Conditional Statements

Math 1001

Quantitative Skills and Reasoning

Conditional Statements

- **Conditional statements** can be written *if p, then q* or in *if p, q* form.
  - If we order takeout, then we can have it delivered.
  - If you go to the basketball game, you will not be able to meet us for game night.
  - If *n* is a prime number greater than 2, then *n* is an odd number.
- In any conditional statement represented by "If *p*, then *q*" or by "If *p*, *q*,"
  - The *p* statement is called the **antecedent**
  - The *q* statement is called the **consequent**

Identify the Antecedent and Consequent

- If I do all of the activities, then I will succeed in this class.

  Antecedent: I do all of the activities
  Consequent: I will succeed in this class

- If I attend office hours, I will get more individualized instruction.

  Antecedent: I attend office hours
  Consequent: I will get more individualized instruction

- If I prepare for each module, then I will get more out of the class.

  Antecedent: I prepare for each module
  Consequent: I will get more out of the class

Arrow Notation

- The conditional statement "If p, then q," can be written using the **arrow notation $p \rightarrow q$**.
- The arrow notation $p \rightarrow q$ is read as "if p, then q" or as "p implies q."
- To determine the truth table for $p \rightarrow q$, consider the advertising slogan for a cooking class that states,
  - "If you can boil an egg, then you can cook a 5-star dinner."
- This slogan is a conditional statement. Let's consider the truth value of $p \rightarrow q$ for each of the following four possibilities.

Truth Table for the Conditional

- ***Antecedent*: You can boil an egg**
- ***Consequent*: You can cook a 5-star dinner**
- First, assume both the antecedent and consequent are true:
  - You can boil an egg and you can cook a 5-star dinner. In this case, the truth value of the advertisement is true.
- Next, assume the antecedent is true, but the consequent is false:
  - You can boil an egg and you cannot cook a 5-star dinner. Here, the advertisement is false.

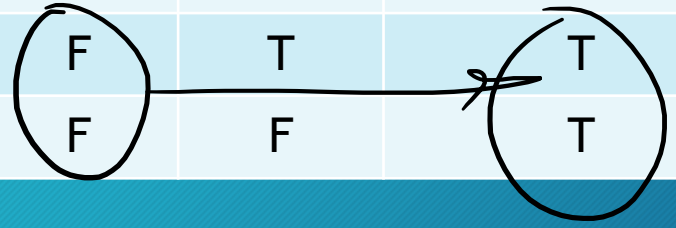
Truth Table for the Conditional

- Then, assume the antecedent is false, but the consequent is true: F T T T
  - You cannot boil an egg but you can cook a 5-star dinner. Because the advertisement does not make any claim about what you might or might not be able to do if you cannot boil an egg, we cannot state that the advertisement is false, and we are compelled to say the conditional statement is true.
- Finally, assume that both antecedent and consequent are false:
  - You cannot boil an egg nor can you cook a 5-star dinner. Similar to the previous situation, we must conclude that this situation makes the conditional statement true.

Truth Table for the Conditional

- The conditional $p \rightarrow q$ is false if p is true and q is false. It is true in all other cases.

p	q	$p \rightarrow q$
T	T	T
T	F	F
F	T	T
F	F	T



Find the Truth Value of a Conditional

- Determine the truth value of each of the following.
  - If 5 is divisible by only 1 and itself, then 5 is a prime number.

    Because the consequent is true, this conditional statement is true.

  - If 3 is an even number, then $1 > 2$.

    Because the antecedent is false, this conditional statement is true.

  - If $1 < 2$, then $2 + 2 = 5$

    Because the antecedent is true and the consequent is false, this conditional statement is false.