neg (P \land Q \land R) \rightarrow \neg S$

ts in time" urse easy"

attention" $\lor \neg$ "you clear your doubts in time" $\to \neg$ "you will find this course very easy"

 $\neg P \lor \neg Q \lor \neg R \to \neg S$

"vou will find this course very easy"

 $S \to P \land Q \land R$

"If you find this course easy, then it implies you attend the lectures regularly, pay attention, and clear your doubts in time"

¬ ("You attend the lectures regularly" ∧ "you pay

attention" \wedge "you clear your doubts in time") $\rightarrow \neg$

 \neg "You attend the lectures regularly" $\lor \neg$ "you pay

P

Do you think this expression is equivalent to the above?

Definition: A **proposition** is a statement that is true or false. attention" \wedge "you clear your doubts in time") $\rightarrow \neg$ "vou will find this course very easy" "If you do not attend the lectures regularly or you do $\neg P \lor \neg Q \lor \neg R \to \neg S$ not pay attention or you do not clear your doubts in ¬ "You attend the lectures regularly" ∨ ¬ "you pay time then you will find this course very difficult." "implies" operator: \rightarrow "or" operator: ∨ "not" function: "and" operator: \(\) "if and only if" operator: Variables: $A, B, C, \ldots, P, Q, R, \ldots, A_1, A_2, \ldots$ Example:

P := "You attend the courses regularly" Q := "You pay attention" R := "You clear your doubts in time" S := "You will find this course easy" $\neg (P \land Q \land R) \rightarrow \neg S$

attention" $\vee \neg$ "you clear your doubts in time" $\rightarrow \neg$ "you will find this course very easy" $S \to P \land Q \land R$ "If you find this course easy, then it implies you attend the lectures regularly, pay attention, and clear your doubts in time" $P \wedge Q$

¬ ("You attend the lectures regularly" ∧ "you pay

Definition: A **proposition** is a statement that is true or false. "If you do not attend the lectures regularly or you do not pay attention or you do not clear your doubts in time then you will find this course very difficult." "implies" operator: \rightarrow "or" operator: ∨ "not" function:

Variables: $A, B, C, \ldots, P, Q, R, \ldots, A_1, A_2, \ldots$

Example: P := "You attend the courses regularly"

"and" operator: \(\) "if and only if" operator:

Q := "You pay attention"

R := "You clear your doubts in time"

S := "You will find this course easy" $\neg (P \land Q \land R) \rightarrow \neg S$

 $\neg P \lor \neg Q \lor \neg R \to \neg S$ ¬ "You attend the lectures regularly" ∨ ¬ "you pay attention" $\vee \neg$ "you clear your doubts in time" $\rightarrow \neg$ "you will find this course very easy"

¬ ("You attend the lectures regularly" ∧ "you pay

attention" \wedge "you clear your doubts in time") $\rightarrow \neg$

"vou will find this course very easy"

 $S \to P \land Q \land R$ "If you find this course easy, then it implies you attend the lectures regularly, pay attention, and clear your doubts in time"

 $P \wedge Q \wedge R$

Definition: A **proposition** is a statement that is true or false. "If you do not attend the lectures regularly or you do not pay attention or you do not clear your doubts in time then you will find this course very difficult." "implies" operator: \rightarrow "or" operator: ∨ "not" function: "and" operator: \(\) "if and only if" operator:

Variables: $A, B, C, \ldots, P, Q, R, \ldots, A_1, A_2, \ldots$

Example:

P := "You attend the courses regularly"

Q := "You pay attention" R := "You clear your doubts in time"

S := "You will find this course easy" $\neg (P \land Q \land R) \rightarrow \neg S$

 $\neg P \lor \neg Q \lor \neg R \to \neg S$ ¬ "You attend the lectures regularly" ∨ ¬ "you pay attention" $\vee \neg$ "you clear your doubts in time" $\rightarrow \neg$

"you will find this course very easy"

"vou will find this course very easy"

¬ ("You attend the lectures regularly" ∧ "you pay

attention" \wedge "you clear your doubts in time") $\rightarrow \neg$

the lectures regularly, pay attention, and clear your

 $S \to P \land Q \land R$ "If you find this course easy, then it implies you attend

doubts in time"

 $P \wedge Q \wedge R \rightarrow S$?

Definition: A **proposition** is a statement that is true or false.

"If you do not attend the lectures regularly or you do not pay attention or you do not clear your doubts in time then you will find this course very difficult."

"implies" operator: \rightarrow "or" operator: ∨ "not" function:

"and" operator: ∧ "if and only if" operator:

Variables: $A, B, C, \ldots, P, Q, R, \ldots, A_1, A_2, \ldots$

Example:

P := "You attend the courses regularly"

Q := "You pay attention"

R := "You clear your doubts in time"

S := "You will find this course easy"

 $\neg (P \land Q \land R) \rightarrow \neg S$

"you will find this course very easy"

¬ ("You attend the lectures regularly" ∧ "you pay

attention" \wedge "you clear your doubts in time") $\rightarrow \neg$

¬ "You attend the lectures regularly" ∨ ¬ "you pay

attention" $\vee \neg$ "you clear your doubts in time" $\rightarrow \neg$

 $S \to P \land Q \land R$

 $\neg P \lor \neg Q \lor \neg R \to \neg S$

"If you find this course easy, then it implies you attend the lectures regularly, pay attention, and clear your doubts in time"

 $P \wedge Q \wedge R \rightarrow S$? Not necessarily!!

"vou will find this course very easy"

We will see later that it is not

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Variables: $A, B, C, \ldots, P, Q, R, \ldots, A_1, A_2, \ldots$

Example:

P := "You attend the courses regularly" Q := "You pay attention"

R := "You clear your doubts in time"

S := "You will find this course easy" $\neg (P \land Q \land R) \rightarrow \neg S$

Because in natural language we get this

 $\neg P \lor \neg Q \lor \neg R \to \neg S$

$$\neg P \lor \neg Q \lor \neg R \to \neg S$$

¬ "You attend the lectures regularly" ∨ ¬ "you pay attention" $\vee \neg$ "you clear your doubts in time" $\rightarrow \neg$ "you will find this course very easy"

¬ ("You attend the lectures regularly" ∧ "you pay

attention" \wedge "you clear your doubts in time") $\rightarrow \neg$

$$S \to P \wedge Q \wedge R$$

"If you find this course easy, then it implies you attend the lectures regularly, pay attention, and clear your doubts in time"

 $P \land Q \land R \rightarrow S$? Not necessarily!! You may attend the lectures regularly,

"vou will find this course very easy"

or false. "If you do not attend the lectures regularly or you do not pay attention or you do not clear your doubts in

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Example:

P := "You attend the courses regularly"

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 $\neg (P \land Q \land R) \rightarrow \neg S$

"vou will find this course very easy" $\neg P \lor \neg Q \lor \neg R \to \neg S$ ¬ "You attend the lectures regularly" ∨ ¬ "you pay attention" $\vee \neg$ "you clear your doubts in time" $\rightarrow \neg$

¬ ("You attend the lectures regularly" ∧ "you pay

attention" \wedge "you clear your doubts in time") $\rightarrow \neg$

$$S \to P \land Q \land R$$

"you will find this course very easy"

"If you find this course easy, then it implies you attend the lectures regularly, pay attention, and clear your doubts in time"

 $P \wedge Q \wedge R \rightarrow S$? Not necessarily!!

You may attend the lectures regularly, pay attention,

or false. "If you do not attend the lectures regularly or you do not pay attention or you do not clear your doubts in

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"implies" operator: \rightarrow

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Variables: $A, B, C, \ldots, P, Q, R, \ldots, A_1, A_2, \ldots$

Example: P := "You attend the courses regularly"

Q := "You pay attention" R := "You clear your doubts in time"

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 $\neg (P \land Q \land R) \rightarrow \neg S$

 $\neg P \lor \neg Q \lor \neg R \to \neg S$ ¬ "You attend the lectures regularly" ∨ ¬ "you pay attention" $\vee \neg$ "you clear your doubts in time" $\rightarrow \neg$ "you will find this course very easy"

¬ ("You attend the lectures regularly" ∧ "you pay

attention" \wedge "you clear your doubts in time") $\rightarrow \neg$

"vou will find this course very easy"

$$S \to P \land Q \land R$$

"If you find this course easy, then it implies you attend the lectures regularly, pay attention, and clear your doubts in time"

doubts in time"

$$P \land Q \land R \rightarrow S$$
? Not necessarily!

