

WHAT ARE TRUTH TABLES?

WEEK 1 . TOPIC INTRODUCTION

RECALL:

$(\neg C \wedge D)$

Translation manual:

C is "He's a white supremacist" and

D is "He's a racist."

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But what if we don't know?

Is there a way we can represent all the possibilities?

IS $(\neg C \wedge D)$ TRUE OR FALSE?

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C is true and D is true

C is true and D is false

C is false and D is true

C is false and D is false



all the possibilities

A **truth table** allows us to consider the truth value of a wff under all possible assignments of truth values to its atomic constituents.

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YOU CAN THINK OF
EACH ROW OF THE
TRUTH TABLE AS A
POSSIBLE WORLD.

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all the possibilities

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all the possibilities

C	D
T	T
T	F
F	T
F	F

IS $(\neg C \wedge D)$ TRUE OR FALSE?

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C is true and D is false
C is false and D is true
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all the possibilities

C	D	$\neg C$
T	T	F
T	F	F
F	T	T
F	F	T

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T	F	F	F
F	T	T	T
F	F	T	F

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T	T	F	F
T	F	F	F
F	T	T	T
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TRUTH TABLES FOR ALL THE CONNECTIVES

\wedge (and)

A	B	$A \wedge B$
T	T	T
T	F	F
F	T	F
F	F	F

\wedge (and)

A	B	$A \wedge B$
T	T	T
T	F	F
F	T	F
F	F	F

\vee (or)

A	B	$A \vee B$
T	T	T
T	F	T
F	T	T
F	F	F

\wedge (and)

A	B	$A \wedge B$
T	T	T
T	F	F
F	T	F
F	F	F

\vee (or)

A	B	$A \vee B$
T	T	T
T	F	T
F	T	T
F	F	F

you can see we're
not using the "exclusive or"
here!

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T	F	F
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\vee (or)

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\wedge (and)

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\vee (or)

A	B	$A \vee B$
T	T	T
T	F	T
F	T	T
F	F	F

\neg (negation)

A	$\neg A$
T	F
F	T

\rightarrow (conditional)

A	B	$A \rightarrow B$
T	T	T
T	F	F
F	T	T
F	F	T

\rightarrow (conditional)

A	B	$A \rightarrow B$
T	T	T
T	F	F
F	T	T
F	F	T

Conditional can be tricky!
Note that it is only false if the
antecedent (A) is true but the
conclusion (B) is not.

→ (conditional)

A	B	$A \rightarrow B$
T	T	T
T	F	F
F	T	T
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Conditional can be tricky!
Note that it is only false if the
antecedent (A) is true but the
conclusion (B) is not.

Example: Suppose I tell my sister

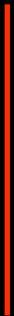
“If you do your homework, I’ll give you a cookie.”

To understand implication, think: “When does she have the right to be mad?” When she does her homework but I don’t give her a cookie!

But I haven’t said anything about the case where she doesn’t do her homework. Maybe she goes and makes cookies herself!

\rightarrow (conditional)

A	B	$A \rightarrow B$
T	T	T
T	F	F
F	T	T
F	F	T



→ (conditional)

A	B	$A \rightarrow B$
T	T	T
T	F	F
F	T	T
F	F	T

Example: Suppose I have the following script:

```
if x :  
    a = 2  
print(a)
```

Think of implication like you've triggered the "if" condition. If x is True, the script will print "2." If x is False, the script might still print "2" because a was already 2 but it might print something else.

\rightarrow (conditional)

A	B	$A \rightarrow B$
T	T	T
T	F	F
F	T	T
F	F	T

\rightarrow (conditional)

A	B	$A \rightarrow B$
T	T	T
T	F	F
F	T	T
F	F	T

\leftrightarrow (biconditional)

A	B	$A \rightarrow B$	$B \rightarrow A$	$((A \rightarrow B) \wedge (B \rightarrow A))$
T	T	T	T	T
T	F	F	T	F
F	T	T	F	F
F	F	T	T	T

\rightarrow (conditional)

A	B	$A \rightarrow B$
T	T	T
T	F	F
F	T	T
F	F	T

This is like
 $((A \rightarrow B) \wedge (B \rightarrow A))$

\leftrightarrow (biconditional)

A	B	$A \rightarrow B$	$B \rightarrow A$	$((A \rightarrow B) \wedge (B \rightarrow A))$
T	T	T	T	T
T	F	F	T	F
F	T	T	F	F
F	F	T	T	T

\rightarrow (conditional)

A	B	$A \rightarrow B$
T	T	T
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\wedge

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A	B	$A \rightarrow B$	$B \rightarrow A$	$((A \rightarrow B) \wedge (B \rightarrow A))$
T	T	T	T	T
T	F	F	T	F
F	T	T	F	F
F	F	T	T	T

\rightarrow (conditional)

A	B	$A \rightarrow B$
T	T	T
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