Necessary condition

Rule: A is a necessary condition for B if B cannot happen without A.

Example: *Rain* is a necessary condition for the *road to be wet*. Or,
The wet road *cannot* happen *without* the rain.
Road cannot be wet *unless* it is raining. (unless == without)
Road is wet *only if* it is raining. / *Only if* it is raining, then the road is wet.

Translation to standard propositional form:

1) If it is rain, then the road is wet (wrong translation)
(because road can be wet for another reason)

2) If it is not raining, then the road is not wet (right)
~R -> ~W

3) If the road is wet, then it is raining (right, logically the same as previous)
W -> R

```
R W | ~R -> ~W | W -> R
T T    F  T  F   T  T T
T F    F  T  T   F  T T
F T    T  F  F   T  F F
F F    T  T  T   F  T F
```

Sufficient condition

Rule: A is a sufficient condition for B if the occurrence of A is all that is needed for the occurrence of B.

Example: *Rain* is a sufficient condition for the *road to be wet.* Or,
Rain is *all that is needed* for the road to be wet.

Translation:

1) If it is raining, then the road is wet (right)
R -> W

```
R W | ~W -> ~R | R -> W
T T    F  T  F   T  T T
F T    F  T  T   F  T T
T F    T  F  F   T  F F
F F    T  T  T   F  T F
```

SUN mnemonic
(to easily remember the order of placing antecedent and consequent)

Rule: S -> N, here S is a placeholder for a sufficient condition, N for necessary.

Example: *Rain* is a sufficient condition for the *road to be wet.*
Raining -> road is wet

Rain is a necessary condition for the *road to be wet*
Road is wet -> raining

Neither P nor Q

Example: Neither *Cola* nor *Pepsi* are good.
I like neither *Cola* nor *Pepsi*.
I don't like either *Cola* or *Pepsi*. (see Addon)

~Cola • ~Pepsi
~(Cola v Pepsi)

Either P or Q

Example: Either *School* or *University* are good.

S v U (here, inclusive or)

Addon...

De Morgan's laws for equivalence of "neither nor" and "either or"

1) I don't like either Cola or Pepsi = I like neither Cola nor Pepsi
2) I don't like either of them = I like neither of them

Lab 7 Exercises Review

Part F.
7. In order to be ARRESTED, it is sufficient AND not necessary to COMMIT a crime and GET caught.

In order to be ARRESTED, it is sufficient to COMMIT a crime and GET caught.
AND
not … It is not the case that (In order to be ARRESTED, it is necessary to COMMIT a crime and GET caught.)

SUN (please remember!)
S -> N
x -> N
S -> x

((C ^ G) -> A)
^
~(A -> (C ^ G))

Part F.
8. If it is RAINING, I will play BASKETBALL; otherwise, I will go JOGGING.

If it is RAINING, then I will play BASKETBALL
AND
If it is not RAINING, then I will go JOGGING.

(R -> B) ^ (~R -> J)