PHL 215: INDUCTIVE LOGIC
COURSE OUTLINE-**PART ONE** (Version 2009A)

Chapter 1: Truth

I. We normally speak of statements being either true or false, but we can distinguish between various kinds of truth.
   A. Most commonly, when we say that a statement is true, we mean that it is actually true. The statement "Wright State University is located in Ohio" is actually true. The statement "To be a bachelor, you must be unmarried" is also actually true.
   B. Among the statements that are actually true, we can distinguish between those that are necessarily true and those that are contingently true.
      1. The statement "Wright State University is located in Ohio" is contingently true: although it is in fact true, we can imagine it being false. Some other contingent truths: "The Pope lives in the Vatican" and "Some roses are red."
      2. The statement "To be a bachelor, you must be unmarried" is necessarily true: it not only is true, but it couldn't possibly be false (given the meaning of words).
      3. The different kinds of necessary truths:
         a. "To be a bachelor, you must be unmarried" expresses a linguistic truth.
         b. "2 + 2 = 4" expresses a mathematical truth.
         c. "If pigs can fly, then pigs can fly" expresses a logical truth.
      4. Although only some actually true statements are contingently true, all contingently true statements are actually true. And although only some actually true statements are necessarily true, all necessarily true statements are actually true: if a statement can't possibly be false, then it must actually be true.
      5. The statement "Pigs can fly" is neither necessarily nor contingently true, since it isn't even true.
   C. Besides contingent and necessary truths, there are possible truths.
      1. The statement "There is an elephant outside the door right now" is possibly true. We can imagine it being true; furthermore, it doesn't violate the laws of logic for it to be true.
      2. The statement "Pigs can fly" is also possibly true: pigs flying may violate the laws of nature but not the laws of logic.
         a. Laws of nature describe the way our universe is. Some examples: $E = mc^2$, $F = ma$, "like charges repel each other," and "bodies with mass attract each other." These laws are contingently true, and to discover them, scientists must study the universe.
         b. Laws of logic express statements that are necessarily true by virtue of their logical structure. One example is the Law of the Excluded Middle: Either P or not-P. (Either pigs can fly or pigs can't fly.) These laws can be discovered without studying the universe.
         c. Miracles are violations of the laws of nature, but not the laws of logic. The consensus view among theologians is that although God can violate the laws of nature (He is the author of these laws, after all), He is bound by the laws of logic.
      3. The statement "The Pope lives in the Vatican" is possibly true. Indeed, any actually true statement must also be possibly true: after all, if it weren't possible for a statement to be true, it couldn't actually be true.
      4. Since all necessarily true statements are actually true and all actually true statements are possibly true, it follows that any necessarily true statement will be possibly true as well. Thus, the statement "2 + 2 = 4" is not only necessarily true, but possibly true.
      5. Since all contingently true statements are actually true and all actually true statements are possibly true, it follows that any contingently true statement will be possibly true as well. Thus, the statement "The Pope lives in the Vatican" is not only contingently true, but possibly true.
      6. The difference between being possible and being probable: although it is possible that there is an elephant outside the door right now, it is not probable. To say something is probable means that it is a good bet; to say that something is possible means that we can imagine it happening. We can imagine

all sorts of things happening that in fact are quite unlikely to happen.

7. Sometimes people say that anything is possible, but this isn't so. It isn't possible, for example, that there is a married bachelor standing outside the doorway right now, since we can't imagine this situation being true.

The Kinds of Truth

A statement is **actually true** if it is, as a matter of fact, true.
A statement is **contingently true** if, although it is in fact true, it could be false.
A statement is **necessarily true** if it not only is in fact true, but it couldn't possibly be false.
A statement is **possibly true** if it could be true.

	➚	**Necessarily true**
Actually true		or
	➘	**Contingently true**

(But a statement can't be **both** necessarily **and** contingently true.)

Actually true ➔ Possibly true

Necessarily true ➔ Actually true ➔ Possibly true

Contingently true ➔ Actually true ➔ Possibly true

Exercise 1-1. For each of the following statements, tell whether it is **actually true**, whether it is **contingently true**, whether it is **necessarily true**, and whether it is **possibly true**.