 $P \wedge Q \wedge R \rightarrow S$? Not necessarily!! You may attend the lectures regularly, pay attention, clear your doubts in time.

Definition: A **proposition** is a statement that is true or false.

"If you do not attend the lectures regularly or you do

not pay attention or you do not clear your doubts in time then you will find this course very difficult."

"or" operator: ∨ "not" function: "and" operator: ∧

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Variables: $A, B, C, \ldots, P, Q, R, \ldots, A_1, A_2, \ldots$

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P := "You attend the courses regularly" Q := "You pay attention"

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S := "You will find this course easy" $\neg (P \land Q \land R) \rightarrow \neg S$

 $S \to P \land Q \land R$ "If you find this course easy, then it implies you attend

 $\neg P \lor \neg Q \lor \neg R \to \neg S$

the lectures regularly, pay attention, and clear your doubts in time"

¬ ("You attend the lectures regularly" ∧ "you pay

attention" \wedge "you clear your doubts in time") $\rightarrow \neg$

¬ "You attend the lectures regularly" ∨ ¬ "you pay

attention" $\vee \neg$ "you clear your doubts in time" $\rightarrow \neg$

"vou will find this course very easy"

"you will find this course very easy"

 $P \wedge Q \wedge R \rightarrow S$? Not necessarily!! You may attend the lectures regularly, pay attention, clear your doubts in time, but it may not be enough for this course!

or false.

"If you do not attend the lectures regularly or you do not pay attention or you do not clear your doubts in time then you will find this course very difficult."

Definition: A **proposition** is a statement that is true

"implies" operator: →
"or" operator: ∨
"not" function: ¬

"and" operator: \(\triangle \)

"if and only if" operator:

Variables: $A, B, C, \ldots, P, Q, R, \ldots, A_1, A_2, \ldots$

Example:

P := "You attend the courses regularly" Q := "You pay attention"

R := "You clear your doubts in time"

 $S:= \text{ "You will find this course easy"} \\ \neg (P \land Q \land R) \to \neg S$

attention" $\lor \lnot$ "you clear your doubts in time" $\to \lnot$ "you will find this course very easy"

"vou will find this course very easy"

¬ ("You attend the lectures regularly" ∧ "you pay

attention" \wedge "you clear your doubts in time") $\rightarrow \neg$

¬ "You attend the lectures regularly" ∨ ¬ "you pay

 $S \to P \land Q \land R$ "If you find this

 $\neg P \lor \neg Q \lor \neg R \to \neg S$

"If you find this course easy, then it implies you attend the lectures regularly, pay attention, and clear your doubts in time"

 $P \wedge Q \wedge R \rightarrow S?$ Not necessarily!! You may attend the lectures regularly, pay attention, clear your doubts in time, but it may not be enough for this course! I might make the course very difficult!

 \neg ("You attend the lectures regularly" \land "you pay attention" \land "you clear your doubts in time") \rightarrow ¬ "you will find this course very easy"

$$\neg P \vee \neg Q \vee \neg R \to \neg S$$

 \neg "You attend the lectures regularly" $\lor \neg$ "you pay attention" $\lor \neg$ "you clear your doubts in time" $\to \neg$ "you will find this course very easy"

$$S \to P \land Q \land R$$

"If you find this course easy, then it implies you attend the lectures regularly, pay attention, and clear your doubts in time"

 $P \land Q \land R \rightarrow S?$ Not necessarily!! You may attend the lectures regularly, pay attention, clear your doubts in time, but it may not be enough for this course! I might make the course very difficult!

Let us now change interpretations of the variables

P := "You will keep up with the lecture"

 \neg ("You attend the lectures regularly" \land "you pay attention" \land "you clear your doubts in time") \rightarrow \neg "you will find this course very easy"

$$\neg P \lor \neg Q \lor \neg R \to \neg S$$

$$\neg \text{ "You attend the lectures regularly"} \lor \neg \text{ "you pay}$$

attention" $\lor \lnot$ "you clear your doubts in time" $\to \lnot$ "you will find this course very easy"

$$S \to P \wedge Q \wedge R$$

"If you find this course easy, then it implies you attend the lectures regularly, pay attention, and clear your doubts in time"

 $P \wedge Q \wedge R \rightarrow S$? Not necessarily!! You may attend the lectures regularly, pay attention, clear your doubts in time, but it may not be enough for this course! I might make the course very difficult!

P := "You will keep up with the lecture" Q := "You will find the lecture interesting"

 \neg ("You attend the lectures regularly" \wedge "you pay attention" \wedge "you clear your doubts in time") \to \neg "you will find this course very easy"

$$\neg P \lor \neg Q \lor \neg R \to \neg S$$

$$\neg \text{ "You attend the lectures regularly"} \lor \neg \text{ "you pay}$$

attention" $\lor \neg$ "you clear your doubts in time" $\to \neg$ "you will find this course very easy"

$$S \to P \land Q \land R$$

"If you find this course easy, then it implies you attend the lectures regularly, pay attention, and clear your doubts in time"

 $P \wedge Q \wedge R \rightarrow S$? Not necessarily!! You may attend the lectures regularly, pay attention, clear your doubts in time, but it may not be enough for this course! I might make the course very difficult!

Q := "You will find the lecture interesting" R := "You will understand everything"

P := "You will keep up with the lecture"

attention" $\vee \neg$ "you clear your doubts in time" $\to \neg$ "you will find this course very easy" $S \to P \wedge Q \wedge R$ "If you find this course easy, then it implies you attend the lectures regularly, pay attention, and clear your doubts in time"

"vou will find this course very easy"

 $P \wedge Q \wedge R \rightarrow S$? Not necessarily!!

 $\neg P \lor \neg Q \lor \neg R \to \neg S$

 \neg ("You attend the lectures regularly" \land "you pay attention" \land "you clear your doubts in time") \rightarrow \neg

¬ "You attend the lectures regularly" ∨ ¬ "you pay

You may attend the lectures regularly, pay attention, clear your doubts in time, but it may not be enough for this course! I might make the course very difficult!

 $\begin{array}{ll} R := & \text{``You will understand everything''} \\ S := & \text{``You pay attention''} \end{array}$

P := "You will keep up with the lecture"

Q := "You will find the lecture interesting"

 \neg "You attend the lectures regularly" $\lor \neg$ "you pay attention" $\lor \neg$ "you clear your doubts in time" $\to \neg$ "you will find this course very easy" $S \to P \land Q \land R$ " If you find this course easy, then it implies you attend the lectures regularly, pay attention, and clear your

"vou will find this course very easy"

 $\neg P \lor \neg Q \lor \neg R \to \neg S$

doubts in time"

 $P \wedge Q \wedge R \to S$? Not necessarily!! You may attend the lectures regularly, pay attention, clear your doubts in time, but it may not be enough for this course! I might make the course very difficult!

 \neg ("You attend the lectures regularly" \land "you pay attention" \land "you clear your doubts in time") \rightarrow \neg

P:= "You will keep up with the lecture" Q:= "You will find the lecture interesting" R:= "You will understand everything" S:= "You pay attention" S

 \neg ("You attend the lectures regularly" \wedge "you pay attention" \wedge "you clear your doubts in time") \rightarrow \neg "you will find this course very easy"

$$\neg P \lor \neg Q \lor \neg R \to \neg S$$

$$\neg \text{ "You attend the lectures regularly"} \lor \neg \text{ "you pay}$$

attention" $\lor \neg$ "you clear your doubts in time" $\to \neg$ "you will find this course very easy"

$$S \to P \land Q \land R$$

"If you find this course easy, then it implies you attend the lectures regularly, pay attention, and clear your doubts in time"

 $P \wedge Q \wedge R \rightarrow S$? Not necessarily!! You may attend the lectures regularly, pay attention, clear your doubts in time, but it may not be enough for this course! I might make the course very difficult!

 $\begin{array}{ll} Q:=& \text{"You will find the lecture interesting"}\\ R:=& \text{"You will understand everything"}\\ S:=& \text{"You pay attention"}\\ S\to P \end{array}$

P := "You will keep up with the lecture"

"you will find this course very easy" $S\to P\wedge Q\wedge R$ "If you find this course easy, then it implies you attend the lectures regularly, pay attention, and clear your doubts in time"

You may attend the lectures regularly, pay attention, clear your doubts in time, but it may not be enough for this course! I might make the course very difficult!

