

Conditional Reasoning

Necessary Vs Sufficient Conditions

It is very important that you know the difference between a necessary and sufficient condition.

A necessary condition is essential for an outcome to occur. Without it, the outcome can NOT be achieved.

A sufficient condition is something that is enough for an outcome to occur. If we have a sufficient condition fulfilled, we can be 100% certain of the outcome.

So to put it simply:

Necessary condition: something you NEED

Sufficient condition: something that is ENOUGH

Example:

I play football. I am the best football player in the world

Sufficiency

1. I have won the Best FIFA Men's Player award.
2. Other footballer players and experts unanimously agree that I am the best football player, and I am consistently voted as MVP.



Necessity

1. I know the rules of football.
2. I work very hard
3. I am alive
4. I can tell the difference between hand and feet
5. I can walk
6. I can breathe
7. I can tell who's on my team and who isn't

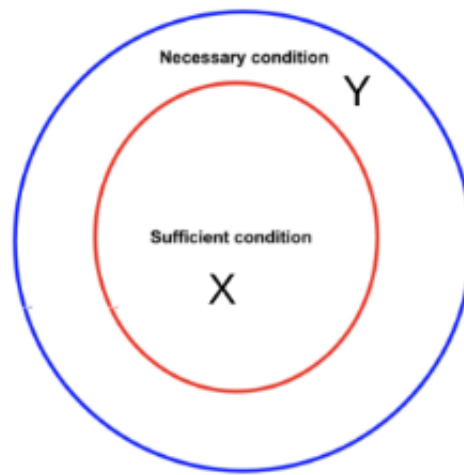
What is a conditional statement? (If X, then Y)

Think of conditional statements as a cause-and-effect relationship, neatly packaged in an "if-then" format.

If X then Y

X: The "if" portion, also known as the antecedent, sets up a scenario or hypothesis. It represents the sufficient condition.

Y: The "then" section, also known consequent, reveals what happens next or the outcome. It represents the necessary condition.



Example:

Imagine it's cloudy.

You could say, **"If it is cloudy (X), then it will rain (Y)."**

This can be translated into:

Cloudy \rightarrow Rain

$X \rightarrow Y$

This sentence connects the clouds to the certainty of rain, showing how one leads to the other.

Here, cloudy weather is a sufficient condition (enough), to guarantee that it will rain.

What is a Conditional Chain? (If X, then Y, then Z)

Now, let's extend the previous example about the cloudy day to see how one event leads to another, like a storyline unfolding. This is where conditional chains come into play, connecting multiple "if-then" statements together.

Contrapositives are formed by negating and reversing conditional statements.



For example, if we take: "If it is cloudy (X), then it will rain (Y)." $[X \rightarrow Y]$
1st step (Negate): If it is not cloudy (X), then it will not rain (Y).

2nd step (Reverse): If it did not rain (Y), then it was not cloudy (X). $[\text{not } Y \rightarrow \text{not } X]$
 Our final statement is the contrapositive!

Exam Tips

Before we dive into the details of the cheat sheet, take note of this advice.

You can not bring any cheat sheet into the exam hall.

If you find yourself thinking about "if-then" logic all the time, you might be overdoing it.

Try not to draw diagrams for every argument in the test!

Follow your intuition and think carefully!

Only make diagrams, or consider the logical translations, if you think it will really HELP you get to the correct answer quicker.

Conditional Logic: Cheat Sheet

LOGIC STATEMENT TRANSLATIONS		X: Sufficient indicators that translate to "IF": All, any, every, whenever, each, the only.
Conditional Statement: If X, then Y $X \rightarrow Y$	Contrapositive: If not Y, then not X $\neg Y \rightarrow \neg X$	Y: Necessary indicators that translate to "THEN": Must, only, only if, requires, always, other
X: Sufficient Condition Y: Necessary Condition		Other indicators: Unless= If not Without= If not

$X \rightarrow Y (\text{NOT } Y \rightarrow \text{NOT } X)$	$X \rightarrow \text{NOT } Y (Y \rightarrow \text{NOT } X)$	$\text{NOT } X \rightarrow Y (\text{NOT } Y \rightarrow X)$	$X \leftrightarrow \text{NOT } Y (Y \leftrightarrow \text{NOT } X)$	$X \leftrightarrow Y (\text{NOT } Y \leftrightarrow \text{NOT } X)$
If X, then Y If not Y, then not X All Xs are Ys X only if Y Not X, unless Y Not X, until Y Only Y can be X The only way to do X is to do Y Cannot have X without Y None but Y are A None except Y are X Not until I do Y can I do X	If X, then not Y If Y, then not X No X are Y No Y are X Cannot have both X and Y X only if not Y Y only if not X At most one of X or Y is selected At least one of X or Y is not be selected	If not X, then Y If not Y, then X Without X, we must have Y Without Y, we must have X At least one of X or Y is selected At most one of X or Y is not selected Either X or Y is selected	Either X or Y, but not both, is selected All except X are Y All except Y are X All but X are Y All but Y are X All except Y are X All but X are Y All but Y are X X if and only if not Y Y if and only if not X Either X is selected without Y, or else Y is selected without X Either X is selected and Y is not selected, or else Y is selected and X is not selected	If X then Y, and if Y then X All X are Ys and all Y are X X if and only if Y Y if and only if X Cannot have X without Y, and cannot have Y without X Either X and Y are both selected, or else neither X nor Y is selected

Conditional Reasoning: Necessary & Sufficient Conditions

DRILL 4 : IS THIS A NECESSARY OR SUFFICIENT CONDITION?

1. Identify if the statements below are expressing a necessary or sufficient condition.

1. **All qualified candidates for the job must have graduated from university.**

Is a university degree a necessity or a sufficiency for the job?



2. **For a fire to occur, there must be adequate oxygen.**

Is oxygen a necessity or sufficiency for a fire to occur?

3. **If Josh skips the final exam, he will fail the course.**

Is skipping the final exam a necessity or sufficiency for failure of the course?

4. **All NBA players are over 1.85m tall.**



Is >1.85 m a necessity or sufficiency to being an NBA player?

DRILL 5: CONDITIONAL REASONING (CORE)

1. If Jessica plays netball, she will play the wing defence position. If she plays the wing defence position, then she will score at least one goal.

Which of the following statements must be true?

A. If Jessica is not playing wing defence position, then she will not score any goals.

B. If Jessica plays any sport other than netball, she will also play in a defence position.

C. If Jessica is not playing wing defence, then she will not play netball.

D. Jessica was not always able to score in every netball game.

ANSWERS:
1. NECESSITY
2. NECESSITY
3. SUFFICIENCY
4. NECESSITY