1. You are either married or unmarried.
   Check all that apply: actually ☐ contingently ☐ necessarily ☐ possibly ☐
2. The Pope is a woman.
   Check all that apply: actually ☐ contingently ☐ necessarily ☐ possibly ☐
3. John Kerry is president of the United States.
   Check all that apply: actually ☐ contingently ☐ necessarily ☐ possibly ☐
4. The Wright brothers invented the airplane.
   Check all that apply: actually ☐ contingently ☐ necessarily ☐ possibly ☐
5. Dayton is the capital of Ohio.
   Check all that apply: actually ☐ contingently ☐ necessarily ☐ possibly ☐
6. Six is greater than five.
   Check all that apply: actually ☐ contingently ☐ necessarily ☐ possibly ☐
7. You are both married and unmarried.
   Check all that apply: actually ☐ contingently ☐ necessarily ☐ possibly ☐
8. You will either get and A in this class or you won't.
   Check all that apply: actually ☐ contingently ☐ necessarily ☐ possibly ☐
9. You are presently asleep, dreaming that you are in class.
   Check all that apply: actually ☐ contingently ☐ necessarily ☐ possibly ☐
10. The instructor of this course is an alien being disguised as a human.
   Check all that apply: actually ☐ contingently ☐ necessarily ☐ possibly ☐

II. Proving and disproving statements

A. Types of statements

1. Universal generalizations
   a. "All men are mortal."
   b. Other "key words": Every, always, none, never
   c. Very hard to prove, easy to disprove.
      (1) Disprove with counterexamples. A counterexample is a single instance that disproves a universal generalization.
2. Statistical generalizations
   a. "Most men have tasted milk."
   b. Other "key words": Few, many, almost all, percent (but not 0% and 100%)
   c. Somewhat hard to prove or disprove—requires a statistical survey
3. Existential claims
   a. "Some men are bald."
   b. Other "key words": There are, there exist
   c. Easy to prove, very hard to disprove
4. Categorical claims
   a. "Joe is bald"
   b. These are specific claims about specific things.
      (1) "Joe always wears a hat" is not a categorical claim, since it makes a universal claim about a specific thing.
   c. Easy to prove or disprove

B. You can only counterexample universal generalizations; you cannot counterexample categorical claims, statistical generalizations, or existential claims.

Exercise 1-2. Examine the following false claims. If a claim can be refuted by means of a counterexample, give the counterexample. Otherwise, explain why it cannot be refuted by means of a counterexample.

1. All men have beards.
2. Some men are over ten feet tall.
3. Nearly all men have beards.
4. No state is named after a president.
5. Gemstones are never red in color.
6. Most women have red hair.
7. The Pope grew up in Dayton.
8. Wright State offers no philosophy classes.
9. Only 34 percent of men are bald.
10. The Pope never drinks wine.

III. Conceptual counterexamples

A. Consider the following two statements:

1. All crows are black.
2. To count as a crow, a bird must be black.

B. These statements are both about crows and are both false, but there is a subtle difference between them:

1. Whoever asserted the first statement is making a contingent claim about crows. It is a claim which, if true, would be contingently true.
2. Whoever asserted the second statement is making a conceptual claim about crows. He thinks that crows don't just happen to be black, they must be black. It is necessarily true, in other words, that they be black. It could not be otherwise.
   a. The person who says "All crows are black," by way of contrast, allows that it is possible that crows

aren't black; he just thinks that as a matter of fact, they are all black.
   b. Another example of a conceptual claim: "It is necessarily true that all crows are black."