 \neg ("You attend the lectures regularly" \land "you pay attention" \land "you clear your doubts in time") \rightarrow \neg

 \neg "You attend the lectures regularly" $\lor \neg$ "you pay attention" $\lor \neg$ "you clear your doubts in time" $\rightarrow \neg$

"vou will find this course very easy"

 $P \wedge Q \wedge R \rightarrow S$? Not necessarily!!

 $\neg P \lor \neg Q \lor \neg R \to \neg S$

 $\begin{array}{ll} Q:=&\text{"You will find the lecture interesting"}\\ R:=&\text{"You will understand everything"}\\ S:=&\text{"You pay attention"}\\ S\to P\wedge Q \end{array}$

P := "You will keep up with the lecture"

 $S\to P\wedge Q\wedge R$ "If you find this course easy, then it implies you attend the lectures regularly, pay attention, and clear your doubts in time"

You may attend the lectures regularly, pay attention, clear your doubts in time, but it may not be enough for this course! I might make the course very difficult!

 \neg ("You attend the lectures regularly" \land "you pay attention" \land "you clear your doubts in time") \rightarrow \neg

 \neg "You attend the lectures regularly" $\lor \neg$ "you pay attention" $\lor \neg$ "you clear your doubts in time" $\rightarrow \neg$

"vou will find this course very easy"

"you will find this course very easy"

 $P \wedge Q \wedge R \rightarrow S$? Not necessarily!!

 $\neg P \lor \neg Q \lor \neg R \to \neg S$

Q := "You will find the lecture interesting" R := "You will understand everything" S := "You pay attention" $S \to P \land Q \land R$

P := "You will keep up with the lecture"

"you will find this course very easy" $S\to P\wedge Q\wedge R$ "If you find this course easy, then it implies you attend the lectures regularly, pay attention, and clear your doubts in time"

You may attend the lectures regularly, pay attention, clear your doubts in time, but it may not be enough for this course! I might make the course very difficult!

 \neg "You attend the lectures regularly" $\lor \neg$ "you pay attention" $\lor \neg$ "you clear your doubts in time" $\rightarrow \neg$

 \neg ("You attend the lectures regularly" \land "you pay attention" \land "you clear your doubts in time") \rightarrow \neg

"vou will find this course very easy"

 $P \wedge Q \wedge R \rightarrow S$? Not necessarily!!

 $\neg P \lor \neg Q \lor \neg R \to \neg S$

$$\begin{split} P &:= \text{ "You will keep up with the lecture"} \\ Q &:= \text{ "You will find the lecture interesting"} \\ R &:= \text{ "You will understand everything"} \\ S &:= \text{ "You pay attention"} \\ \frac{S}{\rightarrow} P \wedge Q \wedge R \\ \text{"If you pay attention,} \end{split}$$

 \neg ("You attend the lectures regularly" \wedge "you pay attention" \wedge "you clear your doubts in time") \rightarrow \neg "you will find this course very easy"

$$\neg P \lor \neg Q \lor \neg R \to \neg S$$

$$\neg \text{ "You attend the lectures regularly"} \lor \neg \text{ "you pay attention"} \lor \neg \text{ "you clear your doubts in time"} \to \neg \text{ "you will find this course very easy"}$$

"If you find this course easy, then it implies you attend the lectures regularly, pay attention, and clear your doubts in time"

$$P \wedge Q \wedge R \rightarrow S$$
? Not necessarily!! You may attend the lectures regularly, pay attention, clear your doubts in time, but it may not be enough for this course! I might make the course very difficult!

 $S \to P \land Q \land R$

$$P:=\text{ "You will keep up with the lecture"} \\ Q:=\text{ "You will find the lecture interesting"} \\ R:=\text{ "You will understand everything"} \\ S:=\text{ "You pay attention"} \\ S \to P \land Q \land R \\ \text{"If you pay attention, then you will keep up with the lecture,} \\ \end{cases}$$

 \neg "You attend the lectures regularly" \vee \neg "you pay attention" \vee \neg "you clear your doubts in time" \rightarrow "you will find this course very easy" $S \rightarrow P \wedge Q \wedge R$ " If you find this course easy, then it implies you attend the lectures regularly, pay attention, and clear your doubts in time"

You may attend the lectures regularly, pay attention, clear your doubts in time, but it may not be enough for this course! I might make the course very difficult!

"vou will find this course very easy"

 $P \wedge Q \wedge R \rightarrow S$? Not necessarily!!

 $\neg P \lor \neg Q \lor \neg R \to \neg S$

 \neg ("You attend the lectures regularly" \land "you pay attention" \land "you clear your doubts in time") \rightarrow \neg

P := "You will keep up with the lecture" Q := "You will find the lecture interesting" R := "You will understand everything" S := "You pay attention" $S \to P \land Q \land R$ "If you pay attention, then you will keep up with the lecture, find the lecture interesting,

 \neg "You attend the lectures regularly" $\lor \neg$ "you pay attention" $\lor \neg$ "you clear your doubts in time" $\to \neg$ "you will find this course very easy" $S \to P \land Q \land R$ " If you find this course easy, then it implies you attend the lectures regularly, pay attention, and clear your doubts in time"

You may attend the lectures regularly, pay attention, clear your doubts in time, but it may not be enough for this course! I might make the course very difficult!

"vou will find this course very easy"

 $P \wedge Q \wedge R \rightarrow S$? Not necessarily!!

 $\neg P \lor \neg Q \lor \neg R \to \neg S$

 \neg ("You attend the lectures regularly" \land "you pay attention" \land "you clear your doubts in time") \rightarrow \neg

P := "You will keep up with the lecture" Q := "You will find the lecture interesting" R := "You will understand everything" S := "You pay attention" $S \to P \land Q \land R$ "If you pay attention, then you will keep up with the lecture, find the lecture interesting, and understand everything"

— "You attend the lectures regularly" \vee — "you pay attention" \vee — "you clear your doubts in time" \to — "you will find this course very easy" $S \to P \wedge Q \wedge R$ " If you find this course easy, then it implies you attend the lectures regularly, pay attention, and clear your doubts in time"

You may attend the lectures regularly, pay attention, clear your doubts in time, but it may not be enough for this course! I might make the course very difficult!

 \neg ("You attend the lectures regularly" \land "you pay attention" \land "you clear your doubts in time") \rightarrow \neg

"vou will find this course very easy"

 $P \wedge Q \wedge R \rightarrow S$? Not necessarily!!

 $\neg P \lor \neg Q \lor \neg R \to \neg S$

Q := "You will find the lecture interesting" R := "You will understand everything" S := "You pay attention" $S \to P \land Q \land R$ "If you pay attention, then you will keep up with the lecture, find the lecture interesting, and understand everything"

P := "You will keep up with the lecture"

$$\neg P$$

 $P \wedge Q \wedge R \rightarrow S$? Not necessarily!!

attention" \land "you clear your doubts in time") $\rightarrow \neg$ "vou will find this course very easy" $\neg P \lor \neg Q \lor \neg R \to \neg S$

$$\neg F \lor \neg Q \lor \neg R \to \neg S$$

 \neg "You attend the lectures regularly" $\lor \neg$ "you pay

attention" $\vee \neg$ "you clear your doubts in time" $\rightarrow \neg$ "you will find this course very easy"

 \neg ("You attend the lectures regularly" \land "you pay

$$S \to P \land Q \land R$$
 "If you find this course easy, then it implies you attend

the lectures regularly, pay attention, and clear your doubts in time"

You may attend the lectures regularly, pay attention, clear your doubts in time, but it may not be enough for this course! I might make the course very difficult!

$$\begin{array}{ll} Q:=&\text{"You will find the lecture interesting"}\\ R:=&\text{"You will understand everything"}\\ S:=&\text{"You pay attention"}\\ S\to P\wedge Q\wedge R\\ &\text{"If you pay attention, then you will keep up with the lecture, find the lecture interesting, and understand everything"}\\ \neg P\vee \neg Q \end{array}$$

 \neg "You attend the lectures regularly" $\lor \neg$ "you pay attention" $\lor \neg$ "you clear your doubts in time" $\to \neg$ "you will find this course very easy" $S \to P \land Q \land R$ " If you find this course easy, then it implies you attend the lectures regularly, pay attention, and clear your doubts in time"

You may attend the lectures regularly, pay attention, clear your doubts in time, but it may not be enough for this course! I might make the course very difficult!

