Phil 104
Logic Handout and Exercises #1

Arguments and Validity

An *argument* is a collection of statements, one of which (the conclusion) is supported by the others (the premises).

An *inference* is the relation between the premises and the conclusion. It is also called a *relation of support.*

The most important kind of argument for philosophers is a ***deductively valid*** argument. It is something like a proof in mathematics and geometry.
An argument is ***deductively valid*** if and only if the following condition is met:

- *If* the premises are true, then the conclusion must be true.

For example: (1) All men are mortal. (premise)
(2) Socrates is a man. (premise)
(3) Therefore, Socrates is mortal. (conclusion)

If it is true that all men are mortal, and Socrates is a man, then Socrates *must* be mortal.

Deductive validity is about the *structure* of the argument, about the relation of the premises to the conclusion. It is possible for an argument to be deductively valid and yet have a false conclusion, if the argument has a valid *structure* or *form*.

For example: (1) All Germans are fascists.
(2) J.S. Bach was a German.
(3) Therefore, Bach was a fascist.

J.S. Bach was decidedly *not* a fascist, so the conclusion is false. But the argument is still deductively valid. Why? Because it has a valid logical form. Notice that *if* all the premises *were* true, the conclusion would be true. But in fact the first premise is *false*—not all Germans are fascists. So a valid argument can have a false conclusion only if one of the premises is false.

The very best kind of argument for a philosopher is a ***sound*** argument. A sound argument has two characteristics:

(i) It is deductively valid.
(ii) All its premises are true.

These two characteristics together ensure the argument will have a true conclusion. So a sound argument indubitably proves its conclusion.

You should try to bear in mind throughout the course that these definitions lend you a powerful tool for criticizing the arguments of even great philosophers. When reading a philosophical argument, always ask yourself: 'Is the argument deductively valid?' and 'Are all the premises true?' You will often find the answer to these questions to be 'no', in which case you've got a perfectly legitimate criticism of the argument.

Sentences and Truth

Most (perhaps all) declarative sentences are either true or false. Accordingly, declarative sentences have *truth conditions*, circumstances under which they are either true or false.

For example: The sentence 'Snow is white' is true if and only if snow is in fact white. If snow is any other color, the sentence is false. Similarly, the sentence 'Boston is west of New York' is false, because Boston is in fact not west of New York, but east. So the *fact* that snow is white and that Boston is east of New York make the above sentences, respectively, true and false—these facts are the truth conditions for the respective sentences.

Most English sentences are more complex than 'Snow is white', and therefore have more complex truth conditions. I won't try to prove this here, but nearly all English declarative sentences can be reduced to one of the following forms or structures.

(1) Conjunction
(2) Disjunction
(3) Conditional

Conjunctions work like this. Let us call a simple sentence like 'Snow is white' by a name—let us call it 'A'. A conjunction will be two simple sentences joined by 'and', for example 'Snow is white *and* grass is green.' (call it 'A and B' for short).

A conjunction has its own truth conditions. It is true only when both its parts (its *conjuncts*) are true. So a sentence of the form 'A and B' is true if and only if A is true and B is true. If one of these is false, then the whole sentence is false.

A *disjunction* has the following form: A *or* B. For example: 'Snow is white *or* grass is green.' A disjunction is true if and only if *one* of its parts (or *disjuncts*) is true. So 'A or B' is true if either A is true or B is true. It is false only when both A and B are false.

A *conditional* is an *if-then* statement. It has the form 'If A, then B'. For example: 'If it rains, I will get wet.' A conditional is always true except in one case: A (the antecedent) is true *and* B (the consequent) is false. In this case the whole conditional is false.

So simple (sometimes called *atomic*) sentences are made true or false by some fact in the world, while complex sentences are true or false in virtue of their logical structure.

The principle of non-contradiction

Essentially, the principle of non-contradiction is this: no sentence can be both true and false at the same time.

To understand this a little more thoroughly, we need the notion of *negation*. The negation of a sentence is its logical opposite. For example, the negation of 'Snow is white' is 'Snow is *not* white' (more correctly, but not important for now, it would be '*It is not the case* that snow is white.')
The *tilda* (~) is often used to represent negation. For example, we might represent 'Snow is white' by A. Then 'Snow is not white' would be represented by ~A. It should be obvious that if a sentence A is true, its negation, ~A, is false, and vice versa.

Technically, a contradiction is a conjunction of a sentence and its negation—so something of the form 'A and ~A'. We said that a conjunction is true if and only if both its conjuncts are true. Suppose A is 'Snow is white'. Then the conjunction would be 'Snow is white and snow is not white.' But clearly it cannot be the case that snow both is and isn't white at the same time. So one of these sentences must be false. But if one is false, then the conjunction cannot be true.