C. We will use different techniques to refute the above two statements.
   1. To refute the first statement, "All crows are black," we will use a counterexample. Notice, however, that the counterexample has to be an actual counterexample—something that actually exists! We cannot, in particular, counterexample the claim that "All crows are black" by asking the person who makes this claim to imagine one that isn't black, we have to actually find one that isn't black. We might find, for example, an albino crow.
   2. There are two ways, though, for us to refute the second statement, "To count as a crow, a bird must be black."
      a. We can refute it with an actual counterexample. We can find, for example, an albino crow.
      b. But we can also refute it with a conceptual counterexample: we can describe a state of affairs that, although far-fetched, is possible, and thereby show that we can conceive of the statement being false. If we can conceive of a statement being false, though, it isn't necessarily true. Thus, we might tell a story about a bird that was a crow, in the biological sense of the word, but that had inherited the gene for albinism. Having this gene, we could point out, wouldn't stop it from being a crow, any more than having this gene stops a human albino from being a human. This story would refute the claim; we wouldn't have to find an actual counterexample. Indeed, even though there has never, in the history of the world, existed a non-black crow, our story would still refute the claim that "To count as a crow, a bird must be black."
   3. Another example.
      a. The statement "All pro-football players weigh more than 100 pounds" makes a contingent claim, so to refute it, we cannot come up with a conceptual counterexample. We cannot, for example, tell a story about a midget football player. We must instead come up with an actual pro-football player who weighs less than 100 pounds.
      b. The statement "To be a pro-football player, someone must weigh more than 100 pounds," by way of contrast, makes a conceptual claim. Consequently, we can refute it with a conceptual counterexample. More precisely, we can tell a story: "Suppose the owner of a pro-football team offered a contract to his seven-year-old son as part of a birthday present. Wouldn't this son then be a pro-football player who weighed less than 100 pounds? So your claim that to be a pro-football player, someone must weigh more than 100 pounds isn't true."
         (1) Notice that even though there currently doesn't actually exist a pro-football player who weighs less than 100 pounds, and even though such a football player has never actually existed, our ability to conceive of such a football player disproves the claim that "To be a pro-football player, someone must weigh more than 100 pounds."
   4. Conceptual counterexamples are important to philosophers because many of the statements they are interested in disproving are statements that are supposed to be necessarily true. The problem is that many people don't understand the difference between actual and conceptual counterexamples, and they accuse philosophers of telling far-fetched stories and talking about non-existent things.

Exercise 1-3. Tell whether or not a given statement can be refuted by means of a conceptual counterexample. If it can, give a conceptual counterexample that refutes it.

1. All human beings have reasoning ability.
2. If there were fewer than 10 people in this room, then there would have to be fewer than 5 people in this room.
3. If something has reasoning ability, then it will necessarily count as a human being.
4. There have never been more than 100 people in this room.
5. If you believe something, and if what you believe is true, then the thing you believe will necessarily count as knowledge.
6. To count as a dog, an animal has to have four legs.

Chapter 2: Arguments

I. The anatomy of arguments
   A. An argument is a series of statements, one of which is supported by the others.
   B. The premises of an argument do the supporting.
   C. The conclusion of an argument is supported by the premises.
   D. Ways to indicate a conclusion: therefore, hence, so, since, it follows that, ergo, ∴
   E. Conclusions needn't "conclude" an argument.

II. Good and bad arguments
   A. Some sample arguments:

1. All men are mortal.
   The Pope is a man.
   Therefore, the Pope is mortal.

> **The first two conditions that must be met for an argument to be good:**
>
> To be good, an argument's premises must all be (actually) true.
> To be good, an argument must have good logic.

2. All men play professional football.
   The Pope is a man.
   Therefore, the Pope plays professional football.

3. All professional football players live in the Vatican.
   The Pope is a professional football player.
   Therefore, the Pope lives in the Vatican.

4. Grass is green.
   Therefore, the sky is blue.

5. Some men live in the Vatican.
   The Pope is a man.
   Therefore, the Pope lives in the Vatican.

6. There were 100 marbles in this bag.
   The first 99 marbles drawn from this bag were black.
   The first 99 marbles drawn from this bag were drawn in a random fashion.
   Therefore, the remaining marble is black.

   a. The difference between deductive and inductive logic
   b. An argument for the above conclusion: "If there had been 99 black marbles and 1 non-black marble in the bag, I almost certainly would not have gotten 99 black marbles by drawing randomly. (Indeed, in 99 times out of 100 that I drew marbles from the bag, I would have gotten the non-black marble in my sample.) I did get 99 black marbles by drawing randomly. Therefore, it is highly probable that the bag did not have 99 black marbles and 1 non-black marble—meaning that it is highly probable that the remaining marble is black."
   c. Degrees of support in inductive logic

Exercise 2-1. For each of the following arguments, tell whether its premises are true, then tell whether its logic is good, and then tell whether it is a good argument.

1. Anyone who lives in Dayton lives in Ohio.
   Anyone who lives in Ohio lives in the United States.
   Therefore, anyone who lives in Dayton lives in the United States.