 \neg ("You attend the lectures regularly" \land "you pay attention" \land "you clear your doubts in time") \rightarrow \neg

"vou will find this course very easy"

 $P \wedge Q \wedge R \rightarrow S$? Not necessarily!!

 $\neg P \lor \neg Q \lor \neg R \to \neg S$

$$\begin{array}{ll} Q:=& \text{"You will find the lecture interesting"} \\ R:=& \text{"You will understand everything"} \\ S:=& \text{"You pay attention"} \\ S\to P\wedge Q\wedge R \\ \text{"If you pay attention, then you will keep up with the lecture, find the lecture interesting, and understand everything"} \\ \neg P\vee \neg Q\vee \neg R \end{array}$$

 \neg "You attend the lectures regularly" $\lor \neg$ "you pay attention" $\lor \neg$ "you clear your doubts in time" $\to \neg$ "you will find this course very easy" $S \to P \land Q \land R$ " If you find this course easy, then it implies you attend the lectures regularly, pay attention, and clear your doubts in time"

You may attend the lectures regularly, pay attention, clear your doubts in time, but it may not be enough for this course! I might make the course very difficult!

 \neg ("You attend the lectures regularly" \land "you pay attention" \land "you clear your doubts in time") \rightarrow \neg

"vou will find this course very easy"

 $P \wedge Q \wedge R \rightarrow S$? Not necessarily!!

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$$\begin{array}{ll} Q:=&\text{"You will find the lecture interesting"}\\ R:=&\text{"You will understand everything"}\\ S:=&\text{"You pay attention"}\\ S\to P\wedge Q\wedge R\\ &\text{"If you pay attention, then you will keep up with the lecture, find the lecture interesting, and understand everything"}\\ \neg P\vee \neg Q\vee \neg R\to \neg S \end{array}$$

attention" \vee ¬ "you clear your doubts in time" \rightarrow ¬ "you will find this course very easy" $S \rightarrow P \wedge Q \wedge R$ " If you find this course easy, then it implies you attend the lectures regularly, pay attention, and clear your doubts in time"

You may attend the lectures regularly, pay attention, clear your doubts in time, but it may not be enough for this course! I might make the course very difficult!

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 $P \wedge Q \wedge R \rightarrow S$? Not necessarily!!

 $\neg P \lor \neg Q \lor \neg R \to \neg S$

 \neg ("You attend the lectures regularly" \land "you pay attention" \land "you clear your doubts in time") \rightarrow \neg

¬ "You attend the lectures regularly" ∨ ¬ "you pay

Q:= "You will find the lecture interesting" R:= "You will understand everything" S:= "You pay attention" $S\to P\wedge Q\wedge R$ "If you pay attention, then you will keep up with the lecture, find the lecture interesting, and understand everything"

P := "You will keep up with the lecture"

$$\neg P \lor \neg Q \lor \neg R \to \neg S$$

"If you are not keeping up with the lecture,

attention" \wedge "you clear your doubts in time") $\to \neg$ "you will find this course very easy" $\neg P \vee \neg Q \vee \neg R \to \neg S$

$$\neg$$
 "You attend the lectures regularly" $\lor \neg$ "you pay

attention" $\ \lor \ \lnot$ "you clear your doubts in time" $\ \to \ \lnot$ "you will find this course very easy"

 \neg ("You attend the lectures regularly" \land "you pay

$$S \to P \land Q \land R$$
"If you find this

"If you find this course easy, then it implies you attend the lectures regularly, pay attention, and clear your doubts in time"

 $P \wedge Q \wedge R \to S$? Not necessarily!! You may attend the lectures regularly, pay attention, clear your doubts in time, but it may not be enough for this course! I might make the course very difficult!

Q := "You will find the lecture interesting" R := "You will understand everything" S := "You pay attention" $S \to P \land Q \land R$ "If you pay attention, then you will keep up with the lecture, find the lecture interesting, and understand everything" $\neg P \lor \neg Q \lor \neg R \to \neg S$ finding the lecture interesting,

P := "You will keep up with the lecture"

attention" $\vee \neg$ "you clear your doubts in time" $\rightarrow \neg$ "you will find this course very easy" $S \to P \land Q \land R$ "If you are not keeping up with the lecture, or you are not" If you find this course easy, then it implies you attend the lectures regularly, pay attention, and clear your doubts in time"

> You may attend the lectures regularly, pay attention, clear your doubts in time, but it may not be enough for this course! I might make the course very difficult!

"vou will find this course very easy"

 $P \wedge Q \wedge R \rightarrow S$? Not necessarily!!

 $\neg P \lor \neg Q \lor \neg R \to \neg S$

 \neg ("You attend the lectures regularly" \land "you pay attention" \land "you clear your doubts in time") $\rightarrow \neg$

¬ "You attend the lectures regularly" ∨ ¬ "you pay

R := "You will understand everything" S := "You pay attention" $S \to P \land Q \land R$ "If you pay attention, then you will keep up with the lecture, find the lecture interesting, and understand everything"

P := "You will keep up with the lecture"

Q := "You will find the lecture interesting"

$$\neg P \lor \neg Q \lor \neg R \to \neg S$$
 "If you are not keeping up with the lecture, or you are no

finding the lecture interesting, or you do not understand something

"you will find this course very easy" $S \to P \land Q \land R$ "If you are not keeping up with the lecture, or you are not" If you find this course easy, then it implies you attend the lectures regularly, pay attention, and clear your doubts in time"

 \neg ("You attend the lectures regularly" \land "you pay attention" \wedge "you clear your doubts in time") \rightarrow \neg

¬ "You attend the lectures regularly" ∨ ¬ "you pay

attention" $\vee \neg$ "you clear your doubts in time" $\rightarrow \neg$

"vou will find this course very easy"

 $\neg P \lor \neg Q \lor \neg R \to \neg S$

 $P \wedge Q \wedge R \rightarrow S$? Not necessarily!! You may attend the lectures regularly, pay attention, clear your doubts in time, but it may not be enough for this course! I might make the course very difficult!

$$\begin{array}{l} Q:=\quad \text{"You will find the lecture interesting"}\\ R:=\quad \text{"You will understand everything"}\\ S:=\quad \text{"You pay attention"}\\ S\to P\wedge Q\wedge R\\ \text{"If you pay attention, then you will keep up with the lecture, find the lecture interesting, and understand everything"}\\ \neg P\vee \neg Q\vee \neg R\to \neg S\\ \text{"If you are not keeping up with the lecture, or you are not finding the lecture interesting, or you do not understand something, then you are not paying attention."} \end{array}$$

d attention" \vee ¬ "you clear your doubts in time" \rightarrow ¬ "you will find this course very easy" $S \rightarrow P \land Q \land R$ not "If you find this course easy, then it implies you attend the lectures regularly, pay attention, and clear your doubts in time"

You may attend the lectures regularly, pay attention, clear your doubts in time, but it may not be enough for this course! I might make the course very difficult!

"vou will find this course very easy"

 $P \wedge Q \wedge R \rightarrow S$? Not necessarily!!

 $\neg P \lor \neg Q \lor \neg R \to \neg S$

 \neg ("You attend the lectures regularly" \land "you pay attention" \land "you clear your doubts in time") \rightarrow \neg

¬ "You attend the lectures regularly" ∨ ¬ "you pay

Q:= "You will find the lecture interesting" R:= "You will understand everything" S:= "You pay attention" $S\to P\wedge Q\wedge R$ "If you pay attention, then you will keep up with the lecture, find the lecture interesting, and understand everything"

P := "You will keep up with the lecture"

$$\neg P \lor \neg Q \lor \neg R \to \neg S$$

"If you are not keeping up with the lecture, or you are not finding the lecture interesting, or you do not understand

something, then you are not paying attention."

attention" \land "you clear your doubts in time") $\rightarrow \neg$ "you will find this course very easy" $\neg P \lor \neg Q \lor \neg R \rightarrow \neg S$

$$\neg$$
 "You attend the lectures regularly" $\lor \neg$ "you pay

attention" $\lor \lnot$ "you clear your doubts in time" $\to \lnot$ "you will find this course very easy"

 \neg ("You attend the lectures regularly" \land "you pay

$$S \to P \land Q \land R$$

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 $P \land Q \land R \rightarrow S?$ Not necessarily!! You may attend the lectures regularly, pay attention, clear your doubts in time, but it may not be enough for this course! I might make the course very difficult!

