

# critical thinking

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# deductive argument: propositional logic

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## Template for critical analysis of arguments

1. What's the point (claim/opinion/conclusion)?
  - Look for subconclusions as well.
2. What are the reasons/what is the evidence?
  - Articulate all unstated premises.
  - Articulate connections.
3. What exactly is meant by . . . ?
  - Define terms.
  - Clarify all imprecise language.
  - Eliminate or replace “loaded” language and other manipulations.
4. Assess the reasoning/evidence:
  - **If deductive, check for truth/acceptability and validity.**
  - If inductive, check for truth/acceptability, relevance, and sufficiency.
5. How could the argument be strengthened?
  - Provide additional reasons/evidence.
  - Anticipate objections—are there adequate responses?
6. How could the argument be weakened?
  - Consider and assess counterexamples, counterevidence, and counterarguments.
  - Should the argument be modified or rejected because of the counterarguments?
7. If you suspend judgment (rather than accepting or rejecting the argument), identify further information required.

# 1

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# Propositional logic

Propositional logic (also called sentential logic or truth/functional logic) deals with propositions (sentences that propose that something is or is not the case); more specifically, it deals with propositions involving certain connectives.

There are four kinds of propositions that you should become familiar with:

Conjunction:	p and q.
Disjunction:	p or q (or both).
Negation:	Not-p.
Conditional:	If p, then q.

Let's consider each of these kinds of propositions in turn.

## 1.1 Conjunction

**p and q.** For example, "It is wet and it is cold."

When you are dealing with a conjunction, you *must* consider *both* p and q (called 'conjuncts') to be the case. That is to say, a conjunction is true if and only if both conjuncts are true.

## 1.2 Disjunction

**p or q (or both).** For example, “It is wet or it is cold.”

When you are dealing with a disjunction, *at least one* of the parts (disjuncts) must be true. For an exclusive disjunction, *only one* of the disjuncts can be true; for an inclusive disjunction, *both* disjuncts may be true. Unless it is clear from the context, assume you’re dealing with an inclusive disjunction: one must be true, both may be true.

## 1.3 Negation

**Not-p.** For example, “It is not green.”

It’s important to understand that “not-p” simply means “it’s not the case that p”—it doesn’t imply anything about what *is* the case; a common mistake is to assume that “not-p” means that some sort of “opposite-to-p” is the case, but that’s not necessarily so—all “not-p” means is it’s not p!

## 1.4 Conditional

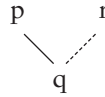
**If p, then q.** For example, “If it is green, then it is heavy.”

If p is true, then q is also true—that’s what a conditional proposition says.

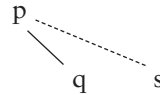
In the proposition “If p, then q,” p is the *antecedent* and q is the *consequent*. The antecedent, p, is given as a *condition* for the consequent, q. In other words, q being the case is conditional upon p being the case. In fact, p is a *sufficient condition* for q—if p occurs, that’s all it takes, q will also occur (see Section 5.3.2 regarding sufficient conditions).

In the case of conditionals, it is important to distinguish between the two terms because, unlike conjunctions and disjunctions, the converse of a conditional is not equivalent to it. In other words, “p and q” is the same as “q and p” (“It is wet and it is cold” is the same as “It is cold and it is wet”), and “p or q” is the same as “q or p” (“It is wet or it is cold” is the same as “It is cold or it is wet”). But “If q, then p” is not the same as “If p, then q”—“If it is green, then it is heavy” is not the same as “If it is heavy, then it is green.”

A common mistake with conditionals is to assume *incorrectly* that it’s *only* when p that q occurs. “If p, then q” does *not* necessarily mean “*Only* if p, then q”; p is *not a necessary condition* for q. That is to say, “If p, then q” doesn’t exclude the possibility that “If r, then q.” If it’s green, then it’s heavy, but it could also be the case that if it’s blue, then it’s heavy.



Another common mistake with conditionals is to assume *incorrectly* that if  $p$ , then *only*  $q$  will occur. “If  $p$ , then  $q$ ” does *not* necessarily mean “If  $p$ , then *only*  $q$ .” So, if it’s green, there are other things that may be the case in addition to it being heavy—maybe also it is round. That is to say, “If  $p$ , then  $q$ ” doesn’t exclude the possibility that “If  $p$ , then  $s$ .”



Lastly, note that not all sentences with the “If . . . then . . .” structure are true conditionals. Consider the sentence “If you are bored when alone, it is your own fault” (*Adbusters* Jan/Feb 2003). The boredom being your fault is *not* conditional on being bored when alone; if it were, then you could as sensibly say if you’re *not* bored when alone, then it’s *not* your fault—but that doesn’t make sense because if you’re not bored when alone, then the rest of the sentence simply doesn’t apply. The sentence is actually more correctly put thus: “Are you bored when you’re alone? Well, that’s your own fault.”

### 1.4a Practice translating ordinary language into propositional statements

Each of the following translates correctly into one of the preceding four kinds of propositional statements—write that translation.

1. As for the 100-mile race, I’d say either Tim Twietmeyer or Ann Trason will win; they’ve run first and second twice now.
2. In order to pass this course, you have to have an average grade of 60% or better on your course assignments and tests and you must pass the final exam.
3. A mineral is a natural compound that is formed through geological processes.
4. Neither injury nor poverty kept them from practicing.
5. Their presence at the meeting surely implies their concern about the proposed tax on oxygen.
6. Memoirs, no matter how interesting the characters, are not considered to be novels.
7. Even though few women hold positions of authority, women, as a whole, are not a minority.
8. When you travel, even outside your own town or city, you discover there’s more than one way to do everything, including live.