   Check all that apply: premises all true ☐ logic good ☐ good argument ☐

2. No American president has been Jewish.
   Clinton was an American president.
   Therefore, Clinton wasn't Jewish.

   Check all that apply: premises all true ☐ logic good ☐ good argument ☐

3. George Bush is the Pope.
   The Pope lives in the Vatican.
   Therefore, George Bush lives in the Vatican.

   Check all that apply: premises all true ☐ logic good ☐ good argument ☐

4. All roses are red.
   All violets are blue.
   Therefore, George Bush loves his wife.

   Check all that apply: premises all true ☐ logic good ☐ good argument ☐

B. Definitions of good logic:
   1. An argument has <u>good deductive logic</u> =
      a. The truth of the premises guarantees the truth of the conclusion.
      b. If the premises were true, the conclusion would have to be true.
      c. (<u>The Official Definition</u>) It is impossible for the premises to be true and simultaneously for the conclusion to be false.
         (1) To use this definition, we try to imagine a situation in which
            (a) The premises are all true <u>and at the same time</u>
            (b) The conclusion is false.
         (2) We either can or can't imagine this situation.
            (a) If we <u>can</u> imagine it, then it is <u>possible</u> for the premises to be true and simultaneously for the conclusion to be false, so the argument <u>fails to meet</u> definition c, so the argument has <u>bad</u> deductive logic.
            (b) If we <u>can't</u> imagine it, then it is <u>impossible</u> for the premises to be true and simultaneously for the conclusion to be false, so the argument <u>meets</u> definition c, so the argument has <u>good</u> deductive logic.
   2. An argument has <u>good inductive logic</u> = the truth of the premises makes it likely that the conclusion is true, but does not guarantee the truth of the conclusion.
   3. Some terminology:
      a. To say that an argument has <u>good logic</u> is to say that its logic is <u>either</u> deductively <u>or</u> inductively good.
      b. To say that an argument has <u>bad logic</u> is to say that its logic is <u>neither</u> deductively good <u>nor</u> inductively good.

Exercise 2-2. Determine whether the following arguments have good or bad logic. If they have bad logic, say so; if they have good logic, tell whether it is good deductive logic or good inductive logic.

1. Most people have two kidneys.
   Dr. Irvine is a person.
   Therefore, Dr. Irvine has two kidneys.

   Check one: bad logic ☐ good deductive logic ☐ good inductive logic ☐

2. All people live in Fairborn, Ohio.
   Dr. Irvine is a person.
   Therefore, Dr. Irvine lives in Fairborn, Ohio.

   Check one: bad logic ☐ good deductive logic ☐ good inductive logic ☐

3. Some people have only one kidney.
   Dr. Irvine is a person.
   Therefore, Dr. Irvine has only one kidney.

   Check one: bad logic ☐ good deductive logic ☐ good inductive logic ☐

4. Somewhere between 80 and 90 percent of the students in this class will get a passing grade.
   You are a student in this class.
   Therefore, you will get a passing grade in this class.

   Check one: bad logic ☐ good deductive logic ☐ good inductive logic ☐

C. Some connections:
   1. An argument with true premises can have bad logic.
   2. An argument with good logic can have false premises.
   3. An argument with a true conclusion can have bad logic and/or false premises.
   4. A bad argument can have true premises.
   5. A bad argument can have good logic.
   6. Any argument with premises that are actually true and a conclusion that is actually false will have bad deductive logic.
      a. To see why this is so, consult definition c of good deductive logic: If the premises are actually true and the conclusion is actually false, then it is possible for the premises to be true and simultaneously for the conclusion to be false, so the argument has bad deductive logic.

D. The two other conditions a good argument must meet:
   1. The THIRD condition: To be good, an argument must not be circular.
      a. An example of a circular argument:

         Grass is green.
         Therefore, grass is green.

      b. Circular arguments always have good deductive logic.
      c. Circular arguments are objectionable because the only people who will accept their premises (and therefore find them persuasive) are people who already accept their conclusion (and hence don't need to be persuaded).

2. The FOURTH condition: To be good, an argument (with good inductive logic) must be <u>complete</u>.
    a. To say that an argument is complete is to say that it embodies all relevant information.
    b. An example of an argument that is not complete:

        The Pope is a man.
        Most men live outside the Vatican.
        Therefore, the Pope lives outside the Vatican.

        An example of an argument that might or might not be complete (depending upon what we know about George):

        George is a 35-year-old man.
        Nearly all 35-year-old men live for at least ten more years.
        Therefore, George will live for at least ten more years.

    c. When an inductive argument is incomplete, we can devise a "narrower" induction that yields the opposite conclusion. We can do this with the "George" argument just given, but not with the "Pope" argument above it.
    d. Completeness is a relative notion: An argument that is complete for one person may not be complete for a person who has more information available to him.
    e. We only worry about completeness <u>when an argument has good inductive logic</u>. Therefore, we needn't worry about completeness if an argument is circular or has contradictory premises.