Although each variable has an interpretation in natural language...

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$$\neg P \lor \neg Q \lor \neg R \to \neg S$$

"If you are not keeping up with the lecture, or you are not finding the lecture interesting, or you do not understand

something, then you are not paying attention."

 \neg ("You attend the lectures regularly" \land "you pay

attention" \land "you clear your doubts in time") $\rightarrow \neg$ "vou will find this course very easy" $\neg P \lor \neg Q \lor \neg R \to \neg S$

$$\neg P \lor \neg Q \lor \neg R \to \neg S$$

¬ "You attend the lectures regularly" ∨ ¬ "you pay attention" $\vee \neg$ "you clear your doubts in time" $\rightarrow \neg$ "you will find this course very easy"

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$$\neg P \lor \neg Q \lor \neg R \to \neg S$$

"If you are not keeping up with the lecture, or you are not finding the lecture interesting, or you do not understand

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attention" \land "you clear your doubts in time" $)\to \neg$ "you will find this course very easy" $\neg P \lor \neg Q \lor \neg R \to \neg S$

$$\neg$$
 "You attend the lectures regularly" $\lor \neg$ "you pay

attention" $\lor \neg$ "you clear your doubts in time" $\to \neg$ "you will find this course very easy"

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$$S \to P \land Q \land R$$

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 $P \land Q \land R \rightarrow S?$ Not necessarily!! You may attend the lectures regularly, pay attention, clear your doubts in time, but it may not be enough for this course! I might make the course very difficult!

 $\begin{array}{ll} Q:=&\text{``You will find the lecture interesting''}\\ R:=&\text{``You will understand everything''}\\ S:=&\text{``You pay attention''}\\ S\to P\wedge Q\wedge R\\ \text{``If you pay attention, then you will keep up with the lecture, find the lecture interesting, and understand everything''} \end{array}$

P := "You will keep up with the lecture"

$$\neg P \lor \neg Q \lor \neg R \to \neg S$$

"If you are not keeping up with the lecture, or you are not finding the lecture interesting, or you do not understand

something, then you are not paying attention."

attention" \land "you clear your doubts in time") \rightarrow ¬ "you will find this course very easy" $\neg P \lor \neg Q \lor \neg R \to \neg S$

 $S \to P \land Q \land R$

doubts in time"

$$\neg$$
 "You attend the lectures regularly" $\lor \neg$ "you pay

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Q:= "You will find the lecture interesting" R:= "You will understand everything" S:= "You pay attention" $S\to P\wedge Q\wedge R$ "If you pay attention, then you will keep up with the lecture, find the lecture interesting, and understand everything"

"If you are not keeping up with the lecture, or you are not

finding the lecture interesting, or you do not understand

P := "You will keep up with the lecture"

$$\neg P \lor \neg Q \lor \neg R \to \neg S$$

something, then you are not paying attention."

Let ${\cal S}$ denote the set of propositional variables.

attention" \land "you clear your doubts in time") $\rightarrow \neg$ "you will find this course very easy" $\neg P \lor \neg Q \lor \neg R \rightarrow \neg S$

$$\neg F \lor \neg Q \lor \neg R \to \neg S$$

 \neg "You attend the lectures regularly" $\lor \neg$ "you pay attention" $\lor \neg$ "you clear your doubts in time" $\to \neg$ "you will find this course very easy"

 \neg ("You attend the lectures regularly" \land "you pay

$$S \to P \land Q \land R$$

"If you find this course easy, then it implies you attend the lectures regularly, pay attention, and clear your doubts in time"

 $P \wedge Q \wedge R \rightarrow S$? Not necessarily!! You may attend the lectures regularly, pay attention, clear your doubts in time, but it may not be enough for this course! I might make the course very difficult!

Q := "You will find the lecture interesting" R := "You will understand everything" S := "You pay attention"

P := "You will keep up with the lecture"

 $S \to P \land Q \land R$ "If you pay attention, then you will keep up with the

 $\neg P \lor \neg Q \lor \neg R \to \neg S$

everything"

"If you are not keeping up with the lecture, or you are not finding the lecture interesting, or you do not understand something, then you are not paying attention."

lecture, find the lecture interesting, and understand

valuation is a function $\nu: S \to \{True, False, \}$.

Let S denote the set of propositional variables. Then a

"you will find this course very easy"

 $\neg P \lor \neg Q \lor \neg R \to \neg S$

"vou will find this course very easy"

 $S \to P \land Q \land R$

"If you find this course easy, then it implies you attend the lectures regularly, pay attention, and clear your doubts in time"

 \neg ("You attend the lectures regularly" \land "you pay

attention" \wedge "you clear your doubts in time") $\rightarrow \neg$

¬ "You attend the lectures regularly" ∨ ¬ "you pay

attention" $\vee \neg$ "you clear your doubts in time" $\rightarrow \neg$

 $P \wedge Q \wedge R \rightarrow S$? Not necessarily!! You may attend the lectures regularly, pay attention,

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P := "You will keep up with the lecture"

$$\neg P \lor \neg Q \lor \neg R \to \neg S$$
 "If you are not keeping up with the lecture, or you are not

something, then you are not paying attention."

Let S denote the set of propositional variables. Then a **valuation** is a function $\nu: S \to \{True, False, \}$.

attention" \land "you clear your doubts in time") \rightarrow ¬ "you will find this course very easy" $\neg P \lor \neg Q \lor \neg R \to \neg S$

"you will find this course very easy"

¬ "You attend the lectures regularly" ∨ ¬ "you pay

 \neg "You attend the lectures regularly" $\lor \neg$ "you pay attention" $\lor \neg$ "you clear your doubts in time" $\to \neg$

 $S \to P \land Q \land R$

"If you are not keeping up with the lecture, or you are not "If you find this course easy, then it implies you attend finding the lecture interesting, or you do not understand the lectures regularly, pay attention, and clear your something, then you are not paying attention."

 \neg ("You attend the lectures regularly" \land "you pay

You may attend the lectures regularly, pay attention, clear your doubts in time, but it may not be enough for this course! I might make the course very difficult!

and only care if the propositional variables are assigned True or False in a given context

 $\begin{array}{ll} Q:=& \text{"You will find the lecture interesting"}\\ R:=& \text{"You will understand everything"}\\ S:=& \text{"You pay attention"}\\ S\to P\wedge Q\wedge R\\ \text{"If you pay attention, then you will keep up with the lecture, find the lecture interesting, and understand} \end{array}$

P := "You will keep up with the lecture"

$$\neg P \lor \neg Q \lor \neg R \to \neg S$$

everything"

finding the lecture interesting, or you do not understand something, then you are not paying attention."

"If you are not keeping up with the lecture, or you are not

Let S denote the set of propositional variables. Then a **valuation** is a function $\nu: S \to \{True, False, \}$.

attention" \land "you clear your doubts in time") \rightarrow ¬ "you will find this course very easy" $\neg P \lor \neg Q \lor \neg R \to \neg S$

$$\neg F \lor \neg Q \lor \neg K \to \neg S$$

 \neg "You attend the lectures regularly" $\lor \neg$ "you pay attention" $\lor \neg$ "you clear your doubts in time" $\to \neg$ "you will find this course very easy"

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$$S \to P \land Q \land R$$

"If you find this course easy, then it implies you attend the lectures regularly, pay attention, and clear your doubts in time"

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R:= "You will understand everything" S:= "You pay attention" $S \to P \land Q \land R$

something, then you are not paying attention."

 $\neg P \lor \neg Q \lor \neg R \to \neg S$

P := "You will keep up with the lecture" Q := "You will find the lecture interesting"

"If you pay attention, then you will keep up with the lecture, find the lecture interesting, and understand everything"

"If you are not keeping up with the lecture, or you are not finding the lecture interesting, or you do not understand

Let
$$S$$
 denote the set of propositional variables. Then a valuation is a function $\nu:S \to \{True,False,\}$.