9. There are many skills children learn only if they're taught at the right time—too early or too late, and there's no point.
10. Provided that our suppliers continue to stock high quality material, we can continue to produce high quality goods.

# 2

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## Valid forms

One can test for validity using truth tables, which we'll do in Section 4. However, again as in math, it may be sufficient for you to know the valid and invalid forms without knowing how to determine that they are indeed valid or invalid.

We'll consider eight common valid forms.

### 2.1 Affirming the antecedent (modus ponens)

✓ If p, then q.  
p.  
Therefore, q.

This one is pretty straightforward: if p, then q; so if p is true, then q will also be true. The second premise says that p is indeed the case—it affirms the antecedent (remember that p is the antecedent)—so this form is called “affirming the antecedent.”

Recall, as per previous comments (Section 1.4), that “if” doesn't mean “if and only if.” So “If p, then q” doesn't exclude the possibility that “If s, then q.” And that's why you can't conclude from not-p that there will be not-q—s might be present and cause q to occur (reasoning from not-p to not-q is called denying the antecedent, and it is, as explained in the next section, an error).

Also, given that “If s, then q” is possible, you can't conclude from q that p—again, s, rather than p, might have resulted in q (reasoning from q to p is called affirming the consequent, another error, also in the next section).

Another way of saying all of this is that p is sufficient, but not necessary, for q (see Chapter 5 of your text to review sufficient and necessary conditions).

Lastly, “If p, then q” doesn't exclude the possibility of, also, “If p, then r”—



this syllogism is just asserting that if p, then q for sure, regardless of what else might end up from p.

Here's an example of an argument that affirms the antecedent:

If the symptoms get worse, then the medication should be changed. The symptoms are getting worse, so the medication should be changed.

Expressed in standard form, the argument is this:

If the symptoms get worse, then the medication should be changed.	If p, then q.
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<u>The symptoms are getting worse.</u>	<u>p.</u>
Therefore, the medication should be changed.	Therefore, p.

### 2.1a Practice identifying the valid form of affirming the antecedent

Which of the following five arguments have the valid form of affirming the antecedent? (You may want to put the argument in standard form before you decide.)

1. The value to science of any ruins we discover will be reduced if the work is not done in accordance with accepted procedures. Accepted procedures require you to lay a grid before you begin, and you didn't do that! So I'm afraid you won't be getting your paper published after all.
2. Since the description of what an Aries is fits me perfectly, astrology is accurate!
3. She said that she'd be in class unless her flu took a turn for the worse. I didn't see her, so I think we should go by her place and make sure she's okay.
4. If the new policy results in fewer people applying for assistance, I'd say it's a success. Well, it's official: the numbers have gone down by 10%. Time to celebrate!
5. If Bush were Christian, he would have advocated, after 9/11, that we offer other tall buildings to the terrorists; he would've said we should turn the other cheek. Instead, he said we should go find them and kill them. So he's not Christian.

## 2.2 Denying the consequent (modus tollens)

- ✓ If p, then q.  
not-q.  
Therefore, not-p.

“If p, then q” means that p at least (if not also r and others) must result in q, so we can conclude that if we don’t have q, we didn’t have p. (But remember that we can’t conclude that if we *do* have q, we *did* have p—we could’ve had r leading to q.) The second premise says that q is not the case—it denies the consequent (remember that q is the antecedent)—so this form is called “denying the consequent.”

Here’s an example of an argument that denies the consequent:

If opponents of abortion were basing their opinion on the rights of the fetus, then they wouldn’t allow exceptions in the case of rape, but they do, so their opposition to abortion must not be based on the rights of the fetus.

Here is the argument in standard form:

If opponents of abortion were basing their opinion on the rights of the fetus, they wouldn’t allow exceptions in the case of rape.	If p, then q.
<u>They do allow exceptions in the case of rape.</u>	<u>Not-q.</u>
Therefore, they must not be basing their opinion on the rights of the fetus.	Therefore, not-p

### 2.2a Practice identifying the valid form of denying the consequent

Which of the following five arguments have the valid form of denying the consequent? (Again, it might help if you put the argument in standard form before you decide.)

1. If near-death experiences were based on birth memories (of passing through the tunnel of the vagina into the bright light of the hospital room), then those who were born by Cesarean section should not have tunnel experiences when they are near death. However, they do. Therefore near-death experiences aren’t based on birth memories.  

(Based on Theodore Schick, Jr. and Lewis Vaughn,  
*How to Think About Weird Things*, 1998)
2. The Roman Catholic Church believes we are all born in a state of “original sin.” Just by being born, you’re bringing sin into the world. We don’t want to bring more sin into the world, so we should endorse abortion.
3. If American women are so equal, why do they represent two-thirds of all poor adults? . . . Why does the average female college graduate today earn less than a man with no more than a high school diploma (just as she did in the

‘50s)—and why does the average female high school graduate today earn less than a male high school dropout? . . .

If women have “made it,” why are they less than 8 percent of all federal and state judges, less than 6 percent of all law partners, and less than one half of 1 percent of top corporate managers? Why are there only three female state governors, two female U.S. senators, and two Fortune 500 chief executives?

(Susan Faludi, *Backlash: The Undeclared War Against American Women*, 1991)

4. If she arrived before me, I would have seen the tire tracks of her truck in the snow. I didn’t see any tracks, so she must’ve arrived on foot.
5. If the universe were infinitely old, there would be no hydrogen left in it, since hydrogen is steadily converted into helium throughout the universe, and this conversion is a one-way process. But in fact, the universe consists almost entirely of hydrogen. Thus the universe must have had a definite beginning.