Exercise 2-3. Are the following arguments complete? Explain why or why not.

1. Most people have two kidneys.
   Dr. Irvine is a person.
   Therefore, Dr. Irvine has two kidneys.

2. Wright State is an American university.
   Most American universities are located outside the Dayton area.
   Therefore, Wright State is located outside the Dayton area.

3. Pepperdine University is an American university.
   Most American universities are not located in Malibu, California.
   Therefore, Pepperdine University is not located in Malibu, California.

4. Most Ohio universities have football teams.
   Ohio State University is an Ohio university.
   Therefore, Ohio State University has a football team.

E. In conclusion, there are <u>four</u> conditions an argument must meet in order to be good:
    1. It must have all true premises.
    2. It must have good logic.
    3. It must not be circular.
    4. (If it has good inductive logic) it must be complete.

Chapter 3: Deeper into Logic

I. The Problem of Evil Argument

A. The arguments we have considered in the previous chapter were trivial. Here is a more interesting argument, one that philosophers have thought about for centuries.

1. If God exists, then God is omniscient (knows everything).
2. If God exists, then God is omnipotent (can do anything).
3. If God exists, then God is perfectly good.
4. If God is omniscient, then God knows when evil things are going to happen.
5. If God is omnipotent, then if God knows when evil things are going to happen, God can prevent them from happening.
6. If God is perfectly good, then if God can prevent evil things from happening, God will prevent them from happening.
7. If God prevents evil things from happening, then evil things won't happen.
8. Evil things do happen.

Therefore, God doesn't exist.

B. Although the logical structure of this argument is rather complex, it appears to have good deductive logic. Therefore, if we wish to reject its conclusion (as most Christians will), we will have to reject one of its premises, but they all seem to be true!

II. Creative thinking

A. In the above discussion, we distinguished between inductive and deductive logic. In many cases, though, everyday reasoning involves a mix of inductive and deductive logic.
   1. The Jumble Puzzle: PIOHP

B. Trial-and-Error Reasoning
   1. The process:
      a. Try something. If it doesn't work, discard it, but try to learn from the mistake.
      b. Try something else.
      c. Continue doing this until you have succeeded.
   2. Who uses this strategy:
      a. This process is used by many creative people.
      b. It is used by many successful people. A claim: a successful person will make more "mistakes" than an unsuccessful person. Furthermore, someone who never makes "mistakes" is probably quite unsuccessful. "If you never make a mistake, you are making a mistake."
      c. It is also used in countries with free enterprise.
      d. It is also used by nature, in evolution. "Evolution is smarter than we are."
      e. But many people are reluctant to use trial and error. They find error to be too painful. They quit after one error. Or, they don't even attempt one trial, for fear that it will result in error.

C. Mental Incubation
   1. The most interesting examples of rational thinking don't take place in the conscious mind. Instead, they take place in brain systems whose job it is to process things rationally. These systems grind away at a problem and hand us the result when they are done. (In this sense, they are much like a calculator: we get the answer on the digital readout, but we aren't really sure what went on inside to produce that answer.) We can then, if we wish, try to reconstruct what took place within the system.
   2. My experience as a math major.
   3. Henri Poincaré, a far greater mathematician than myself:
      a. In one case, a mathematical discovery came to him out of the blue, while he was on a geologic excursion: "we entered an omnibus to go some place or other. At the moment when I put my

foot on the step the idea came to me, without anything in my former thoughts seeming to have paved the way for it, that the transformations I had used to define the Fuchsian functions were identical with those of the non-Euclidean geometry. I did not verify the idea; I should not have had time, as, upon taking my seat in the omnibus, I went on with a conversation already commenced, but I felt a perfect certainty. On my return to Caen, for conscience's sake I verified the result at my leisure."

b. Poincaré describes another such breakthrough that occurred "with just the same characteristics of brevity, suddenness and immediate certainty" while he walked by the sea. His conclusion: "These sudden inspirations . . . never happen except after some days of voluntary effort which has appeared absolutely fruitless and whence nothing good seems to have come, where the way taken seems totally astray. These efforts then have not been as sterile as one thinks; they have set agoing the unconscious machine and without them it would not have moved and would have produced nothing."

