Class 1 - August 28
Arguments (§1.1, §1.4)

I. Introduction to the class

Handouts: syllabus, rules sheet, paper assignment, course bibliography
The course website is:
Our grader is Megha Hoon, mhoon@hamilton.edu
Assistance is available at QLit; hours will be announced

The work in this course will become increasingly difficult.
Good habits are important.
Everyone must hand in the first six homework sets.
After the first test, you are only required to hand in homework if you received lower than 80% on the most recent test.
There will be no make-up tests.

II. Defining 'Logic'

Consider the following pair of definitions:

A: Logic is the study of argument.
B: Arguments are what logic studies.

There is a circularity here, which makes the definitions unhelpful.
This circularity is a formal result.
We study formal results, in logic.

Now, replace B., above, with:

B': An argument is a set of statements, called premises, intended to establish a specific point, called the conclusion.

B' is a better definition.
It is not circular.
It reduces a term to be defined to simpler ones.

An alternative description of logic: logic is the rules of reasoning.
A big philosophical question: Is logic descriptive, representing how we actually reason?
Or is it prescriptive, setting out rules for good reasoning?
Before we can start to answer this question, we have to see what logic looks like, at least a bit.

Here is another definition: a 'proposition', or a 'statement', is a declarative sentence that has a truth value.
We will consider only two truth values: true and false.

There are logics with more than two truth values.
The most interesting logics have three, or infinitely many.
In this course, we will mostly study two-valued, or bivalent, logic.
But, we will look at three-valued logics a little bit.

III. Separating Premises from Conclusions

Our first task is to analyze arguments, indicating their structures and separating premises from conclusions.
Consider the following argument:

> We may conclude that eating meat is wrong. This may be inferred from the fact that we must kill
> to get meat. And killing is wrong.

The conclusion is: 'Eating meat is wrong.'
The premises are: 'We must kill to get meat. Killing is wrong.'
Note the elimination of certain words: these are indicators.
When formally representing arguments, we omit indicators.

Here are some conclusion indicators:
> therefore
> we may conclude that
> we may infer that
> entails that
> hence
> thus
> consequently
> so
> it follows that
> implies that
> as a result.

Here are some premise indicators:
> since
> because
> for
> in that
> may be inferred from
> given that
> seeing that
> for the reason that
> inasmuch as
> owing to

'And' often indicates the presence of an additional premise.
Natural language is inexact, and non-formulaic.
Not all sentences will contain indicators.

You will have to judge from the content of the propositions which are premises and which are conclusions.

The best way to determine premises and conclusions is to determine what the main point is, and then look to see what supports that point.

Some arguments contain irrelevant, extraneous information.
Some arguments contain implicit information; these are called 'enthymemes'.

We can represent the argument above in the following manner:

> P1: We must kill to get meat.
> P2: Killing is wrong.
> C: Eating meat is wrong.

The order of the premises is unimportant.
The number of premises is unimportant: you may combine or separate premises, at times.
Sometimes, a sentence may contain both a premise and a conclusion, and so must be divided.

IV. Exercises A. Represent the following arguments in premise/conclusion form.

1. The psychological impact and crisis created by the birth of a defective infant is devastating. Not only is the mother denied the normal tension release from the stress of pregnancy, but both parents feel a crushing blow to their dignity , self-esteem, and self-confidence. In a very short time, they feel grief for the loss of the normal, expected child, anger at fate, numbness, disgust, waves of helplessness and disbelief.

2. Neither a borrower nor a lender be,
For loan oft loses both itself and friend,
And borrowing dulls the edge of husbandry.

3. If a piece of information is not "job relevant," then the employer is not entitled qua employer to know it. Consequently, since sexual practices, political beliefs, associational activities, etc., are not part of the descriptions of most jobs, that is, since they do not directly affect one's job performance, they are not legitimate information for an employer to know in the determination of the hiring of a job applicant.

