Notice that these two arguments each have the same logical pattern or form: if a ...

Notice that these two arguments each have the same logical pattern or form: If A then B. A. Therefore, B. This pattern, as we have seen, is called modus ponens. Arguments with this pattern consist of one conditional premise, a second premise that asserts as true the antecedent (the if part) of the conditional, and a conclusion that asserts as true the consequent (the then part) of the conditional. Other common varieties of hypothetical syllogisms include - chain argument - modus tollens (denying the consequent) - denying the antecedent - affirming the consequent Chain arguments consist of three conditional statements that link together in the following way: If A then B. If B then C. Therefore, if A then C. Here is an example of a chain argument: If we don't stop for gas soon, then we'll run out of gas. If we run out of gas, then we'll be late for the wedding. Therefore, if we don't stop for gas soon, we'll be late for the wedding. Modus tollens8 arguments have the following pattern: If A then B. Not B. Therefore, not A. Arguments of this pattern are sometimes called " denying the consequent" because they consist of one conditional premise, a second premise that denies (i. e., asserts to be false) the consequent of the conditional, and a conclusion that denies the antecedent of the conditional. Here is an example: If we're in Sacramento, then we're in California. We're not in California. Therefore, we're not in Sacramento. Modus ponens, chain argument, and modus tollens are all logically reliable patterns of deductive reasoning. That is, any argument that has one of these patterns is absolutely guaranteed to have a true conclusion if the premises are also true. But not all patterns of deductive reasoning are completely reliable in this way. Two patterns that are not logically reliable are denying the antecedent and affirming the consequent. Denying the antecedent arguments have the following pattern: If A then B. Not A.

Therefore, not B. O most lame and impotent conclusion! –Shakespeare Here is an example: If Shakespeare wrote War and Peace, then he's a great writer. Shakespeare didn't write War and Peace. Therefore, Shakespeare is not a great writer. Notice in this example that the premises are true and the conclusion is false. This shows straightaway that the pattern of reasoning of this argument is not logically reliable. Another faulty pattern of deductive reasoning is affirming the consequent. Its pattern is as follows: If A then B. B. Therefore, A. Here is an example: If we're on Neptune, then we're in the solar system. We are in the solar system. Therefore, we're on Neptune. Given that this argument has true premises and a false conclusion, it is clear that affirming the consequent is not a logically reliable pattern of reasoning. Because modus ponens, modus tollens, and chain argument are logically reliable patterns of reasoning, they should always be treated as deductive. Denying the antecedent and affirming the consequent are not logically reliable patterns of reasoning; nevertheless, they should generally be treated as deductive because they have a pattern of reasoning that is characteristically deductive. exercise 3. 2 For each of the following, indicate which type of hypothetical syllogism it is: modus poiiens, modus tolkns, chain argument, denying the antecedent, or affirming the consequent. In some cases, the argument may need to be rephrased slightly to make the logical pattern explicit. 1. If we're in London, then we're in England. We are not in England. So, we are not in London. 2. If we're in Paris, then we are in France, If we're in France, then we are in Europe. So, if we are in Paris, then we are in Europe. 3. We are not in Mexico, because if we are in Mexico City, we are in Mexico, and we are not in Mexico City. 4. We're in Berlin, given that if we are in Berlin, then we are in Germany, and we are in Germany.

Categorical Syllogism Another common pattern of deductive reasoning is categorical syllogism. For present purposes, a categorical syllogism may be defined as a three-line argument in which each statement begins with the word all, some, or no,'' Here are two examples: All oaks are trees. All trees are plants. So, all oaks are plants. Some Democrats are elected officials. All elected officials are politicians, Therefore, some Democrats are politicians. Because categorical reasoning like this is such a familiar form of rigorous logical reasoning, such arguments should nearly always be treated as deductive. Argument by Elimination An argument by elimination seeks to logically rule out various possibilities until only a single possibility remains. Here are two examples: Either Joe walked to the library or he drove. But Joe didn't drive to the library. Therefore, Joe walked to the library. 10 Either Dutch committed the murder, or Jack committed the murder, or Celia committed the murder. If Dutch or Jack committed the murder, then the weapon was a rope. The weapon was not a rope. So, neither Dutch nor jack committed the murder. Therefore, Celia committed the murder. Because the aim of such arguments is to logically exclude every possible outcome except one, such arguments are always deductive. Argument Based on Mathematics Mathematics is a model of logical, step-by-step reasoning. Mathematicians don't claim that their conclusions are merely likely or probable. They claim to prove their conclusions on the basis of precise mathematical concepts and reasoning. In an argument based on mathematics, the conclusion is claimed to depend largely or entirely on some mathematical calculation or measurement (perhaps in conjunction with one or more nonmathematical premises). 11 Here are two examples: Eight is greater than four. Four is greater than two. Therefore, eight is greater than two. Light travels at a rate