4. Another mathematician, W. Rowan Hamilton, had been haunted by a particular problem for fifteen years. On October 16, 1843, during a walk with his wife, they came to a bridge, and Hamilton "felt the galvanic circuit of thought *close*; and the sparks which fell from it were *the fundamental equations between* i, j, k; *exactly such* as I have used them ever since." He pulled out a notebook and jotted down the basis of what became known as the method of "Quaternions."

5. Chemist Friedrich August Kekule discovered the structure of benzene molecules in his sleep. He had pondered their structure for a long time, but with little success. Then, as he dozed before a fire, he had his breakthrough: "The atoms were gamboling before my eyes . . . . [My mental eye] could distinguish larger structures, of manifold conformation; long rows, sometimes more closely fitted together; all twining and twisting in snakelike motion. But look! What was that? One of the snakes had seized hold of its own tail, and the form whirled mockingly before my eyes. As if by a flash of lightning I awoke." Benzene molecules, he realized, were shaped like rings.

6. Physicist Leo Szilard he had long contemplated whether it was possible to liberate the energy of the atom; the greatest minds of his time said it was not. But then, on the morning of September 12, 1933, he went out for a walk in London. He stood at an intersection. When the streetlight turned green, he stepped from the curb and, in a flash, had the solution to his problem—he realized the possibility of a neutron chain reaction.

7. Cosmologist Roger Penrose was working on the singularity theorems of general relativity theory. He was walking with a friend, talking. While they were crossing a street, a thought flashed through Penrose's mind but vanished before he could apprehend it. On the other side of the street, he resumed the conversation. That evening, he found himself inexplicably elated. He started reviewing the day's events to figure out why. It was then that the breakthrough thought he had had crossing the street came back to him.

D. The psychology of mental incubation:

1. You need to plant a question in your subconscious. You might need to put space between your "planting" sessions, and do this over a prolonged period.
   a. In other cases, incubation can take place in a few minutes:
      (1) The Jumble puzzle
      (2) Remembering a name
      (3) My writing
2. Planting questions requires considerable effort with little to show for it. This is why most people don't take full advantage of the process of mental incubation. But deprive yourself of the process of mental incubation, and it is unlikely that you will have creative thoughts.

III. The Problem of Induction

A. This is a course about induction. As it so happens, though, there are some unsolved puzzles regarding induction.

B. The <u>first attack</u> on inductive logic: There is no good reason to think that past patterns can be projected into the future. This is the <u>Traditional Problem of Induction</u> (David Hume).

1. We are, as we have seen, unable to justify most of our beliefs

2. Is the belief that the sun will rise tomorrow justifiable?
   a. The "standard" justification
   b. Hume's criticism of the "standard" justification
   c. Hume's conclusions about the belief that the sun will rise tomorrow:
      (1) It is not justifiable.
      (2) Nevertheless, we will continue to believe it: We are "induction addicts."
3. Science's leap of faith: the belief that the universe is regular and that future will resemble the past.

C. The second attack on inductive logic: Even if there were good reason to think that past patterns could be projected into the future, there is no way of knowing which patterns to project. This is the New Problem of Induction (Nelson Goodman)
1. The intelligence-test problem
   a. Give the next number in this series: 1, 3, 5, 7, ____?
   b. The standard answer
      (1) We use a two-step process to justify an answer:
         (a) We find a pattern in the numbers we are given.
         (b) We project that pattern to discover the next number.
   c. Alternative answers to this intelligence-test problems, and the justifications for those answers.
2. Variations on the intelligence test problem
3. Some conclusions:
   a. "Find the pattern" problems test not reasoning ability, but cultural indoctrination.
   b. Patterns are in the mind of the beholder, not in the world itself.
      (1) Rorschach ink blots
4. A scientific version of the New Problem of Induction: The black-box problem

IV. The limits of logic

A. Belief sets
1. What they are.
2. How we form them.

B. Logic can be used to extend belief sets.
1. Consider the following belief set:
   a. John is married.
   b. Priests are never married.
2. Someone could use logic to conclude that given what he believes, he should also believe that John is not a priest. If he does this, he will have extended his belief set.

C. Logic can be used to show that belief sets are inconsistent—that the things a person believes cannot all be true.
1. Consider the following belief set:

   #1. John is married.
   #2. John is a priest.
   #3. Priests are never married.

