A. We use symbols to represent logic sentences as follows:

Statements: $p$ $q$ $r$ (some lower case letter)
Conjunction (and): $\land$
Disjunction (or): $\lor$
Negation (not): $\neg$
Conditional (if.. then, or "implies" in some texts) : $\rightarrow$
Biconditional (if and only if – abbreviated iff): $\leftrightarrow$

Note 1 - statements are always given in the positive form

Note 2: To negate a compound statement in symbolic form use parentheses

Given the simple statements: $p$: Frank plays soccer $q$: Sue plays volleyball

Put these compound statements into symbols:
1. Frank does not play soccer or Sue plays volleyball.
2. Frank plays soccer and Sue plays volleyball.
3. It is false that Sue plays volleyball and Frank plays soccer.
   (Sometimes written as It is false that,…..)
4. Frank plays soccer if and only if Sue plays volleyball.
5. If Frank plays soccer then Sue does not play volleyball.
   (Sometimes written as if, then…..)

Put these symbolic statements into words:
6. $\neg q \land p$
7. $p \rightarrow \neg q$
8. $\neg (p \lor q)$
9. $\neg p \land \neg q$
10. $q \leftrightarrow \neg p$

Note 3: $\neg p \land \neg q$ (Frank does not play soccer and Sue does not play volleyball) is sometimes read using neither/nor - "Neither Frank plays soccer nor Sue plays volleyball".

Note 4: If the statement contains a quantifier the negation is done using the "chart".
Example: $p$: All students play soccer $q$: Some students play volleyball
Translate: $\neg p \lor \neg q$
B. COMPOUND SENTENCES USING THREE STATEMENTS:

\[ t: \text{I go by train} \quad p: \text{I go by plane} \quad b: \text{I go by bus} \]

Translate: \( t \land p \lor b \)

But what about "grouping"? Is \( (t \land p) \lor b \) the same as \( t \land (p \lor b) \)?

To identify grouping in words we use commas. Items not split by a comma go inside the parentheses:

I go by train and I go by plane, or I go by bus --
\( (t \land p) \lor b \) (disjunction)

I go by train, and I go by plane or I go by bus --
\( t \land (p \lor b) \) (conjunction)

Put these symbols into words:
\[ \sim b \leftrightarrow (p \lor t) \]
\[ (\sim p \lor t) \land b \]

Put these words into symbols:

1. I go by plane if and only if I go by bus, and I go by train.
2. If I go by plane and I do not go by train, then I go by bus.
3. I go by train, and I do not go by plane or I do not go by bus.

NOTE 5: When there are no parentheses use this "order of operations"
(Natasha’s C/D Contains Ballet)

- Negation
- Conjunction/Disjunction from left to right
- Conditional
- Biconditional

Example: Put parentheses into the following statement using order of operations, then translate the statement into words using appropriate commas:
\[ p \lor b \rightarrow b \land \sim t \]

In Class: Section 3.1 Problems 42 – 56 even, 58 – 62 even, 68 – 72 even

Homework: Section 3.1 Page 93 - Problems 35 – 71 odd