of 186, 000 miles per second. The sun is more than 93 million miles distant from the earth. Therefore, it takes more than eight minutes for the sun's light to reach the earth. Because mathematical arguments are generally models of precise logical reasoning, arguments based on mathematics are usually best treated as deductive. Arguments based on mathematics can be inductive, however, as this example shows: My blind uncle told me that there were 8 men, 6 women, and 12 kids at the party. By simple addition, therefore, it follows that there were 26 people at the party. Pop Culture Connection Logic in Narnia Fans of G. S. Lewis's best-selling children's book series, The Chronicles of Narnia, will readily recall the memorable scene in The Lion, the Witch, and the Wardrobe (also featured in the recent Disney/Walden Media film version of the book) in which the Professor uses an argument by elimination to convince Peter and Susan Pevensie that, fantastic as it may seem, their sister, Lucy, is probably telling the truth about a magical realm she calls " Narnia." Lucy claims to have walked through a wardrobe into a wintry world inhabited by witches, fauns, and other strange and mythological creatures. After muttering, " Logic! Why don't they teach logic in these schools?" the Professor reminds Peter and Susan that there are only three possibilities: Lucy is lying, or she's crazy, or she's telling the truth. The children quickly agree that it would be completely out of character for Lucy to lie. They also agree that she has shown no telltale signs of madness. " For the moment, then," the Professor concludes, " and unless any further evidence turns up, we must assume that she is telling the truth." The Professor's argument by elimination is clearly modeled on " Lewis's trilemma," a famous argument for Christian belief Lewis had put forward in his 1952 book, Mere Christianity. The trilemma Lewis offers is that Jesus did

not claim to be simply a moral teacher; he claimed to be God. This leaves us only three real viable alternatives: Jesus was lying, or he was crazy, or he was exactly who he claimed to be: God. Based on everything we know about Jesus, it is impossible to believe he was either lying or insane. Thus, we should conclude, Jesus was God. Is Lewis's trilemma a sound argument by elimination? In particular, are there any other possibilities besides the three Lewis identifies (" Liar, Lunatic, Lord")? Here, the conclusion clearly does not follow from the premise because it is possible for the premise to be true and the conclusion false. (Maybe my blind uncle miscounted, for example.) For that reason, the argument is best treated as inductive. Argument from Definition In an argument from definition, the conclusion is presented as being " true by definition," that is, as following simply by definition from some key word or phrase used in the argument. Here are two examples: Janelle is a cardiologist. Therefore, Janelle is a doctor. Bertha is an aunt. It follows that she is a woman. Because a statement that follows by definition is necessarily true if the relevant definition is true, arguments from definition are always deductive. Our discussion of common patterns of deductive reasoning can be summarized as follows: Arguments by elimination and arguments from definition should always be treated as deductive. Logically reliable hypothetical syllogisms, categorical syllogisms, and arguments based on mathematics should always be treated as deductive. Logically unreliable hypothetical syllogisms, categorical syllogisms, and arguments based on mathematics should be treated as deductive unless there is clear evidence that they are intended to be inductive. Common Patterns of Inductive Reasoning In this section we look at six common patterns of inductive reasoning: - inductive generalization - predictive argument -

argument from authority - causal argument - statistical argument - argument from analogy Inductive Generalization A generalization, as that term is used in critical thinking, is a statement that attributes some characteristic to all or most members of a given class. Here are some examples of generalizations: [pic] All wild grizzly bears in the United States live west of the Mississippi River. Most college students work at least part-time. Men are so unromantic! An inductive generalization is an argument in which a generalization is claimed to be probably true based on information about some members of a particular class. Here are two examples: All dinosaur bones so far discovered have been more than sixty-five million years old. Therefore, probably all dinosaur bones are more than sixty-five million years old. Six months ago I met a farmer from Iowa, and he was friendly. Four months ago I met an insurance salesman from Iowa, and he was friendly. Two months ago I met a dentist from Iowa, and she was friendly. I guess most people from Iowa are friendly. Because all inductive generalizations claim that their conclusions are probable rather than certain, such arguments are always inductive. Predictive Argument A prediction is a statement about what may or will happen in the future. In a predictive argument, a prediction is defended with reasons. Predictive arguments are among the most common patterns of inductive reasoning. Here are two examples: It has rained in Vancouver every February since weather records have been kept. Therefore, it will probably rain in Vancouver next February. Most U. S. presidents have been tall. Therefore, probably the next U. S. president will be tall. Because nothing in the future (including death and taxes) is absolutely certain, arguments containing predictions are usually inductive. It should be noted, however, that predictions can be argued for deductively. For example: If Amy comes to

