Introduction to Logical Reasoning

Workshop #4: Creating Valid & Invalid Arguments (Solutions)

Part I: Each of the following problems asks you to construct a deductive argument with only two premises and a conclusion, which has the characteristics specified. Be sure to put the argument in argumentative form, and then clearly explain why each statement is either true or false, and why the argument itself is either valid or invalid. Be sure that your answer clearly demonstrates that you understand all the logical concepts involved (true, false, valid, and invalid). Use the facts that I provide below to make your answers more concrete. These problems should be fairly straightforward.

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2009 Population Estimate
(World Bank)
791,473
1,409,423
7,441,700
21,092,262
25,391,100
72,903,921

- 1. A valid argument with one true premise, one false premise, and a false conclusion.
 - 1. Qatar has more people than Bahrain. [1]
 - 2. Bahrain has more people than Iran. [1]
 - : Qatar has more people than Iran. [1]

Premise 1 is *true* [1] because Qatar does, in fact, have more people than Bahrain (1,409,423 > 791,473) [1]. Premise 2 is *false* [1], however, since Iran actually has more people than Bahrain (72,903,921 > 791,473) [1]. The conclusion is also *false* [1] since Iran has more people than Qatar (72,903,921 > 1,409,423) [1].

This argument is *valid* [1]. Being valid means there is *no* possible way for both premises to be true while the conclusion is false [2]. To see this, assume (for the sake of argument) both premises are actually true. Imagine that Bahrain really has more people than Iran, and also suppose that Qatar has more than Bahrain. With these both true, the conclusion absolutely must, with a doubt, be true as well: the transitivity property ensures that Qatar must be bigger than Iran. There is simply *no* way to create an imaginary example with true premises but a false conclusion. So the argument is valid. [5]

Argumentative form [1]. Following directions [1]. No other mistakes [1].

- 2. An invalid argument with two false premises and a true conclusion.
 - 1. Bahrain has more people than Qatar. [1]
 - 2. Qatar has more people than Iran. [1]
 - ∴ Iran has more people than Qatar. [1]

Premise 1 is *false* [1] because Qatar actually has more people than Bahrain (1,409,423 > 791,473) [1]. Premise 2 is also *false* [1] since Iran actually has more people than Qatar (72,903,921 > 1,409,423) [1]. The conclusion is also *false* [1] since Iran has more people than Qatar (72,903,921 > 1,409,423) [1].

This argument is *invalid* [1]. Being invalid means that it *is* possible for the premises to be true while the conclusion is false [2]. The easy way to show an argument is invalid is to construct an example with true premises and a false conclusion. To see this, assume (for the sake of argument) both premises are actually true. Imagine that Bahrain really has more people than Qatar, and that Qatar really has more than Iran. Even so, the conclusion is now false because the presumed truth of the second premise means that it is now Qatar with more people than Iran. So it *is* logically possible to create an example with true premises but a false conclusion. So the argument is invalid. [5]

Argumentative form [1]. Following directions [1]. No other mistakes [1].

Workshop #4: Creating Valid & Invalid Arguments (Solutions)

Part II: Each of the following problems asks you to construct a deductive argument with only two premises and a conclusion, which has the characteristics specified. Be sure to put the argument in argumentative form, and then clearly explain why each statement is either true or false, and why the argument itself is either valid or invalid. Be sure that your answer clearly demonstrates that you understand all the logical concepts involved (true, false, valid, and invalid). Use the facts that I provide on the previous page to make your answers more concrete. Some of these problems may require more thought.

- 1. An invalid argument with two true premises and a true conclusion.
 - 1. Qatar has more people than Bahrain. [1]
 - 2. Iran has more people than Bahrain. [1]
 - :. Iran has more people than Qatar. [1]

Premise 1 is *true* [1] because Qatar does, in fact, have more people than Bahrain (1,409,423 > 791,473) [1]. Premise 2 is *true* [1], since Iran really does have more people than Bahrain (72,903,921 > 791,473) [1]. The conclusion is also *true* [1] since Iran does have more people than Qatar (72,903,921 > 1,409,423) [1].

The premises and the conclusion may all be true in the real world, but this argument is actually *invalid* [1]. Being invalid means that it *is* possible for the premises to be true while the conclusion is false. [2] Assuming both premises are true only implies that Qatar and Iran are each bigger than Bahrain. It tells us nothing at all about the relationship between Qatar and Iran. So even with both premises true, we learn nothing about whether the conclusion is true or false. This means that a false conclusion is still possible. So the argument is invalid. [5]

Argumentative form [1]. Following directions [1]. No other mistakes [1].

- 2. A valid argument with two false premises and a true conclusion.
 - 1. Syria has more people than each GCC member. [1]
 - 2. Israel is a member of the GCC. [1]
 - : Syria has more people than Israel. [1]

Premise 1 is *false* [1] because Saudi Arabia is a GCC with more people than Syria (25,391,100 > 21,092,262) [1]. Premise 2 is *false* [1] as Israel is not a member of the GCC [1]. However, the conclusion is *true* [1] since Syria does have more people than Israel (21,092,262 > 7,441,700) [1].

This argument is *valid* [1]. Being valid means there is *no* possible way for both premises to be true while the conclusion is false [2]. To see this, assume (for the sake of argument) both premises are actually true. The first premise then sets up a relationship ("more people than") between Syria and each GCC member, and the second premise means Israel is now in the GCC. As a result, Syria must have that same relationship ("more people than") with Israel, meaning that the conclusion absolutely must, with a doubt, be true as well. There is simply *no* way to create an imaginary example with true premises but a false conclusion So the argument is valid. [5]

Argumentative form [1]. Following directions [1]. No other mistakes [1].

3. A valid argument with two true premises and a false conclusion.

This is *impossible* to construct because if an argument is valid *and* its premises are in fact true, then the conclusion absolutely must be true! [10] A valid argument with two true premises is a *sound* argument. And a sound argument gives a 100% guarantee of the truth of its conclusion. [10]