Section L.1: Introduction to Logic

Logic is the science of correct reasoning and making valid conclusions from a collection of statements.

**Definition:** A statement is a declarative sentence that is either true or false but not both.

Example: Which of the following would be a statement?

A) Math is fun.  
   - no

B) 2 + 4 = 6  
   - yes

C) What time is it?  
   - no

D) There are 20 students in this classroom.  
   - yes

E) Andy Murray is the 2nd best tennis player in the world.  
   - no

F) Roger Federer won the French open in 2009.  
   - yes
**Definition:** A compound statement is a collection of simple statements joined together with connectives: "and" (conjunction), "or" (disjunction), or "not" (negation).

Example: $2 + 4 = 6$ and $2 \times 10 = 8$

$2 + 4 = 6$ or $2 \times 10 = 8$

**Definition:** A conjunction is a statement of the form "p and q" and is written symbolically as $p \land q$.

<table>
<thead>
<tr>
<th>p</th>
<th>q</th>
<th>$p \land q$</th>
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<tbody>
<tr>
<td>T</td>
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*False.*
**Definition:** A disjunction is a statement of the form "p or q" and is written symbolically as $p \lor q$.

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<thead>
<tr>
<th>p</th>
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<th>$p \lor q$</th>
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Inclusive or.

**Definition:** A negation is a statement of the form "not p" and is written symbolically as $\neg p$.

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<thead>
<tr>
<th>p</th>
<th>$\neg p$</th>
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<td>F</td>
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Example: Express the following compound statements with symbolic notation.

\[ t: \text{The shirt was bought from Target.} \quad b: \text{The shirt is blue.} \]

\[ s: \text{The shirt is a short sleeve shirt.} \]

A) The shirt was bought from Target and it was blue.

\[ t \land b = b \land t \]

B) The shirt was blue or it had short sleeves.

\[ b \lor s \]

C) The shirt was not short sleeves and it was blue.

\[ \sim s \land b \]

D) The short sleeve blue shirt was not bought at target.

\[ s \land b \land \sim t \]
Example: Use the statements $r$, $f$, and $n$ to express the following compound statements in words.

$r$: The truck is red.  
$n$: The truck is new.

$f$: The truck is a Ford.

A) $n \land r \land \sim f$  
The new red truck is not a Ford.

B) $\sim r \lor f$  
The truck is not red or it is a Ford.

C) $n \land (r \lor f)$  
The new truck is red or a Ford.