the party, Ted will come to the party. Amy will come to the party. Therefore, Ted will come to the party. Even though this argument contains a prediction, it is clearly deductive because the conclusion must be true if the premises are true. Argument from Authority An argument from authority asserts a claim and then supports that claim by citing some presumed authority or witness who has said that the claim is true. Here are three examples: More Americans die of skin cancer each year than die in car accidents. How do I know? My doctor told me. The Encyclopaedia Britann'tca says that parts of Virginia are farther west than Detroit. In general, the Encyclopaedia Britannica is a highly reliable source of information. Therefore, it's probably true that parts of Virginia are farther west than Detroit. There are bears in these woods. My neighbor Frank said he saw one last week. Because we can never be absolutely certain that a presumed authority or witness is accurate or reliable, arguments from authority should normally be treated as inductive. Arguments from authority are sometimes deductive, however. For example: Whatever the Bible teaches is true. The Bible teaches that we should love our neighbors. Therefore, we should love our neighbors. Because the conclusion of this argument follows necessarily from the premises, the argument should be regarded as deductive. Causal Argument A causal argument asserts or denies that something is the cause of something else. Here are three examples: I can't log-in. The network must be down. Rashid isn't allergic to peanuts. I saw him eat a bag of peanuts on the flight from Dallas. Medical care is the number-one cause of sudden rapid aging among middle-aged people. Ask yourself how many times you have heard somebody tell you a story like this: " Ralph was feeling fine, no problems at all, and then he went in for a routine physical checkup, and the next thing we

heard he was in critical condition with the majority of his internal organs sitting in a freezer in an entirely different building." 12 As we shall see in Chapter 11, we can rarely, if ever, be 100 percent certain that one thing causes, or does not cause, something else. For that reason causal arguments are usually best treated as inductive. It cannot be assumed, however, that causal arguments are always inductive. The following causal argument, for example, is clearly deductive: Whenever iron is exposed to oxygen, it rusts. This iron pipe has been exposed to oxygen. Therefore, it will rust. Statistical Argument A statistical argument rests on statistical evidence–that is, evidence that some percentage of some group or class has some particular characteristic. Here are two examples: Eighty-three percent of St. Stephen's students are Episcopalian. Beatrice is a St. Stephen's student. So, Beatrice is probably Episcopalian. Doctor to patient: Studies show that condoms have an annual failure rate of 2 to 3 percent, even if they are used consistently and correctly. So, you should not assume that condoms will provide complete protection from the risk of pregnancy or sexually transmitted diseases. Because statistical evidence is generally used to support claims that are presented as probable rather than certain, statistical arguments are usually inductive. It should be noted, however, that statistical evidence can be used in deductive reasoning. For example: If 65 percent of likely voters polled support Senator Beltway, then Senator Belt-way will win in a landslide. Sixty-five percent of likely voters polled do support Senator Beltway. Therefore, Senator Beltway will win in a landslide. Argument from Analogy An analogy is a comparison of two or more things that are claimed to be alike in some relevant respect. Here are1 two examples of analogies: Habits are like a cable. We weave a strand of it every day and soon it cannot be

broken. (Horace Mann) As man casts off worn-out garments and puts on others that are new, similarly the embodied soul, casting off worn-out bodies, enters into others, which are new. (Bhagavad-Gita) In an argument from analogy, the conclusion is claimed to depend on an analogy (i. e., a comparison or similarity) between two or more things. Here are two examples: Hershey Park has a thrilling roller-coaster ride. Dorney Park, like Hershey Park, is a great amusement park. Therefore, probably Dorney Park also has a thrilling roller-coaster ride. Bill is a graduate of Central University, and he is bright, energetic, and dependable. Mary is a graduate of Central University, and she is bright, energetic, and dependable. Paula is a graduate of Central University. Therefore, most likely, Paula is bright, energetic, and dependable, too. Note the basic logical pattern of these arguments: These things are similar in such-and-such ways. Therefore, they're probably similar in some further way. Because the conclusions of arguments of this pattern are claimed to follow only probably from the premises, such arguments are clearly inductive. Not all analogical arguments are inductive, however. For example: 1. Automobiles cause thousands of deaths each year and produce noxious and offensive fumes. 2. Smoking causes thousands of deaths each year and produces noxious and offensive fumes. 3. Thus, if smoking is heavily regulated, automobiles should also be heavily regulated. 4. But automobiles shouldn't be heavily regulated. 5. Therefore, smoking shouldn't be heavily regulated, either. This is an analogical argument because the main conclusion, statement 5, is claimed to depend on an analogy between automobiles and smoking. Nevertheless, the argument is deductive because it would be logically inconsistent to assert all the premises and deny the conclusion. Our discussion of common patterns of inductive reasoning can be

summarized as follows: Inductive generalizations, by definition, are always inductive. Predictive arguments, arguments from authority, causal arguments, statistical arguments, and arguments from analogy are generally, but not always, inductive. It takes practice to be able to recognize the patterns of deductive and inductive reasoning that we have discussed, but it is important to be able to do so because such patterns often provide the best clue available as to whether an argument is deductive or inductive. exercise 3. 3 Determine whether the following arguments are deductive or inductive. For each argument, state which test(s) you used in reaching your decision (i. e., the indicator word test, the strict necessity test, the common pattern test, and/or the principle of charity test). If the common pattern test is used, indicate which specific pattern the argument exemplifies (e. g., causal argument, argument from authority, and so on). 1. Because x = 3 and y = 5, then x + y = 8. 2. All inductive generalizations are inductive. Some inductive generalizations are unreliable. Therefore, some inductive arguments are unreliable. 3. If it rains, the game will be postponed until next Saturday. According to the National Weather Service, there's a 90 percent chance of rain. Therefore, probably the game will be postponed until next Saturday.