

Introduction to Logic and Critical Thinking

Version 1.3



"You have logic, I have Roscoe."

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~~There are other English phrases that are commonly used to express conditional statements. Here are some equivalent ways of expressing the conditional, "if it is raining then the ground is wet":~~

~~It is raining *only if* the ground is wet~~

~~The ground is wet *if* it is raining~~

~~*Only if* the ground is wet is it raining~~

~~That it is raining *implies that* the ground is wet~~

~~That it is raining *entails that* the ground is wet~~

~~*As long as* it is raining, the ground will be wet~~

~~*So long as* it is raining, the ground will be wet~~

~~The ground is wet, *provided that* it is raining~~

~~*Whenever* it is raining, the ground is wet~~

~~If it is raining, the ground is wet~~

~~All of these conditional statements are symbolized the same way, namely $R \supset G$. The antecedent of a conditional statement always lays down what logicians call a sufficient condition. A **sufficient condition** is a condition that suffices for some other condition to obtain. To say that x is a sufficient condition for y is to say that any time x is present, y will thereby be present. For example, a sufficient condition for dying is being decapitated; a sufficient condition for being a U.S. citizen is being born in the U.S. The consequent of a conditional statement always lays down a necessary condition. A **necessary condition** is a condition that must be in present in order for some other condition to obtain. To say that x is a necessary condition for y is to say that if x were not present, y would not be present either. For example, a necessary condition for being President of the U.S. is being a U.S. citizen; a necessary condition for having a brother is having a sibling. Notice, however, that being a U.S. citizen is not a sufficient condition for being President, and having a sibling is not a sufficient~~

condition for having a brother. Likewise, being born in the U.S. is not a necessary condition for being a U.S. citizen (people can become “naturalized citizens”), and being decapitated is not a necessary condition for dying (one can die without being decapitated).

~~Exercise 13: Translate the following English sentences into symbolic logic sentences using the constants indicated. Make sure you write out what the atomic propositions are. In some cases this will be straightforward, but not in every case. Remember: atomic propositions never contain any truth functional connectives—and that includes negation! Note: although many of these sentences can be translated using only the horseshoe, others require truth functional connectives other than the horseshoe.~~

- ~~1. The Tigers will win only if the Indians lose their star pitcher. (T, I)~~
- ~~2. Tom will pass the class provided that he does all the homework. (P, H)~~
- ~~3. The car will run only if it has gas. (R, G)~~
- ~~4. The fact that you are asking me about your grade implies that you care about your grade. (A, C)~~
- ~~5. Although Frog will swim without a bathing suit, Toad will swim only if he is wearing a bathing suit. (F, T, B)~~
- ~~6. If Obama isn't a U.S. citizen, then I'm a monkey's uncle. (O, M)~~
- ~~7. If Toad wears his bathing suit, he doesn't want Frog to see him in it. (T, F)~~
- ~~8. If Tom doesn't pass the exam, then he is either stupid or lazy. (P, S, L)~~
- ~~9. Bekele will win the race as long as he stays healthy. (W, H)~~
- ~~10. If Bekele is either sick or injured, he will not win the race. (S, I, W)~~
- ~~11. Bob will become president only if he runs a good campaign and doesn't say anything stupid. (P, C, S)~~
- ~~12. If that plant has three leaves then it is poisonous. (T, P)~~
- ~~13. The fact that the plant is poisonous implies that it has three leaves. (T, P)~~
- ~~14. The plant is poisonous only if it has three leaves. (T, P)~~
- ~~15. The plant has three leaves if it is poisonous. (T, P)~~
- ~~16. Olga will swim in the open water as long as there is a shark net present. (O, N)~~
- ~~17. Olga will swim in the open water only if there is shark net. (O, N)~~
- ~~18. The fact that Olga is swimming implies that she is wearing a bathing suit. (O, B)~~
- ~~19. If Olga is in Nice, she does not wear a bathing suit. (N, B)~~