(Fred Hoyle, astronomer, paraphrased by Anthony Weston in *A Rulebook for Arguments*, 2008)

If women can sleep their way to the top, how come they aren’t there? There must be an epidemic of insomnia out there.

(Ellen Goodman, quoted in Susan Jane Gilman, *Kiss my Tiara: How to Rule the World as a Smart Mouth Goddess*, 2001.)

## 2.3 Reductio ad absurdum (a version of modus tollens)

- ✓ p or not-p.  
Assume p.  
If p, then q.  
q is absurd. (that is, not q)  
Therefore, not p.  
Therefore, not-p.

This form of valid reasoning makes use of denying the consequent and is often used as a counterargument (to argue for not-p when someone is arguing for p). It starts by proposing the either-or disjunction of “p or not-p.” It proceeds to show by a simple conditional of “If p, then q” that the consequence of p is an absurdity, something false or contradictory. Then, it argues that if q is absurd, we don’t want or can’t have p (which led to q); that is, if not q, then not p (there’s the denying the consequent argument). It concludes, then, given the opening disjunction, that if we don’t have p, we must have not-p.

Here’s an example of a reductio ad absurdum:

If abortion is acceptable past the point of viability (the ability of the fetus to live independently, outside the womb), then killing newborns and other people who need someone to feed them and machines to breathe for them or

clean their blood would also be acceptable. But that’s ridiculous! We can’t go around killing everyone on dialysis!

Assuming the implied conclusion that abortion is not acceptable past the point of viability, the argument is as follows:

Abortion past viability is acceptable or it is not.	p or not-p.
If abortion past viability is acceptable, then it’s acceptable to kill newborns, those on dialysis, and dependent others.	If p, then q.
It’s ridiculous to say it’s acceptable to kill newborns, those on dialysis, and dependent others.	Not q.
Therefore, we shouldn’t say that abortion past viability is acceptable.	Therefore, not p.
Therefore, we should say that abortion past viability is unacceptable.	Therefore, not-p.

### 2.3a Practice identifying the valid form of reductio ad absurdum

Which of the following five arguments have the valid form of reductio ad absurdum? (Don’t forget to put the argument in standard form before you decide.)

1. University teachers are supposed to be men with special knowledge and special training such as should fit them to approach controversial questions in a manner peculiarly likely to throw light upon them. . . . Taxpayers think that since they pay the salaries of university teachers, they have a right to decide what these men shall teach. This principle, if logically carried out, would mean that all the advantages of superior education enjoyed by university professors are to be nullified, and that their teaching is to be the same as it would be if they had no special competence.  
(Bertrand Russell, “Freedom and the Colleges,” *Why I am not a Christian*, 1957)
2. If people engaged in sports only to win, then they’d seek out and play against only those opponents they could most likely beat.  
(Paraphrase of Keith Thompson, “Sporting Significance” *The Philosopher’s Magazine*, #25, 1st quarter)
3. Of a pro football game that lasts three and a half hours, only about sixteen minutes are composed of actual football playing, according to an evaluation of a sample game by the Scripps Howard News Service. The rest is taken up with players’ huddling, picking themselves up off of piles of men, running to the line of scrimmage, and rehuddling (one hour, fifty-three minutes);

commercials (twenty-six minutes); halftime (sixteen minutes); penalties (ten minutes); injury delays (six minutes); and other delays including timeouts, official measurements, and fights. Clearly, men who love football are not wading through three and a half hours of television just to see a few spectacular touchdown passes. There must be more to it.

(Mariah Burton Nelson, *The Stronger Women Get, The More Men Love Football: Sexism and the American Culture of Sports*, 1994)

4. Suppose that the world has a Creator like a house does. Now when houses are not perfect, we know who is to blame: the carpenters and masons who created them. But the *world* is also not wholly perfect. Therefore, it would seem to follow that the Creator of the world, God, is not perfect either. But you would consider this conclusion absurd. The only way to avoid the absurdity, however, is to reject the supposition that leads to it. Therefore, the world does not have a Creator in the way that a house does.

(David Hume. *Dialogues Concerning Natural Religion*  
Part V [1779] 1998)

5. Professors should refrain from offensive comments. But if a student finds offensive an opinion that is merely contrary to the one he/she currently holds, what is the professor to do?

## 2.4 Chain argument (hypothetical syllogism)

✓ If p, then q.  
If q, then r.  
 Therefore, if p, then r.

This syllogism articulates a simple chain of one thing implying another, which implies another, which implies another, and so on. As long as each one builds on the previous one correctly—the antecedent of each statement must be the previous statement's consequent—your argument will be valid and you can conclude that the very first thing implies the very last thing.

Here's an example of a chain argument:

If Quebec leaves Canada, then the Maritimes will be motivated to leave as they've long said they'd like to, and then B.C. will figure, hey, if the east coast can split off, so can the west coast, and if we lose the west coast, there won't be a Canada.

Expressed in standard form, the argument forms a chain:

If Quebec leaves Canada, then the Maritimes will leave	If p, then q.
If the Maritimes leave, then B.C. will leave.	If q, then r.

If B.C. leaves, then there won't be a Canada.  
Therefore, if Quebec leaves, B.C. will leave.

If r, then s. \_\_\_\_\_  
Therefore, if p, then s.

It is a valid argument, so if the premises are true (which is unlikely), then we must accept that if Quebec leaves Canada, B.C. will also leave.

### 2.4a Practice identifying the valid form of a chain argument

Which of the following five arguments have the valid form of a chain argument?