V. Validity and Soundness

Consider the following three arguments. Are they good?

> 1. All persons are mortal.
>   Socrates is a person.
>   ∴ Socrates is mortal.
>
> 2. All men are fish.
>   Joe is a man.
>   ∴ Joe is a fish.

3.   All Toyotas are cars.
      I own a car.
      ∴ I own a Toyota.

Argument 1 is good.
Arguments 2 and 3 are both bad, but for different reasons.
Argument 3 is invalid.
Argument 2 is valid, but unsound.

The validity of an argument depends on its form.
An argument is valid if the conclusion follows logically from the premises.
Certain forms are valid.
Certain forms are invalid
The soundness of a valid argument depends on truth of its premises.
A valid argument is sound if its premises are true.
Only valid arguments can be sound.

Here is the most important sentence of this course:

> In deductive logic, if the form of an argument is valid and the premises are all true, then the conclusion must be true.

In invalid arguments, the premises can be true at the same time that the conclusion is false, though all can be true.
Validity is independent of truth.
Validity is related to possibility, while soundness is related to truth.

VI. Exercises B. Are the following valid? If so, are they sound?

1. If it snows more than two feet, there will be no classes at Hamilton. It snowed more than two feet last Monday. Therefore, there were no classes at Hamilton.

2. The Mets are a professional baseball team. Professional baseball teams are sports businesses. So, the Mets are a sports business.

3. If police departments improve their effectiveness, crime rates go down. Crime rates have gone down. So, police departments have improved their effectiveness.

4. Since the sun is pink, and made of cheese, it follows that some cheese is pink.

5. Some cars are green. Some cars are Toyotas. So, some cars are green Toyotas.

6. All great singers have strong voices. Celine Dion does not have a strong voice. So Celine Dion is not a great singer.

VII. The form of an argument

Consider each of the following arguments:

1. Either the stock market will rise or unemployment will go up.
    The market won't rise.
    So, unemployment will increase.

2. You will get either rice or beans.
    You don't get the rice.
    So, you'll have the beans.

3. The square root of two is either rational or irrational.
    It's not rational.
    So, it's irrational.

They have the same form:

Either p or q
not-p
So, q.

This form is called 'Disjunctive Syllogism'
We'll study it later.
Just as an architect, when building a building, looks only at the essential structures, so a logician looks only at the form of an argument.

'p' and 'q', above, are like variables, standing for statements;
'either p or q' is a compound sentence, made of simple ones

The language of propositional logic uses capital letters to stand for simple, positive propositions.
Simple propositions are often of subject-predicate form, but not necessarily.
They are the shortest examples of statements; they can not be decomposed further in propositional logic.
In predicate logic, we go beneath the surface, at end of term.

VIII. **Solutions**

Answers to Exercise A:

1.   Premise 1: Not only is the mother denied the normal tension release from the stress of pregnancy,
                but both parents feel a crushing blow to their dignity , self-esteem, and self-confidence.
        Premise 2: In a very short time, they feel grief for the loss of the normal, expected child, anger at
                fate, numbness, disgust, waves of helplessness and disbelief.
        Conclusion The psychological impact and crisis created by the birth of a defective infant is
                devastating.

2.   Premise 1: Loan oft loses both itself and friend.
        Premise 2: Borrowing dulls the edge of husbandry.
        Conclusion: Neither a borrower nor a lender be.

3.   Premise 1: If a piece of information is not "job relevant," then the employer is not entitled qua
                employer to know it.
        Premise 2: Sexual practices, political beliefs, associational activities, etc., are not part of the
                descriptions of most jobs, that is, they do not directly affect one's job performance,
        Conclusion: They are not legitimate information for an employer to know in the determination of
                the hiring of a job applicant.

Answers to Exercises B:

1. Valid, unsound
2. Valid, sound
3. Invalid
4. Valid, unsound
5. Invalid
6. Valid, unsound