

# Truth Tables

Math 1001

Quantitative Skills and Reasoning



COLUMBUS STATE  
UNIVERSITY

# Truth Tables

- Previously determined truth tables:

Negation

$p$	$\sim p$
T	F
F	T

Conjunction

$p$	$q$	$p \wedge q$
T	T	T
T	F	F
F	T	F
F	F	F

Disjunction

$p$	$q$	$p \vee q$
T	T	T
T	F	T
F	T	T
F	F	F

- We will now consider methods of constructing truth tables for a statement that involves a combination of conjunctions, disjunctions, and/or negations.

# Truth Tables

- Construct a table for  $\sim(p \vee \sim q) \vee p$ .

$p$	$q$	$\sim(p \vee \sim q) \vee p$
T	T	T
T	F	T
F	T	F
F	F	F

The table above is annotated with handwritten notes:
 

- Red 'X' marks are placed above the first four rows of the table.
- A blue arrow points to the second row (p=T, q=F).
- A blue circle highlights the 'T' value in the final column of the second row.
- A blue box highlights the entire final column of the table.
- Handwritten numbers 1, 2, 3, 4, 5, and 6 are placed above the columns, with 1, 2, 3, and 4 crossed out in red, and 5 pointing to the final column.

- Use the truth table to determine the truth value of  $\sim(p \vee \sim q) \vee p$  given that  $p$  is true and  $q$  is false.

# Truth Tables

- Compound statements that involve two simple statements required  $2^2 = 4$  rows to include all combinations of T and F.
- Compound statements that involve exactly three simple statements require  $2^3 = 8$  rows to include all combinations.
- Here is the standard arrangement of these combinations:

$p$	$q$	$r$	Given Statement
T	T	T	
T	T	F	
T	F	T	
T	F	F	
F	T	T	
F	T	F	
F	F	T	
F	F	F	

# Truth Tables

- Construct a truth table for  $(p \wedge q) \wedge (\sim r \vee q)$ .
- Complete the table.

$p$	$q$	$r$	<del>X</del> $(p$	2 $\wedge$	<del>X</del> $q)$	4 $\wedge$	<del>X</del> $(\sim r$	6 $\vee$	<del>X</del> $q)$
T	T	T	T	T	T	T	F	T	T
T	T	F	T	T	T	T	T	T	T
T	F	T	T	F	F	F	F	F	F
T	F	F	T	F	F	F	T	T	F
F	T	T	F	F	T	F	F	T	T
F	T	F	F	F	T	F	T	T	T
F	F	T	F	F	F	F	F	F	F
F	F	F	F	F	F	F	T	T	F