1. The population will increase if contraceptives are taxed. And if the population increases, the labor pool will increase. And we all know when there is more labor available, the economy improves. So, you want a better economy? Put a tax on condoms, the pill, IUDs, whatever!
2. But if there be no resurrection of the dead, then is Christ not risen: and if Christ be not risen, then is our preaching vain, and your faith also vain.  
(1 Corinthians 15:13–14)
3. “You see?” [Italie brings back to life some ants she just killed.] “Well, if I can make and unmake them, I have the right to decide for them, haven't I?”  
Catherine thinks this over, frowning. She hadn't looked at it in this way. But no. No. Her parents made her, didn't they? Nevertheless, she doesn't feel the least desire to let them decide for her . . .  
(Elisabeth Vonarburg, *Reluctant Voyagers*, 1995)
4. If you know what you really want to do with your life, you'll do it. And if you do what you really want to do, you'll be happy. So knowing what you want is the first step to being happy.
5. The trickle-down theory is this: the wealth of the rich trickles down to the poor because when people are rich, they invest in businesses, which hire the poor thus providing them with an income, and they in turn make products which are affordable, products which in turn improve their quality of life.

## 2.5 Disjunctive syllogism

✓ p or q.  
not-p. \_\_\_\_\_  
Therefore, q.

✓ p or q.  
not-q. \_\_\_\_\_  
Therefore, p.

Recall that with a disjunction (Section 1.2), at least one term must be true. So if  $p$  isn't true, then  $q$  must be true; alternatively, if  $q$  isn't true,  $p$  must be true. This version of the disjunctive syllogism is often called "argument by elimination."

Here's an example of a disjunctive syllogism:

Either we go to the movie or we go to dinner. The movie has already started and it's stupid to pay unless you see it from the beginning. So let's just go out to eat somewhere.

You'll see the form clearly when we express it as a syllogism:

Either we go to the movie or we go to dinner.	$p$ or $q$ .
<u>We won't go to the movie.</u>	<u>not-<math>p</math>.</u>
Therefore, we'll go to dinner.	Therefore, $q$ .

However, recall (Section 1.2) that there are two ways in which "or" could be used: if it means "and/or" (an inclusive disjunct), then both  $p$  and  $q$  could be true. *In that case*, if  $p$  were true, you couldn't conclude  $q$  was false (not- $q$ ). Also, following the same reasoning, you can conclude  $q$  from not- $p$ . So the disjunctive syllogism employs only exclusive disjuncts.

### 2.5a Practice identifying the valid form of a disjunctive syllogism

Which of the following five arguments have the valid form of a disjunctive syllogism? (Remember to put the arguments in standard form.)

1. If you really want to read an eye-opener, read Crichton's *State of Fear* or Atwood's *The Handmaid's Tale*.
2. Either the animal is suffering from X or Y. If it were suffering from X, it would have these symptoms. But it doesn't. So it must be suffering from Y.
3. Either he's going to stay at home to raise his kids or he's going to keep working and hire someone else to do it. There's no way he's going to choose his dead-end boring job over his kids, so he's going to stay home.
4. Either extraterrestrial beings visited Earth some time in the past or the pyramids are a mirage. I've seen the pyramids with my own eyes, even walked part way up. So ET was here!
5. Either something is good because God tells us to do it or God tells us to do only those things that are good. If it's the former, then that would mean God

could tell us to kill our children and we'd have to say it's good to do so—because God said to do it. That can't be right. But if it's the latter, that would mean there's some higher standard which God consults, which means he's not the supreme judge or whatever. And that can't be right either.

(Based on Plato's *Euthyphro*, 380 BCE)

## 2.6 Conjunctive syllogism

✓ p and q. <u>p.</u> Therefore, q.	✓ Not both p and q. <u>p.</u> Therefore, not-q.
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The first version of this one is pretty straightforward: if you postulate a conjunction, p and q, then if you have p, you must also have q (or, if you have q, you must have p).

Here's an example of this kind of conjunctive syllogism:

For a plant to be poison ivy, it must have three leaves and the leaves must be waxy. This is poison ivy—it has three leaves.

Expressed as a syllogism, the argument is this:

Poison ivy has three leaves and the leaves are waxy.	p and q.
Poison ivy has three leaves.	<u>p.</u>
Therefore, poison ivy has waxy leaves.	Therefore, q.

As is, it seems like a weird form of argument; more often, this version of a conjunctive syllogism is part of a conditional:

In order to be poison ivy, a plant must have three leaves in a bunch and the leaves must be waxy. You've told me this is poison ivy, and I can see that the leaves in your hand are waxy. I can conclude, therefore, that before you picked them off the stalk, there were three of them in a bunch.

The second version, which is far more common, postulates a sort of a negation of the conjunction: if you postulate that you *can't* have *both* p and q (you can have one or the other, or neither, but not both), then if you have p, you can conclude that you don't have q (because, remember, you can't have both).

Here's an example of this kind of conjunctive syllogism:

It cannot be the case that she knew what she was doing and that she is not to blame for her actions. We have proved that she did indeed know what she was doing. Therefore, she is to be held fully responsible for her actions.



Expressed in standard form:

It cannot be the case that she knew what she was doing and that she is not to blame for her actions.  
She knew what she was doing.  
 Therefore, she is to blame.

Not both p and q.  
p.  
 Therefore, not q.

Note, however, that because ‘Not both p and q’ doesn’t exclude the possibility that you have neither, you *can’t* conclude from having not-p that you have q—perhaps you have not-q as well. (This error of reasoning will be in the next section, 3.6.)

### 2.6a Practice identifying the valid form of a conjunctive syllogism

Which of the following five arguments have the valid form of a conjunctive syllogism?