So more technically, the principle of non-contradiction is as follows: a sentence of the form 'A and ~A' is *always false.*

The principle of non-contradiction is the single most important principle in philosophical (and all forms of) reasoning. It provides the foundation on which all rational thought is built. This is because there are *no contradictory facts*. Either something is the case or it isn't, but it can't be both. If a philosopher's position leads to a contradiction, then the position *is false*. This is because such a position essentially says 'A and ~A', which is always false. So another way to criticize a philosopher's argument is to show that its conclusion contradicts something else he has said.

<u>Valid forms and Fallacies</u>

A *valid logical form* is an argument form that is always valid no matter what the sentences in the argument say (remember this doesn't necessarily mean the sentences will be true—it just means if they *were* true, the conclusion would be true).

For example:
(1) If P, then Q.
(2) P
(3)Therefore, Q.

This form has the Latin name *modus ponens*. This argument will be valid, no matter what you substitute for P and Q. Try anything. Let P= 'It rains' and Q= 'I get wet.'

(1) If it rains, then I get wet.
(2) It rains.
(3)Therefore, I get wet.

But it still works with something absurd. Let P= 'I ate bacon for breakfast today' and Q= 'I slept twelve hours last Thursday.'

(1) If I ate bacon for breakfast today, then I slept twelve hours last Thursday.
(2) I ate bacon for breakfast today.
(3)Therefore, I slept twelve hours last Thursday.

If these premises could be made true, then the conclusion would be true.

Can you see why this is? It is because the premises tell us two things:

- If some condition (P) obtains, then something else (Q) will happen or be the case.
- The condition (P) *does obtain*.

So, it must be the case that Q happens.

Another important form is *modus tollens*:
(1) If P then Q.
(2) ~Q.
(3)Therefore, ~P.

This form tells us that:

- If something (P) happens or obtains, then so will something else (Q).
- But Q does not happen.

From this we must conclude that P didn't happen either, because if it did Q would happen. But (2) tells us Q didn't happen.

Fallacies are *invalid* forms that closely resemble valid forms, and can therefore make one think an argument is valid when it is not.

Denying the antecedent is a fallacy that resembles *modus tollens:*

(1) If P then Q.
(2) ~P
(3)Therefore ~Q.

This argument is not valid. Can you see why? (1) tells us that if P happens, so must Q.
(2) tells us that P *does not happen.*

But we can't conclude from this that Q doesn't happen. Q might happen all on its own, even without P. The first premise only tells us that if P *does* happen, so must Q, but Q could also happen without P. So even if the premises were true, the conclusion *could still be false*. Hence the argument form is invalid.

Affirming the consequent is a fallacy that resembles *modus ponens:*
(1) If P then Q.
(2) Q.
(3)Therefore, P.

This argument is also invalid. This is for much the same reason as we saw just above. Since Q can happen without P happening, just because Q happens doesn't mean P has happened.

For example:
(1) If the battery is dead, the car won't start.

(2) The car won't start.
(3)Therefore the battery is dead.

This is not a valid inference. Why not? The first premise only tells us that if the battery is dead the car won't start. But it says nothing about under what *other* conditions the car won't start (bad starter, alternator, fuel pump, etc.) Just because the car won't start doesn't mean the battery is dead.

Lastly, there are two *informal fallacies* you should know. (*Informal* means they don't have to do with valid forms).

The first is *begging the question*, or *circular reasoning*.
An argument *begs the question* when it uses its conclusion as one of its premises.
For example:

(1) If A then B.
(2) A
Therefore (3) B
(4) If B then A.
(5) Therefore A.

Although this argument proves A from (3) and (4), we had to *assume* A as premise (2) just to get started. So this argument is circular. It is equivalent to arguing like this:
(1) A
(2) Therefore A.

This is always a valid argument form (if A is true, of course A is true). But it is not very convincing. If you want to convince someone that A is true, it doesn't help much to start by asking him to *assume* A is true. Consider this argument for the existence of God:

(1) Everything God says is true.
(2) The Bible is the word of God (He said everything in it).
(3) So everything the Bible says is true.
(4) The Bible says that God exists.
(5) Therefore, God exists.

Can you see how this argument begs the question? The aim is to prove that God exists. But you must already believe that God exists in order to accept premise 1 (and premise 2 for that matter). So this argument will never convince anyone who doesn't believe in God that He exists, because you must *already* believe in God to accept the premises.