Q := "You will find the lecture interesting" R := "You will understand everything"

lecture, find the lecture interesting, and understand

P := "You will keep up with the lecture"

$$S:=$$
 "You pay attention"
$$S\to P\wedge Q\wedge R$$
 "If you pay attention, then you will keep up with the

everything"

 $\neg P \lor \neg Q \lor \neg R \to \neg S$

"If you are not keeping up with the lecture, or you are not finding the lecture interesting, or you do not understand something, then you are not paying attention."

Let S denote the set of propositional variables. Then a valuation is a function $\nu:S \to \{True,False,\}.$

Semantic

Q := "You will find the lecture interesting" R := "You will understand everything"

P := "You will keep up with the lecture"

S := "You pay attention"

 $\neg P \lor \neg Q \lor \neg R \to \neg S$

 $S \to P \land Q \land R$

"If you pay attention, then you will keep up with the lecture, find the lecture interesting, and understand everything"

"If you are not keeping up with the lecture, or you are not finding the lecture interesting, or you do not understand something, then you are not paying attention."

Let S denote the set of propositional variables. Then a valuation is a function $\nu: S \to \{True, False, \}$.

S := "You pay attention" "If you pay attention, then you will keep up with the

Semantic

finding the lecture interesting, or you do not understand something, then you are not paying attention."

"If you are not keeping up with the lecture, or you are not

lecture, find the lecture interesting, and understand

P := "You will keep up with the lecture"

Q := "You will find the lecture interesting" R := "You will understand everything"

 $S \to P \land Q \land R$

 $\neg P \lor \neg Q \lor \neg R \to \neg S$

everything"

Let S denote the set of propositional variables. Then a **valuation** is a function $\nu: S \to \{True, False, \}$.

P := "You will keep up with the lecture" Q := "You will find the lecture interesting"

ure interesting

R := "You will understand everything" S := "You pay attention"

<u>Р</u> Т

Semantic

$$S \to P \land Q \land R$$
 "If you pay attention, then you will keep up with the

lecture, find the lecture interesting, and understand everything"

$$\neg P \lor \neg Q \lor \neg R \to \neg S$$

"If you are not keeping up with the lecture, or you are not finding the lecture interesting, or you do not understand

Let S denote the set of propositional variables. Then a **valuation** is a function $\nu: S \to \{True, False, \}$.

something, then you are not paying attention."

It will have just two possible functions, so we will have 2 rows

P := "You will keep up with the lecture" Q := "You will find the lecture interesting"

 $\hat{R}:=$ "You will understand everything"

S := "You pay attention" $S \to P \land Q \land R$

lecture, find the lecture interesting, and understand everything"

$$\neg P \vee \neg Q \vee \neg R \to \neg S$$

"If you are not keeping up with the lecture, or you are not finding the lecture interesting, or you do not understand something, then you are not paying attention."

Let S denote the set of propositional variables. Then a **valuation** is a function $\nu: S \to \{True, False, \}$.

Semantic

P := "You will keep up with the lecture" Q := "You will find the lecture interesting"

R := "You will understand everything"

S := "You pay attention"

$$S \to P \land Q \land R$$

"If you pay attention, then you will keep up with the lecture, find the lecture interesting, and understand everything"

$$\neg P \vee \neg Q \vee \neg R \to \neg S$$

"If you are not keeping up with the lecture, or you are not finding the lecture interesting, or you do not understand something, then you are not paying attention."

Let S denote the set of propositional variables. Then a **valuation** is a function $\nu: S \to \{True, False, \}$.

Semantic

R := "You will understand everything" S := "You pay attention" "If you pay attention, then you will keep up with the

lecture, find the lecture interesting, and understand everything"

P := "You will keep up with the lecture"

Q := "You will find the lecture interesting"

 $\neg P \lor \neg Q \lor \neg R \to \neg S$ "If you are not keeping up with the lecture, or you are not

 $S \to P \land Q \land R$

finding the lecture interesting, or you do not understand something, then you are not paying attention."

Let S denote the set of propositional variables. Then a **valuation** is a function $\nu: S \to \{True, False, \}$.

$$P :=$$
 "You will keep up with the lecture" $Q :=$ "You will find the lecture interesting"

$$R :=$$
 "You will understand everything"

$$S :=$$
 "You pay attention" $S \to P \land Q \land R$

$$S \to P \land Q \land R$$
 "If you pay attention, then you will keep up with the

lecture, find the lecture interesting, and understand everything"

$$\neg P \vee \neg Q \vee \neg R \to \neg S$$
 "If you are not keeping up with the lecture, or you are not

something, then you are not paying attention."

finding the lecture interesting, or you do not understand

Let S denote the set of propositional variables. Then a valuation is a function $\nu:S \to \{True,False,\}.$

Semantic

P := "You will keep up with the lecture" Q := "You will find the lecture interesting" R := "You will understand everything"

S:= "You pay attention"

 $S \to P \land Q \land R$

"If you pay attention, then you will keep up with the lecture, find the lecture interesting, and understand everything"

$$\neg P \lor \neg Q \lor \neg R \to \neg S$$

"If you are not keeping up with the lecture, or you are not finding the lecture interesting, or you do not understand something, then you are not paying attention."

Let S denote the set of propositional variables. Then a **valuation** is a function $\nu: S \to \{True, False, \}$.

Semantic

Р	-
Т	ı
F	-

 $\begin{array}{c|cccc} P & Q & P \wedge Q \\ \hline T & T & T \end{array}$

$$P :=$$
 "You will keep up with the lecture" $Q :=$ "You will find the lecture interesting"

"If you pay attention, then you will keep up with the

Semantic

lecture, find the lecture interesting, and understand everything"

R := "You will understand everything"

$$\neg P \lor \neg Q \lor \neg R \to \neg S$$
 "If you are not keeping up with the lecture, or you are not

S := "You pay attention"

 $S \to P \land Q \land R$

finding the lecture interesting, or you do not understand something, then you are not paying attention."

Let S denote the set of propositional variables. Then a **valuation** is a function $\nu: S \to \{True, False, \}$.

The output should be true if both P and Q are true

antic

Sem

lecture, find the lecture interesting, and understand everything"

P := "You will keep up with the lecture"

Q := "You will find the lecture interesting" R := "You will understand everything"

$$\neg P \lor \neg Q \lor \neg R \to \neg S$$
 "If you are not keeping up with the lecture, or you are not

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 $S \to P \land Q \land R$

finding the lecture interesting, or you do not understand something, then you are not paying attention."

"If you pay attention, then you will keep up with the

Let S denote the set of propositional variables. Then a **valuation** is a function $\nu: S \to \{True, False, \}$.

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Semantic

something, then you are not paying attention." Let
$$S$$
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"If you are not keeping up with the lecture, or you are not finding the lecture interesting, or you do not understand

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 $\neg P \lor \neg Q \lor \neg R \to \neg S$

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Semantic

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 $\neg P \lor \neg Q \lor \neg R \to \neg S$

valuation is a function $\nu: S \to \{True, False, \}.$

F F F F

"If you pay attention, then you will keep up with the lecture, find the lecture interesting, and understand everything"

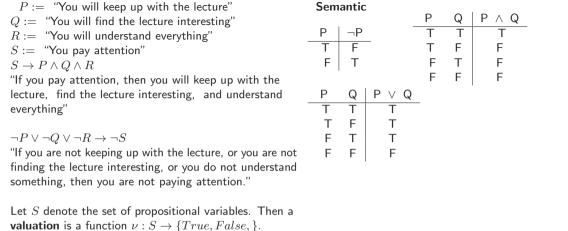
$$\neg P \lor \neg Q \lor \neg R \to \neg S$$
 "If you are not keeping up with the lecture, or you are not finding the lecture interesting, or you do not understand something, then you are not paying attention."

Let S denote the set of propositional variables. Then a valuation is a function $\nu: S \to \{True, False, \}$.

 $\neg P \lor \neg Q \lor \neg R \to \neg S$ "If you are not keeping up with the lecture, or you are not finding the lecture interesting, or you do not understand something, then you are not paying attention."

Let S denote the set of propositional variables. Then a valuation is a function $\nu: S \to \{True, False, \}$.

F F F



R:= "You will understand everything" S:= "You pay attention" $S\to P\wedge Q\wedge R$ "If you pay attention, then you will keep up with the

P := "You will keep up with the lecture"

Q := "You will find the lecture interesting"

lecture, find the lecture interesting, and understand everything $\neg P \lor \neg Q \lor \neg R \to \neg S$

"If you are not keeping up with the lecture, or you are not finding the lecture interesting, or you do not understand something, then you are not paying attention."