1. It’s impossible that you’re making over \$30,000/year and that you’re too poor to provide the necessities of life for yourself. You are making over \$30,000/year. So you are clearly able to provide your own necessities.
2. In order to vote, one must be both a citizen of the country and over eighteen. You were obviously allowed to vote yesterday, and I know you’re a citizen. So now I know you’re also over eighteen.
3. There are those who, in the face of all evidence to the contrary, continue to believe that women are by nature inferior to men. If this were the case, however, there would have been no need for the creation of laws and institutions constricting women’s rights and freedom, excluding them from the public world. If any class is actually inferior to any other class in all ways—physically, emotionally, and intellectually—it is not necessary to subjugate the inferior class.  

(Marilyn French. *Beyond Power*, 1985)
4. If circus animals have to be hurt in order to learn the tricks they do, you can’t say they’re being treated well. Listen to elephant trainer Tim Frisco: “Sink that hook into ’em. When you hear that screaming, then you know you got their attention.” We have a video tape of an elephant trumpeting in agony as Frisco’s bullhook, with its sharp metal hook and spiked end, tears through her sensitive skin. The fact is, animals do not naturally ride bicycles, stand on their heads, balance on balls, or jump through rings of fire. To force them to perform these confusing and physically uncomfortable tricks, trainers use

whips, tight collars, muzzles, electric prods, bullhooks, and other painful tools of the trade. So, no, circus animals are not treated well. We should abandon the idea of animals in circuses and stick to the amazing gymnasts, acrobats, and so on.

(Based on information posted on the PETA website)

5. The passing star hypothesis and the solar nebular hypothesis can't both be right. Stars collide very infrequently, and worse, any gas pulled from the sun and the star when a passing star collided with or passed close to the sun would be too hot to condense to make planets, and worse still, even if planets formed, they wouldn't go into stable orbits. For these reasons, the passing star hypothesis is incorrect. So our solar system must have originated as the solar nebula hypothesis suggests: the planets formed from a disk of gas that surrounded the sun as it formed.

(Based on information in Michael A. Seeds, *Foundations of Astronomy* 2007)

## 2.7 Constructive dilemma

✓ p or q.  
 If p, then r.  
If q, then s.  
 Therefore, r or s.

Note how this form incorporates affirming the antecedent and a disjunction. It might be easier to see this when the argument is expressed this way:

If p, then r.	[and]	If q, then s.
p	or	q
Therefore, r.	or	s.

Here's an example of a constructive dilemma:

Crime is caused by permissive parents who have let their kids do whatever they want with no consequences, no understanding of what's acceptable and what's not. Either that or it's caused by abusive parents. When a kid is constantly being hurt for no good reason (is there ever a good reason to hit a child?), he/she will understandably become very angry and, no doubt, take out that anger on others. If it's caused by permissive parents, then what we should do is encourage parents to set rules and stick by them. And if it's caused by abusive parents, we should get them the hell away from their kids; such parents should be put in prison, case closed. We should surely be able

to arrange for other, more mature adults, to raise their kids. So, in order to reduce crime, we should either encourage parents to set and maintain rules or we should remove abusive parents from their kids.

Here's the argument in standard form:

Either crime is caused by permissive parents or it is caused by abusive parents.	p or q.
If it's caused by permissive parents, then we should encourage parents to have rules.	If p, then r.
And if it's caused by abusive parents, we should remove <u>the parents from the kids.</u>	<u>If p, then s.</u>
Therefore, (in order to reduce crime), we should either encourage parents to have rules or we should remove parents from their kids.	Therefore, r or s.

(Of course, it could be that crime is caused by both permissive parents and abusive parents (and by other parents as well) (and by causes other than parenting). Or it could be that one kind of crime is the result of permissive parenting and another kind of crime is the result of abusive parenting.)

### 2.7a Practice identifying the valid form of a constructive dilemma

Which of the following five arguments have the valid form of a constructive dilemma?

1. If I stay home and study, I'll pass the exam, but if I don't go to work, I'll get fired. Either I stay home or I go to work. So either I pass the exam or I keep my job.
2. You're saying that you don't remember what you read, so either you're not remembering what you're reading or you're not understanding it in the first place. As for not remembering, here's something you can do: close the book every now and then and explain to yourself what you just read. That kind of constant review or rehearsal will put the information into your memory. And if you're not understanding what you're reading and *that's* the problem, then just make sure you do! Look up every single word whose meaning you don't know, and put every single paragraph into your own words before you move on.
3. Either the Bible was written by men or it was written by God. If it was written by men, most likely long after the events described had happened,

and quite probably for various reasons, there are probably errors in it. But if it were written by God, an infallible god, well, he seems to condone some pretty gruesome things. Check out Deut. 28:53 and Hos. 13:16. So I guess we have to conclude that either there are mistakes in the Bible or God is not as loving as we've been led to believe.

4. I'm not going to go for a run if it's raining, and I'm not going to drive into town if it's snowing. Look at the sky! It's going to do one or the other! So I guess I'll just curl up with a good book!
5. Whenever you identify yourself by your skin color, you give tacit permission to be judged by your skin color—racial discrimination. And whenever you identify yourself by your sex, you're doing the same thing, you're saying it's okay for people to make judgments about you on the basis of your sex. That's why if you insist on calling yourself black or a woman, you'll be subject to discrimination of one kind or the other.

## 2.8 Destructive dilemma

✓ not-q or not-s.  
 If p, then q.  
If r, then s.  
 Therefore, not-p or not-r.

And note how this form incorporates denying the consequent and a disjunction:

If p, then q.	[and]	If r, then s.
not-q.	or	not-s.
Therefore, not-p.	or	not-r.

Here's an example of a destructive dilemma:

If you've broken your ankle, you shouldn't be able to put any weight on it, and if you've torn a ligament, it should be swollen. But you *can* put weight on it, and I see that it's *not* swollen, so you haven't broken it nor have you torn a ligament.

