Necessary and Sufficient Conditions

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Definitions

- Among the many things we do in philosophy, we try to provide analysis of terms we find interesting (e.g., free will, the good, knowledge, belief, the mind). One way to do this is to give a definition.

- A definition of a word states the meaning of that word in other words.

- With a proper definition, one should be able to substitute the definiendum (the word being defined) for the definiens (the defining words) in a sentence without affecting the meaning of the sentence.

- However, giving a definition of a word is often very difficult, and often not particularly helpful; if the words in the definition are no more clear than the original word, it will not help us truly understand the meaning of the term (e.g., if “cause” is defined as the thing that produces an effect, and “effect” is defined as the result of a cause).
Necessary and Sufficient Conditions

- One helpful thing to do instead of giving a definition is to give necessary and sufficient conditions for a thing.
- Necessary and sufficient conditions try to use other words to pick out all the same things as a given word (so they are coextensive).

Unlike definitions, necessary and sufficient conditions are not concerned with maintaining the original meaning. In fact, giving necessary and sufficient conditions for a term often increases our understanding of that term, so they couldn’t possibly be merely stating the meaning of the term in other words.

More formally, if P and Q are states of affairs (such as a predicate being true of an object), then
  - P is sufficient for Q if and only if (hereafter iff) necessarily, if P obtains then Q obtains (P⇒Q).
  - P is necessary for Q iff necessarily, if Q obtains then P obtains (P⇐Q).
Examples

P is **sufficient** for Q iff necessarily, if P obtains then Q obtains.

P is **necessary** for Q iff necessarily, if Q obtains then P obtains.

Is the antecedent **necessary**, **sufficient**, **necessary** and **sufficient**, or **neither** for the consequent?

- Having the right key is ___________ for a capable human to be able to open a lock.
- It having rained recently is ___________ for the ground being wet.
- Being two hydrogen atoms bonded to an oxygen atom is ___________ for being water.
- Hating the weather is ___________ for being in South Bend in the winter.
- Being in South Bend is ___________ for being in Indiana.
Examples

P is **sufficient** for Q iff necessarily, if P obtains then Q obtains.

P is **necessary** for Q iff necessarily, if Q obtains then P obtains.

Is the antecedent **necessary**, **sufficient**, **necessary** and **sufficient**, or **neither** for the consequent?

- Being highly intelligent is ____________ for going to Notre Dame.
- Losing to Notre Dame next weekend is ____________ for being the Texas football team.
- Showing up to class is ____________ for getting an A.
- Being mortal is ____________ for being human.
- Being a rational animal is ____________ for being human.
Examples

P is **sufficient** for Q iff necessarily, if P obtains then Q obtains.

P is **necessary** for Q iff necessarily, if Q obtains then P obtains.

Is the antecedent **necessary, sufficient, necessary and sufficient, or neither** for the consequent?

- Being a featherless biped is ____________ for being human.
- Being 2, 4, 6, or 8 is ____________ for being an even number.
- Being 2, 4, 6, or 8 is ____________ for being an even number <10.
- Being such that when divided by 2 it is 1, 2, 3, or 4 is ____________ for being an even number <10.
Creating Necessary and Sufficient conditions

P is sufficient for Q iff necessarily, if P obtains then Q obtains.

P is necessary for Q iff necessarily, if Q obtains then P obtains.

While identifying a connection between things is important, it is much more common in philosophy to have to come up with necessary and sufficient conditions from scratch.

Formulate necessary and sufficient conditions for the following:

- For someone to have scored a touchdown
- For something to be a dress
- For something to be a sandwich
- For a person to be telling a joke
- For a action to have been done intentionally
- For a person to be running