Let S denote the set of propositional variables. Then a valuation is a function $\nu: S \to \{True, False, \}$.

The trickiest one is "implies"

 $S \to P \land Q \land R$ "If you pay attention, then you will keep up with the lecture, find the lecture interesting, and understand everything" $\neg P \lor \neg Q \lor \neg R \to \neg S$ "If you are not keeping up with the lecture, or you are not finding the lecture interesting, or you do not understand

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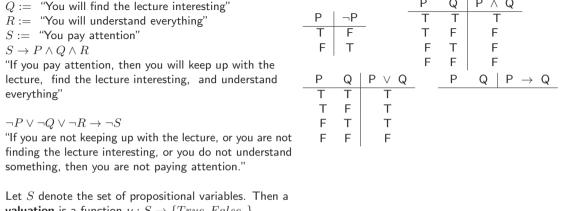
P := "You will keep up with the lecture"

Q := "You will find the lecture interesting" R := "You will understand everything"

S := "You pay attention"

Let S denote the set of propositional variables. Then a valuation is a function $\nu: S \to \{True, False, \}$.

Again, it is better to understand it by asking when it can be "wrong"



Semantic

valuation is a function $\nu: S \to \{True, False, \}$.

P := "You will keep up with the lecture"

Q := "You will find the lecture interesting" R := "You will understand everything" S := "You pay attention" F $S \to P \land Q \land R$ "If you pay attention, then you will keep up with the lecture, find the lecture interesting, and understand $\neg P \lor \neg Q \lor \neg R \to \neg S$ "If you are not keeping up with the lecture, or you are not finding the lecture interesting, or you do not understand something, then you are not paying attention."

Semantic

Let S denote the set of propositional variables. Then a **valuation** is a function $\nu: S \to \{True, False, \}$.

P := "You will keep up with the lecture"

everything"

An implication is false only if the assumption is true but what follows is still false

Q := "You will find the lecture interesting" R := "You will understand everything" S := "You pay attention" F $S \to P \land Q \land R$ "If you pay attention, then you will keep up with the lecture, find the lecture interesting, and understand everything" $\neg P \lor \neg Q \lor \neg R \to \neg S$ "If you are not keeping up with the lecture, or you are not

P := "You will keep up with the lecture"

Let S denote the set of propositional variables. Then a

finding the lecture interesting, or you do not understand

something, then you are not paying attention."

valuation is a function $\nu: S \to \{True, False, \}$.

Q := "You will find the lecture interesting" R := "You will understand everything" S := "You pay attention" F $S \to P \land Q \land R$ "If you pay attention, then you will keep up with the lecture, find the lecture interesting, and understand everything" $\neg P \lor \neg Q \lor \neg R \to \neg S$ "If you are not keeping up with the lecture, or you are not

Semantic

Let S denote the set of propositional variables. Then a

something, then you are not paying attention."

P := "You will keep up with the lecture"

valuation is a function $\nu: S \to \{True, False, \}$.

finding the lecture interesting, or you do not understand $P \wedge Q \rightarrow R$ Q:= "You will find the lecture interesting" R:= "You will understand everything" S:= "You pay attention" $S\to P\wedge Q\wedge R$ "If you pay attention, then you will keep up with the

P := "You will keep up with the lecture"

lecture, find the lecture interesting, and understand everything"

 $\neg P \vee \neg Q \vee \neg R \to \neg S$ "If you are not keeping up with the lecture, or you are not finding the lecture interesting, or you do not understand something, then you are not paying attention."

Let S denote the set of propositional variables. Then a valuation is a function $\nu:S \to \{True,False,\}.$

Semantic F $P \wedge Q \mid P \wedge Q \rightarrow R$

Q:= "You will find the lecture interesting" R:= "You will understand everything" S:= "You pay attention"

P := "You will keep up with the lecture"

 $S \to P \land Q \land R$

"If you pay attention, then you will keep up with the lecture, find the lecture interesting, and understand everything"

 $\neg P \vee \neg Q \vee \neg R \to \neg S$ "If you are not keeping up with the lecture, or you are not

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Let S denote the set of propositional variables. Then a **valuation** is a function $\nu:S\to \{True,False,\}.$

P := "You will keep up with the lecture" Q := "You will find the lecture interesting" R := "You will understand everything"

S:= "You pay attention" $S \to P \land Q \land R$

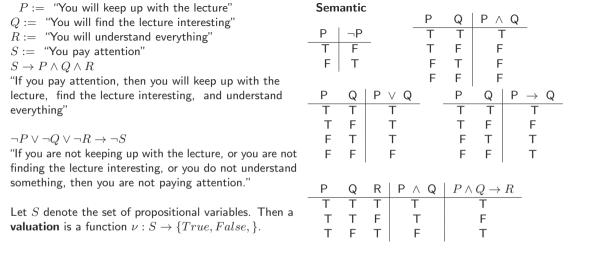
lecture, find the lecture interesting, and understand everything"

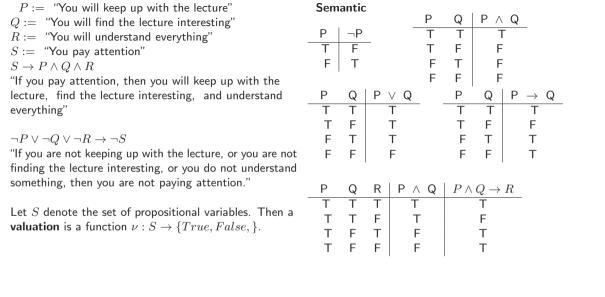
$$\neg P \lor \neg Q \lor \neg R \to \neg S$$

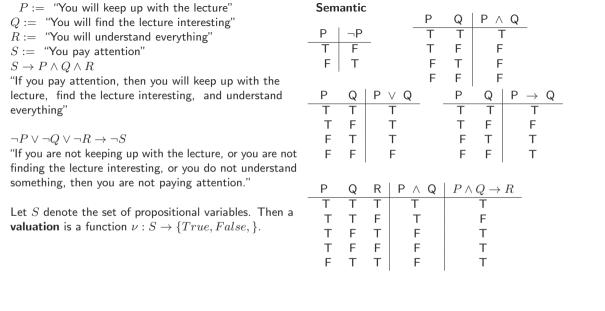
"If you are not keeping up with the lecture, or you are not finding the lecture interesting, or you do not understand something, then you are not paying attention."

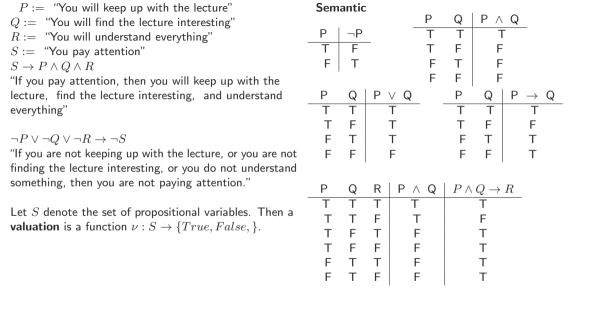
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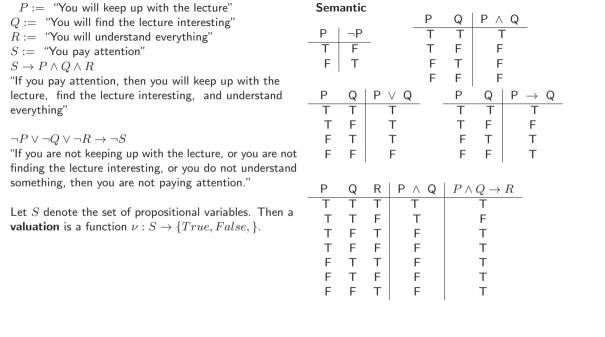
			Р	Q	P ^	. Q
Р	−P	_	Т	Т	٦	
Т	F	_	Т	F	F	
F	Т		F	Т	F	
			F	F	F	
Р	Q	$P \vee Q$		Р	Q	$P \rightarrow Q$
Т	Т	Т		Т	Т	Т
Т	F	Т		Т	F	F
F	Т	Т		F	Т	Т
F	F	F		F	F	Т