Expressed in standard form:

If you've broken your ankle, you shouldn't be able to put any weight on it.	If p, then q.
If you're torn a ligament, it should be swollen.	If r, then s.

You can put weight on it and it's not swollen.  
Therefore, you haven't broken it nor have you  
torn a ligament.

Not-q and/or not-s.  
Therefore, not-p  
and/or not-r.

(Note that this example uses an inclusive disjunct.)

### 2.8a Practice identifying the valid form of the destructive dilemma

Which of the following five arguments have the valid form of the destructive dilemma?

1. In order to increase wages, they're going to have to fire some part-timers. And if they think they're going to hire more consultants, on a contract basis, they're going to have to fire some full-timers. I know for a fact they're not planning on firing anyone! So don't count on a wage increase or consulting assistance!
2. When she dreams her eyelids flutter, and when she's awake, of course, her eyes are open. Her eyes are firmly shut. I conclude that she's neither dreaming nor awake!
3. I keep hearing two theories about global warming: either it's caused by industry (fossil fuel emissions, CFCs, and so on) or it's caused by natural cycles. If it's caused by industry, there would have been no warming prior to the industrial revolution. And if it were due to natural cycles, then I guess it would be happening on some regular or at least predictable basis. Either it has occurred prior to the Industrial Revolution or it's not occurring on a regular or predictable basis.
4. . . . [T]here are even more serious logical flaws in the abductee stories of alien behavior. Most glaring is the obvious lack of any sign of intelligence . . . They are scientifically stupid, mathematically stupid, statistically stupid, linguistically stupid, anthropologically stupid, and psychologically stupid. In fact, they are so generally and far-reachingly stupid they reportedly say they want to breed with human beings, clearly the most aggressive and warlike creatures in the cosmos. . . . Aliens are also so naive they think they *can mate with us!* Biologically humans cannot even breed with their closest relatives, the apes and chimpanzees, much less with aliens that, reportedly, have no sex organs. . . .  
 . . . [I]n spite of nearly fifty years of collecting human samples they still need more and more of the same things from more and more victims. . . . Why don't they ever keep some of the specimens for detailed and intensive

study? Why haven't they taken corpses and performed autopsies? . . . Why do they slaughter hundreds of cows when only one or two would give them all the biological information any intelligent scientist would ever need? . . . As for the kinds and types of people they abduct why don't they show some political savvy and abduct the power brokers—heads of state, influential folk like Bob Dole, Rush Limbaugh, or Ross Perot? . . . If their goal is to truly understand us why don't they abduct leading scientists, Nobel Prize winners, or at least people who know something worth knowing? . . . If their aim is to warn or send messages to humanity, why don't they make use of our wonderfully efficient communication facilities?

(Robert A. Baker, "No Aliens No Abductions: Just Regressive Hypnosis, Waking Dreams, and Anthropomorphism," in Kendrick Frazier, Barry Karr, and Joe Nickell, Eds. *The UFO Invasion*, 1997)

5. It's so highly improbable that life formed on Earth, that the world evolved the way it did. I forget what I read, but it's like one in a million. So God must have created us.

## 2.9 Combinations

The preceding valid forms, and other valid forms, can be combined.

Consider the following, a chain argument consisting of an affirming the antecedent syllogism (2.1) and a disjunctive syllogism (2.5):

It's quite clear that we are running out of fresh water. Wells are drying up because the water table is getting lower and lower. And there is less and less precipitation. This has extreme consequences for agriculture, not only because crops need water, but because without it, the top soil blows away. Simply put, our ability to grow our own food is in jeopardy. If we don't reduce our water use now, we won't have enough for our future needs. And judging by the outrage when we prohibit people from washing their cars, let alone watering their lawns (on which nothing edible grows, I might point out), it's clear we're not about to reduce our use. There will come a time when we will have to buy it from other countries at outrageous prices, or knowing the U.S., we'll just steal it (we won't call it that though). Either that or we develop a way to desalinate the ocean's water. I for one object to the first possibility. And actually, I read that nuclear reactors on ships actually do turn seawater into drinking water. So perhaps we already have the technology, but maybe it's not safe enough yet or cheap enough . . .

Here is the argument expressed in standard form:

If we don't reduce our water use, we won't have enough for our future.	If p, then q.
We are not reducing our water use.	p.
Therefore, we won't have enough for our future.	Therefore, q.
If we don't have enough for our future, we'll either buy/steal it or develop desalination technology.	If q, then r or s.
<u>Buying/stealing it is unacceptable.</u>	<u>Not r.</u>
Therefore, we need to develop desalination technology.	Therefore, s.

### 2.9a Practice identifying the valid combinations

Which of the following five arguments have valid combinations of the above valid forms? (Here most certainly, it will probably help if you put the argument in standard form.)

1. If our sales are declining, then either people don't want to buy slinkies anymore or there is competition out there that's making a better slinky. There is no one else who makes slinkies, so it must be that people just aren't interested anymore in having a slinky.
2. Given that there's evil in the world, either God doesn't want to prevent it or he can't prevent it. If he doesn't want to prevent it, he's not all-good, and if he can't prevent it, he's not all-powerful. But that's ridiculous! He *is* all-good and all-powerful. So I have no choice but to conclude there's no evil.
3. . . .[L]et's consider some unpopular theories about September 11 and the war against terrorism. Differing from orthodox accounts, they haven't figured much in mainstream media and debate . . .

