Logic Statements

Math 1001

Quantitative Skills and Reasoning

Types of Sentences

- All languages contain different types of sentences, such as statements, questions, and commands.
- For instance:
  - "Help your brother." is a command.
  - "How is the weather?" is a question.
  - "Your cooking is delicious!" is an opinion.
  - "There are 12 months in a year." is a statement of fact.

Statements

- A **statement** is a declarative sentence that is either true or false, but not both true and false.
- It is not necessary to determine whether a sentence is true to determine whether or not it is a statement.
- For instance, the statement, "Michael Phelps won six gold medals in the 2012 Olympics."
  - You may not know if the sentence is true, but you do know that the sentence is either true or it is false, and that it is not both true and false.
  - Thus, you know that the sentence is a statement.

Identify Statements

- Determine whether each sentence is a statement.
  - 136,771 is a composite number.   Statement

  - When are office hours?   Not a statement

  - *Jurassic Park* was directed by Steven Spielberg.   Statement

  - $x - 2 = 6.$ Open Statement

Truth Value and Truth Tables

- The **truth value** of a simple statement is either true (T) or false (F).
- A **truth table** is a table that shows the truth value of a statement for all possible truth values of its simple statements.
- The only connective that can be applied to one simple statement is *negation*, so we focus on that first.
- Negation, or *not*, allows us to reverse the meaning of a simple statement, thus changing its truth value.
- We use the ~ symbol to indicate negation.

Truth Value and Truth Tables

- The *negation* of the statement "It is raining" is the statement "It is *not* raining."

- Let p be the statement "It is raining." Then $\sim p$ is the negation, the statement "It is *not* raining."

- The negation of the negation of a statement is the original statement.
  - $\sim(\sim p) = p$

- Truth table for $\sim p$:

p	$\sim p$
T	F
F	T

Negation of a Statement

- Write the negation of each statement:
  - Arnold Swarzenegger owns a Hummer.

    Arnold Swarzenegger does not own a Hummer.

  - Auburn won the football national title in 2012.

    Auburn did not win the football national title in 2012.

  - The bell pepper plant in my garden is not dead.

    The bell pepper plant in my garden is dead.