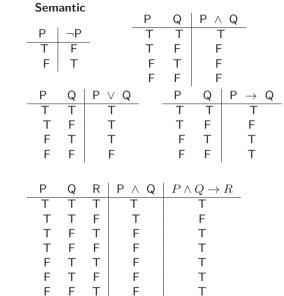
Sem	antic		
5		P Q	P ∧ Q
<u>P</u>	¬P	T T	T
Ţ	F	T F	F
F	Т	F T F F	F
_			F
<u>P</u>	Q P V Q	P	$Q P \rightarrow Q$
Ţ	T T	T	T
Ţ	F T	T	F F
F	T T	F	
F	F F	F	F T
<u>P_</u>	Q R P A	$Q \mid P /$	$\land Q \to R$
Т	TTTT		Т
Т	T F T		F
T	F T F	I	Т
Ţ	F F F	I	<u>T</u>
F	T T F	- 1	T
F	T F F	I	
F	F T F		T
F	F F F		Т

	Sem	antic								
					Р	Q	P ^	Q		
	Р	¬P			Т	Т	٦	Γ	_	
	Т	F	_		Т	F	F			
	F	Т			F	Т	F			
					F	F	F			
	Р	Q	Р	∨ Q		Р	Q	Р	\rightarrow	Q
	Т	Т		Т		Т	Т		Т	
	Т	F		Т		Т	F		F	
	F	Т		Т		F	Т		Т	
	F	F		F		F	F		Т	
	Р	Q	R	P /	Q	$P \wedge$	$Q \rightarrow$	R		
-	Т	Т	Т	Т			Т			
	Т	Т	F	٦	-		F			
	Т	F	Т	F	=		Т			
	Т	F	F	F	=		Т			
	F	Т	Т	F	=		Т			
	F	Т	F	F	=		Т			
	F	F	Т	F	=		Т			
	F	F	F	F	=		Т			

We now consider the syntactic side

Sem	antic			Р	Q	Р∧	Q		
Р	¬Р		-	T	T	7	<u> </u>	-	
Т	F	_		Т	F	F			
F	Т			F	Т	F			
'				F	F	F			
Р	Q	Ρ	∨ Q		Р	Q	Р	\rightarrow	Q
Т	Т		Т		Т	Т		Т	
Т	F		Т		Т	F		F T	
F	Т		Т		F	Т		Т	
F	F		F		F	F		Т	
Р	Q	R	P ^	Q	$P \wedge$	$Q \rightarrow$	R		
Т	Т	Т	Т			Т			
T T	Т	F	Т	-		F			
Т	F	Т	T F F			Т			
Т	F	F	F			Т			
F	Т	Т	F			T T			
F	Т	F	F			Т			
F	F	T F	F			T T			
F	F	F	l F	:		Т			

where we are not concerned with the syntactic means

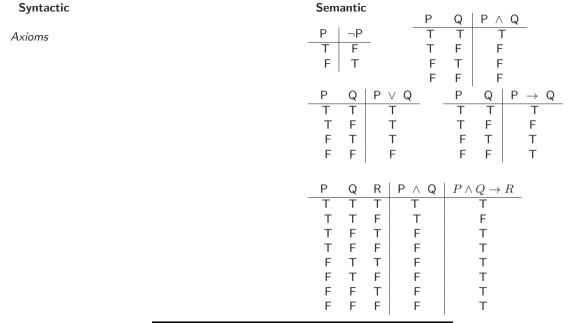


but merely they relate with each other.

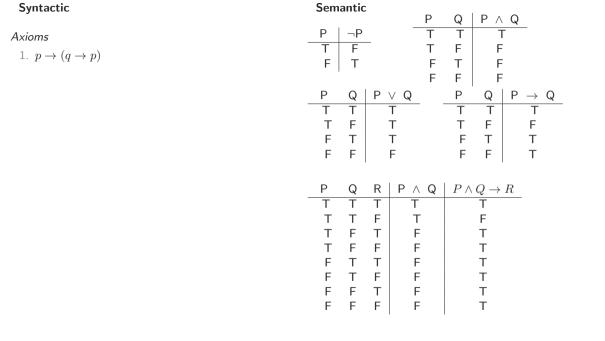
FFF

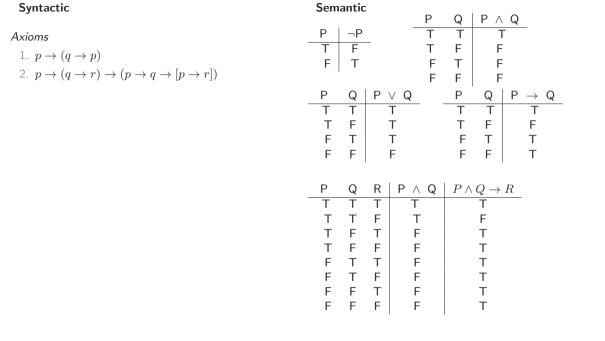
Sem	antic								
				Р	Q	P \	Q		
Р	¬P			Т	Т	٦		_	
Т	F	_		Т	F	F			
F	Т			F	Т	F			
	'			F	F	F			
Р	Q	Р	√ Q		Р	Q	Р	\rightarrow	C
Т	Т		T		Т	Т		Т	
Т	F		Т		Т	F		F	
F	Т		Т		F	Т		Т	
F	F		F		F	F		Т	
	'								
Р	Q	R	P ^	Q	$P \wedge$	$Q \rightarrow$	R		
Т	Т	Т	Т			Т			
Т	Т	F	Т	-		F			
Т	F	Т	F	:		Т			
Т	F	F	F	:		Т			
_	_		_	_	1	_			

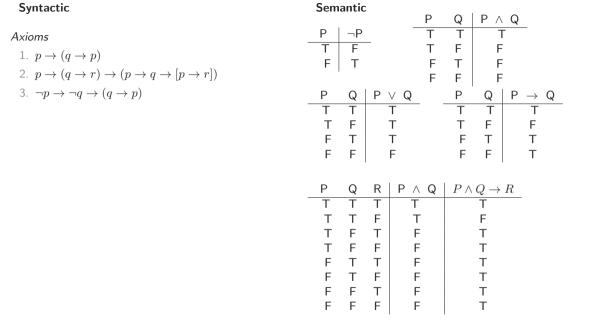
Yet, as we will see, we will be able to prove everything that we could have derived from truth tables

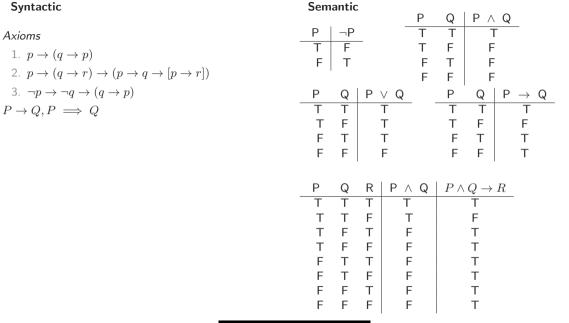


In the next lecture we will be introduced to these axioms

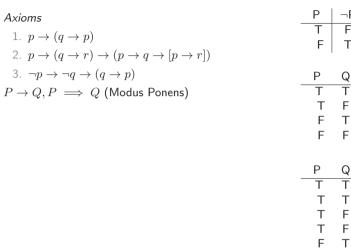








and this very important rule



	Τ	F			Т	F	F	
	F	Т			F	Т	F	
	'				F	F	F	:
	Р	Q	Р	∨ Q		Р	Q	Р
_	T T F	Т		Т		T T	Т	
	Т	F	'	Т		Т	F	
	F	T F T		Т		F	Т	
	F	F		F		F	F	
		'						'
	Р	Q	R	PΛ	Q	$P \wedge$	$Q \rightarrow$	R
-		Q T	R		Q	$P \wedge$	$\frac{Q \rightarrow}{T}$	R
-	Т		Т	Т	Q	$P \wedge$	Т	R
-	T T	Т	T F	T T	Q	$P \wedge$	T F	R
-	T T	T	T F T	T T F	Q	$P \wedge$	T F T	R
-	Т	T T F	T F T F	T T F	Q	$P \wedge$	T F T T	R
-	T T T T	T T F	T F T F	T F F	Q	$P \wedge$	T F T T	R
-	T T T T	T F F T	T F T F	T T F	Q	$P \wedge$	T F T T	R