*Theory Two:* People in the CIA and the FBI knew that bin Laden and his al-Qaeda collaborators were planning these attacks. They knew because they had received many warnings in advance—various anonymous tips, and warnings from German and Russian intelligence. Had they sought to, they could have prevented the attacks; since they didn't prevent them, we can infer that they didn't try. And there's a motive that will make sense of this stunning omission: agents in the CIA and FBI had reasons of their own for wanting these attacks to occur. If the American people saw the country attacked by terrorists, they would support an expansive military campaign enhancing the resources and power of the military. The resulting realignment of U.S. policy would favor oil interests, militarism, and U.S. domination around the world. The war against terrorism has indeed resulted in tremendous public support for the U.S. military campaign. Thus, it's argued, the attacks must have been sponsored or tolerated by people who were working from inside government agencies to build that public support. Call this the Theory of Internal Collusion.

4. I can tell you why women are not in high-ranking positions. They haven't put in the overtime that's required to be promoted to such positions. And I can speculate as to why they haven't put in the overtime. It could be that they simply didn't want to. That's the standard explanation. Or it could be that they weren't allowed to. Did you know that in 1970, 43 states limited the number of hours women could work, generally to eight per day? So while the men were racking up all those hours for the last 10 or 20 years, to finally now be CEO or whatever, the women simply weren't allowed, by law, to do the same.
5. The sanctity of life argument says that life itself is sacred, regardless of its quality. Advocates of euthanasia argue on the basis of quality of life. That leads us to conclude that sanctity of life advocates would not advocate euthanasia.

### 2.9b More practice with valid propositional arguments

Suppose each of the statements in the following pairs is true. What conclusion, if any, can—indeed, *must*—you draw?

1. If we have a natural will to survive, suicide is wrong. Suicide *is* wrong.
2. If biological mothers want to assert any right over the child they carry, they must take responsibility for its interuterine development. Biological mothers, especially surrogate mothers, often do assert such a right.
3. If we continue to allow the Vatican a veto vote at the United Nations, that'll mean we approve of one religion having more power than any other. But we don't approve of that.
4. If your partner has HIV, sex with him/her may be fatal. If sex may be fatal, you should refrain from having sex with him/her.
5. If you're not present, you can't participate. Participation is important.
6. The team wins either because they play well together, they co-operate, they are always aware of each other's position, and they know each other's strengths and weaknesses—or because they have a few individual stars. I know for a fact there is not one outstanding athlete in the team.
7. Allowing more people to have more guns cannot lead to both more crime and more safety. Stats show it leads to more crime.
8. If drug X was working, then you'd be experiencing fewer headaches, and if drug Y was working, your nausea would be gone. You've still got headaches and nausea.
9. If private money rather than public money were to be used for political campaigns, then we'd have an incredibly unfair competition: the richest would have the advantage and the election would be unduly influenced by rich private interests. That is totally unacceptable.



10. We'll either increase jail sentences or increase fines. If we increase jail sentences, the state will have more expenses, but if we increase fines, the state will have more income.

# 3

## Invalid forms

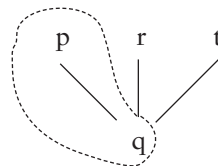
In this section, we'll consider five of the more common invalid forms of argument using propositional logic.

### 3.1 Affirming the consequent

✗ If p, then q.  
q.  
Therefore, p.

The second premise says that q is the case—it affirms the consequent (remember that q is the antecedent)—so this form is called “affirming the consequent.” But it’s an invalid form of argument because r (or t or v . . .) could have caused q or been a condition under which q occurs. Remember that “if” doesn’t mean “only if”: if p, then q, yes, but that doesn’t exclude the possibility that also if r, then q. p is a sufficient cause of q, but not a necessary one; don’t forget to consider other causes of q.

Perhaps this will help:



‘If p, then q’ accounts only for what’s circled with the dotted line; it doesn’t exclude the rest from being possible.

Here’s an example of this particular error, affirming the consequent:

When I’m eating chocolate, I’m happy. I’m happy now, so I must be eating chocolate.

In standard form, the argument is this:

If I’m eating chocolate, I’m happy.	If p, then q.
<u>I’m happy.</u>	<u>q.</u>
Therefore, I’m eating chocolate.	Therefore, p.

Since there might be lots of other things that make me happy, it’d be wrong to conclude that since I’m happy, I must be eating chocolate.

### 3.1a Practice identifying the invalid form of affirming the consequent

Which of the following five arguments have the invalid form of affirming the consequent?

1. *McCormack*: I tell you it’s a conspiracy!  
*Germain*: What evidence do you have that they’re covering it up?  
*McCormack*: None! Don’t you see? That proves it’s a conspiracy—they’re covering it up!
2. Whenever there is sufficient food, little disease, and a good standard of living, a population will increase. In India, population is increasing. Therefore, there must be sufficient food, little disease, and a good standard of living in India.
3. Divorced and single men should get sick and die more often than married men if it’s true that marriage is good for your health or, at least, good for men’s health. Unmarried men *do* get sick and die more often than married men. I wonder why that is . . . In any case, I guess it shows that marriage is good for men’s health.
4. If the state mandates that employers pay a living wage, complete with health benefits, parental leave, and pension, many jobs will go underground and become illegal because many small companies simply can’t afford to do that. At least not for their low-productivity workers—it’s simply not cost-effective. Without government mandated wages and benefits, low skill workers can at

least find jobs, less desirable jobs to be sure, but jobs just the same. But now, they can't—at least not legal jobs.

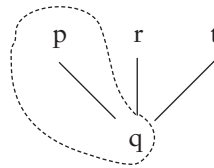
(Based on Jennifer Roback Morse, “When Jobs are Illegal, Only Illegals Will Have Jobs,” rpt in *The Women’s Freedom Network Newsletter* 11.1 (January/February 2004); first appeared in *National Catholic Register* February 8–14/04)

- The doctor said that if my child is hyperactive, Drug X will calm him. Well, I gave him the drug, and sure enough, he calmed right down. I guess he was hyperactive after all!