2. Logic shows us that these beliefs cannot all be true: if beliefs #1 and #2 are true, we can conclude that belief #3 is false; if beliefs #1 and #3 are true, we can conclude that belief #2 is false; and if beliefs #2 and #3 are true, we can conclude that belief #1 is false.
   a. The three above statements therefore form what is called an inconsistent triad.
3. Logic alone cannot tell us which of the above beliefs to reject! The person whose beliefs they are has three options: reject belief #1, #2, or #3.
   a. Suppose we argue that the person should reject belief #1: "Since John is a priest and priests are never married, it follows that John is unmarried. So you should give up belief #1." He can turn our argument around: "No, since John is a priest and John is married, it follows that priests are sometimes married! I should give up belief #3, not belief #1!"
4. Logic, in other words, can be used to reveal an inconsistency, but cannot be used to resolve that

inconsistency.

D. Logic cannot be used to determine what statements are (contingently) true and what statements are (contingently) false. To see why I say this, consider the following two belief sets:
   1. Belief Set A:

      a. The Pope is married.
      b. The Pope plays for the New York Knicks.
      c. All married people play for the New York Knicks.

   2. Belief Set B:

      a. The Pope is a bachelor.
      b. The Pope is a Catholic.
      c. There are Catholics who are bachelors.

   3. Logic would regard these two belief sets as being equally plausible, even though we know all of the beliefs in Set A to be false and all of the beliefs in Set B to be true.

E. Logic and ethics.
   1. In some of my ethical writings, I reveal double-standards in people's ethical beliefs. In doing so, I am revealing an ethical inconsistency. People have options on how to resolve such inconsistencies, though, and they don't always resolve them the way I hope they will.
      a. Class discussion:
         (1) People's views on cruelty to animals.
         (2) People's views on adoption procedures.
      b. Notice that once an inconsistency has been revealed, a person has two ways to resolve it.
   2. People have inconsistent beliefs because they tend to believe things not as the result of careful thought processes but as the result of indoctrination: people tell them what to believe, and they accept what they are told.
      a. The difference (again) between belief and knowledge.
         (1) If you know something to be true, you not only believe that it is true but can explain why the thing you believe is true.
         (2) Most people are only two why-questions away from being forced to admit their ignorance about the world. (This is why it is so humbling to spend time with two-year-old children.)
         (3) Beliefs are cheap. Everyone, after all, has a head full of beliefs. Knowledge, by way of contrast, is precious.
      b. People don't like it when you challenge their beliefs.
         (1) The accusation of bias.
            (a) Sometimes when you criticize someone's beliefs, he will accuse you of being biased. To such an individual, unless you accept all beliefs as being equally valid, you are displaying bias.
               i) In some of my classes, I ask people to defend their religious beliefs. When they are unable to do so, they sometimes accuse me of being "biased against religion."
            (b) In fact, a person is biased if he believes something for no apparent reason. For example, we would say that someone who asserts that members of a certain minority group are inferior in some respect ("White men can't jump") without being able to produce evidence for that assertion can properly be labeled a biased (or prejudiced) individual. On the other hand, if he can produce evidence for his assertion, then although we may find it a troubling assertion, he will not be displaying a bias in asserting it.
            (c) This means that if you believe something and cannot explain why you believe it, it

is you who are biased, and the person who criticizes your belief, rather than being a biased individual, is doing you a favor and helping you overcome your biases.

(2) **Irvine's Rule of Argumentation**: How mad people get about a challenge to one of their beliefs is inversely proportional to their ability to rationally defend the belief in question.

(a) Case one: someone walks up to you and says that 2 + 3 = 7. Most people will calmly explain to this person the nature of his error.

(b) Case two: someone walks up to you and makes some claim about, say, abortion that is contrary to your own beliefs regarding abortion. Many people will become quite angry in the discussion that follows.

(3) Conclusion: When discussing an issue, if you find yourself getting upset, it is a clear sign that you don't fully understand why you believe the things you believe—that you believe these things as the result of being indoctrinated, not as the result of rational thought processes.

(a) In this case, the person you are discussing the issue with, by upsetting you, has done you a big favor: he has revealed your ignorance to you. If you are a fully rational individual, you will thank him for doing so and will set about re-examining your own beliefs.

(b) Most people, of course, are not fully rational. They don't want to expend the time and effort required to examine their beliefs. They simply want to believe and be congratulated for believing whatever it is they believe.