Lastly, *equivocation* is a fallacy which involves a shift in the meaning of an *ambiguous* word.

An *ambiguous* word is one which has more than one meaning, or can be taken in different senses.
For example:
Bank can mean someplace where money is kept. But it can also refer to the edge of a river.

An argument *equivocates* when it uses an ambiguous word in one sense in one premise, and uses it in a different sense in another premise.

For example:
(1) If you do not drink a lot in hot weather, you will become dehydrated.
(2) But if you drink a lot, you will become an alcoholic.
(3) So in order to avoid dehydration, you must become an alcoholic.

This argument equivocates on the word 'drink'. In the first premise it means 'to take in fluids.' But in the second premise, it means specifically 'to take in alcohol.' So it *looks* like the conclusion follows, but in fact it doesn't. The premises must use words in the same sense throughout in order to avoid equivocating.

So now you have more tools at your disposal. For you may now look for instances of equivocation, begging the question, denying the antecedent, and affirming the consequent in the arguments of philosophers. Believe it or not, they occur all the time in the reasonings of the best philosophers, although they are usually harder to identify than the examples shown here. Begging the question is by far the most common fallacy committed by good philosophers, since sometimes the conclusion can 'sneak in' to the premises in very subtle ways.

Exercises

Arguments and Validity

1) Can a *valid* argument have a false conclusion?

2) Can a *sound* argument have a false conclusion?

3) What is the definition of *deductive validity* ?

4) Is the following argument deductively valid?
(1) All dogs are mammals.
(2) All mammals are animals.
(3) Therefore all dogs are animals.

5) What about the following argument?
(1) All Greeks are wise.
(2) J.S. Bach was not a Greek.
(3) Therefore J.S. Bach was a great composer.

Sentences and Truth

Are the following sentences true or false? Assume that the atomic sentences 'Dogs are mammals' and 'Snow is white' are true, and their negations are false.

(1) Dogs are mammals and snow is white.

(2) Dogs are mammals or snow is white.

(3) Dogs are not mammals and snow is white.

(4) Snow is not white or dogs are not mammals.

(5) If snow is white, then dogs are not mammals.

(6) If dogs are mammals, then snow is white.

(7) If snow is not white, then dogs are not mammals.

The Principle of non-contradiction

1) Is the following sentence true or false? Explain why.

Dogs are mammals and dogs are not mammals.

Valid forms and Fallacies

Name the following argument forms and tell whether or not they are valid.

1) If I am hungry, then I go to the grocery store.
I am hungry.
Therefore, I go to the grocery store.

2) If I am hungry, then I go to the grocery store.
I do not go to the grocery store.
Therefore, I am not hungry.

3) If dogs are mammals, then snow is white.
Snow is white.
Therefore, dogs are mammals.

4) If dogs are mammals, then snow is white.
Dogs are not mammals.
Therefore snow is not white.

5) If snow is white, then I go to the grocery store.
I do not go to the grocery store.
Th. snow is not white.

6) If snow is white, then I am hungry.
Snow is not white.
Th. I am not hungry.

Name the informal fallacy committed by these arguments. If the fallacy is begging the question, tell which premise is equivalent to the conclusion (or requires a commitment to the conclusion). If the fallacy is equivocation, tell which is the ambiguous word, and describe how it is used in different ways.

7) Britain is supposed to be a free country.
But in Britain everything costs money—nothing is free.
So the British are either liars or hypocrites—their country isn't free at all.

8) A person is either identical to his soul or to his body.
But the body doesn't make it to the afterlife, while the person does.
So a person can't be identical to his body.
So a person is identical to his soul.

<u>Answers to Exercises</u>

Arguments and Validity

1) Yes

2) No

3) If the premises are all true, the conclusion must be true.

4) Yes

5) No

Sentences and Truth

1) True

2) True

3) False

4) False

5) False

6) True

7) True

Principle of non-contradiction

False. The sentence is a conjunction In order for it to be true, both conjuncts would have to be true. But both conjuncts can't be true, because one is the negation of the other. So it is false.

Valid forms and Fallacies

1) modus ponens—valid.

2) modus tollens—valid.

3) affirming the consequent—invalid.

4) denying the antecedent—invalid.

5) modus tollens—valid.

6) denying the antecedent—invalid.

7) Equivocation. The argument equivocates on ‘free’. In the first premise it is used to mean ‘at liberty’. In the second it is used to mean ‘costs nothing’.

8) Begging the question. If a person *is* identical to his body (that is, a person is nothing more than just his or her body), then there will be no afterlife—the person will die when the body dies. So the second premise already supposes that a person is identical to his soul, which is what the argument tries to prove.