INTRO LOGIC
DAY 07
TRANSLATIONS IN
SENTENTIAL LOGIC

EXAM #1
Exam Covers:
1. Validity and Invalidity
   10 argument forms 4 points each
2. Translations in SL
   12 translations 5 points each

Complex Statements
Step by Step Procedure
1. Identify the simple (atomic) statements; abbreviate them by upper case letters.
2. Identify all the connectives. Which are standard? Which are non-standard?
3. Rewrite the sentence replacing the simple statements by their abbreviations. Retain internal punctuation.
4. Identify the major connective. [Notice commas!]
5. If the major connective is standard, symbolize it; otherwise, paraphrase it and repeat 4.
6. Work on the constituent formulas resulting from 5 [go to 4].
7. Substitute constituents back into overall formula.
8. Translate the formula back into English, and compare it with original sentence.

Example 1
if neither JAY nor KAY is working, then we will go on VACATION.

1. simple sentences
   J = Jay is working
   K = Kay is working
   V = we go on vacation

2. connectives
   if...then (standard)
   neither...nor (non-standard)
Example 1 b

3. first formula
   if neither J nor K, then V
4. main connective?
   if neither J nor K, then V
5. standard or non-standard?
   standard, so we symbolize it
   (neither J nor K) → V

Example 1 c

6. work on constituents
   (neither J nor K) → V
   (not J and not K)
   (~J & ~K)
7. substitute constituents
   (~J & ~K) → V
8. translate formula back into English
   if Jay is not working,
     and Kay is not working,
     then we will go on vacation.

Example 2

unless the exam is EASY,
I will PASS only if I STUDY

1. simple sentences
   E = the exam is easy
   P = I pass
   S = I study
2. connectives
   unless (non-standard)
   only if (non-standard)

Example 2 b

3. first formula
   unless E, P only if S
4. main connective
   unless E, P only if S
5. standard or non-standard
   non-standard, so we paraphrase it
   unless = if not
   if not E, then P only if S
Example 2 c

if not E, then P only if S

4. main connective
   if not E, then P only if S

5. standard or non-standard
   standard, so we symbolize it
   ( not E ) → ( P only if S )

6. work on constituents
   ( not E ) → ( P only if S )

Example 2 d

7. Substitute constituents
   \( \sim E \rightarrow ( \sim S \rightarrow \sim P ) \)

8. Translate formula back into English
   if the exam is not easy,
   then
   if I do not study,
   then I will not pass

Example 3

if I am HAPPY only if I am DRUNK, then I am not HAPPY unless I am DRUNK.

1. simple sentences:
   H = I am happy
   D = I am drunk

2. connectives:
   if...then (standard)
   only if (non-standard)
   not (standard)
   unless (non-standard)

Example 3 b

3. first formula:
   if H only if D, then not-H unless D

4. main connective:
   if H only if D, then not-H unless D

5. standard or non-standard:
   standard, so we symbolize it
   ( H only if D ) → ( not-H unless D )
Example 3 c

6. Work on constituents
   \[(H \text{ only if } D) \rightarrow (\text{not-}H \text{ unless } D)\]
   \[(\text{not } H \text{ if not } D)\]
   (if not D, then not H)
   \[\left(\sim D \rightarrow \sim H\right)\]
   \[(H \text{ only if } D) \rightarrow (\text{not-}H \text{ unless } D)\]
   \[(\text{not-}H \text{ if not } D)\]
   (if not-D then not H)
   \[\left(\sim D \rightarrow \sim H\right)\]

Example 3 d

7. Substitute constituents
   \[\left(\sim D \rightarrow \sim H\right) \rightarrow \left(\sim D \rightarrow \sim H\right)\]

8. Translate formula back into English
   IF
   if I am not drunk
   then I am not happy
   THEN
   if I am not drunk
   then I am not happy

Example 4

if I CONCENTRATE well only if I am ALERT,
then provided I am WISE
I will not FLY an airplane unless I am SOBER

1. simple sentences:
   \[C = \text{I concentrate well}\]
   \[A = \text{I am alert}\]
   \[W = \text{I am wise}\]
   \[F = \text{I fly an airplane}\]
   \[S = \text{I am sober}\]

2. connectives:
   if...then (standard)
   only if (non-standard)
   provided (non-standard)
   not (non-standard)
   unless (non-standard)

Example 4 b

3. first formula:
   if C only if A, then provided W not F unless S

4. main connective:
   if C only if A, then provided W not F unless S

5. standard or non-standard
   standard, so we symbolize it
   \[(C \text{ only if } A) \rightarrow (\text{provided } W \text{ not } F \text{ unless } S)\]
Example 4 c

6a. work on first constituent – antecedent

( C only if A ) → ( provided W not-F unless S )
(not C if not A )
(if not A, then not C )
( ~A → ~C )

Example 4 d

6b. work on second constituent – consequent

( C only if A ) → ( provided W, not-F unless S )
main connective?
provided W, not-F unless S
paraphrase?
if W, then ( not-F unless S )
W → ( not F unless S )
W → ( not F if not S )
W → ( if not S, then not F )
W → (~S → ~F )

Example 4 e

7. substitute constituents
(~A → ~C) → ( W → (~S → ~F ) )
8. Translate formula back into English
IF
if I am not alert
then I do not concentrate well
THEN
if I am wise,
then
if I am not sober
then I will not fly an airplane