Logical Forms Lecture 1 Section 2.4

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## 3 Truth Tables



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- 2 Logical Operators
- 3 Truth Tables
- Assignment

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#### • A statement is a sentence that is either true or false, but not both.

- These are statements:
  - Today is Saturday.
  - Discrete Math meets today.
- These are *not* statements:
  - Hello.
  - Are you there?
  - Go away!

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### 3 Truth Tables

### Assignment

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- Binary operators
  - Conjunction "and"
  - Disjunction "or"
- Unary operator
  - Negation "not"
- Other operators
  - XOR "exclusive or"
  - NAND "not both"
  - NOR "neither"

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- Statements are represented by letters: *p*, *q*, *r*, etc.
- $\bullet~\wedge$  means "and".
- V means "or".
- $\sim$  means "not".

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#### Basic statements

- *p* = "HSC is in North Carolina."
- q = "UVA is in Virginia."
- Compound statements
  - $p \land q =$  "HSC is in North Carolina and UVA is in Virginia."
  - $p \lor q =$  "HSC is in North Carolina or UVA is in Virginia."
  - $\sim p =$  "HSC is not in North Carolina."

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$$(\sim p) \land (\sim q) = ???$$

• 
$$\sim (p \wedge q) = ???$$

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- Statement: "Everyone loves Raymond."
- Incorrect negation: "Everyone does not love Raymond."
- Correct negation: "Someone does not love Raymond."

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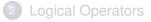
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- Statement: "Someone loves Raymond."
- Incorrect negation: "Someone does not love Raymond."
- Correct negation: "No one loves Raymond."

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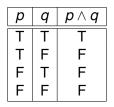


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- Make a column for every variable.
- List every possible combination of truth values of the variables.
- Make one more column for the expression.
- Write the truth value of the expression for each combination of truth values of the variables.

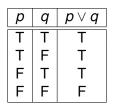
# Truth Table for "and"



- $p \land q$  is true if p is true and q is true.
- $p \wedge q$  is false if p is false or q is false.

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- $p \lor q$  is true if p or true and q is true.
- $p \lor q$  is false if p and false or q is false.

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# Truth Table for "not"



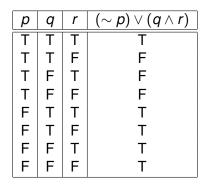
- $\sim p$  is true if p is false.
- $\sim p$  is false if p is true.

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Image: A matrix and a matrix



• Truth table for the statement  $(\sim p) \lor (q \land r)$ .

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- 2 Logical Operators
- 3 Truth Tables



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#### Assignment

- Read Section 2.1, pages 23 29.
- Exercises 6 8, 10, 12 15, page 37.

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