### 3.2 Denying the antecedent

✗ If p, then q.  
not-p.  
 Therefore, not-q.

The second premise says that p is not the case—it denies the antecedent (remember that p is the antecedent)—so this form is called “denying the antecedent.” But, again, it’s an invalid form because “if” doesn’t mean “only if,” so if p, then q, yes, but maybe, also, if r, then q—in which case not-p needn’t imply not-q, because r could cause q. Again, don’t forget to consider other causes of q.



Here’s an example of this invalid form, denying the antecedent:

The Turing test involves a panel of human beings interrogating an unknown. If they can’t tell, on the basis of the answers they receive to their questions, whether the unknown is a human or a computer, and it’s a computer, the computer passes the test. If a computer passes the test, it is deemed able to think. So if a human doesn’t pass, what, they can’t think?

Here’s the argument in standard form:

If it passes the test, it can think.  
It doesn’t pass the test.  
 Therefore, it can’t think.

If p, then q.  
Not-p.  
 Therefore, not-q.

(Of course, one needs to define “think” . . .)

### 3.2a Practice identifying the invalid form of denying the antecedent

Which of the following five arguments have the invalid form of affirming the consequent?

1. Religious people are moral people; they have a moral compass, the word of God. It follows that if you're a pagan, someone who hasn't yet found the Lord Jesus Christ, you're floundering in a moral abyss, without any sense of right or wrong to guide you in this life.
2. The Pope says that if a man with AIDS can't abstain from intercourse, it's better that he infect his wife than use a condom. Men *can* abstain from intercourse, so it's *not* better that he infect his wife than use a condom.
3. If the Earth is only 6,000 years old, then most of cosmology, astronomy, physics, chemistry, biochemistry, geology, paleontology, archaeology, genetics, etc. are wrong.  
(Michael Shermer <http://www.skeptic.com/eskeptic/archives/2004/04-05-10.html#miracle> retrieved May 10, 2004)
4. If we had a natural will to survive, we wouldn't want to commit suicide. But we do. People do want to commit suicide on occasion. So that proves we *don't* have a natural will to survive.
5. *Lalibert*: Homosexuality is unnatural. That's why it's wrong!  
*Swiede*: You're mistaken. There's a genetic basis for homosexuality. So it's not wrong!

## 3.3 Broken chain

✗ If p, then q.  
If r, then q. \_\_\_\_\_  
Therefore, if p, then r.

You'll see how in the valid chain argument, there *is* a chain:

✓ If p, then q.  
If q, then r.  
If r, then s.  
If s, then t.  
...

But in a broken chain argument, there isn't a chain, there's just a straight line down the one side.

$\times$  If p, then q.  
~~If r, then q.~~  


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 Therefore, if p, then r.

Here's an example of a broken chain argument:

Whenever there's an accident, the traffic slows down. And of course whenever it's raining, traffic slows. So hey, I just figured it out! Whenever there's an accident, it must be raining!

Alas, no.

If there's an accident, traffic slows.	If p, then q.
<u>If it's raining, traffic slows.</u>	<u>If r, then q.</u>
Therefore, if there's an accident, it's raining.	If p, then r.

### 3.3a Practice identifying the invalid form of a broken chain

Which of the following five arguments have the invalid form of a broken chain?

1. The main reason to abolish nuclear weapons is to eliminate the danger of a great nuclear disaster. Even "extreme" proposals that would allow "each side" a thousand warheads leave this danger in place. As long as military establishments retain large nuclear stockpiles, they will plan for the use of these weapons in war; and as long as such plans exist, one cannot rule out the possibility of a deliberate decision to carry them out.  
 (Lincoln Wolfenstein, "End Nuclear Addiction," *The Bulletin of the Atomic Scientists* May 1991, rpt. in John T. Rourke ed., *Taking Sides: Clashing Views on Controversial Issues in World Politics*, 6th edn. 1995)
2. If we eat late, we have pizza. And if we eat cheap, we have pizza. Therefore, if we eat late, we eat cheap.
3. Whenever she's angry, she goes and works out, hard. And whenever she has lots of energy, she has a hard workout. So whenever she's angry, she must have lots of energy. Maybe we should piss her off before each race.
4. When grades are inflated and everyone gets an A or a B, students stop taking pride in their achievements. This also happens when grades are unfair. So it's pretty clear to me that when grades are inflated, they're unfair.

5. Let us carry this now to its logical extreme. Let us say, for example, that separation of church and state were accepted as a constitutional premise, which I submit you could not because it is not even in the Constitution.

Let us say further that we require that all vestiges of traditional religious belief or practice in this country of the Judaic-Christian heritage were required to be eliminated. Look at the monstrosity we would create. We could have no chaplains in the Armed Forces; we could have no religious facilities on military bases. We could not open the Senate or the House with prayer. We could not have “In God We Trust” on our coins. We could not say “God Save This Honorable Court” when the Supreme Court opens, and Lord knows, it needs it. We could not allow the President, at the conclusion of his Presidential oath, to say—and every President has acknowledged that he needs it—“So Help Me God.”

All of that would have to be eliminated. Why? Well, now, you see, Mr. President, according to the opposition, you can have absolutely no vestige, no symbolism whatsoever between church and state at any level in the American federal system.

Do you know where that leaves us ultimately, Mr. President? It leaves us with the Central National Government establishing a national religion of secularism. And that is the total perversion ultimately of the intention of the framers, which was that we would have no established national religion. In this case, the religion was becoming secularism. It is a world view. It is materialistic, it is naturalistic.

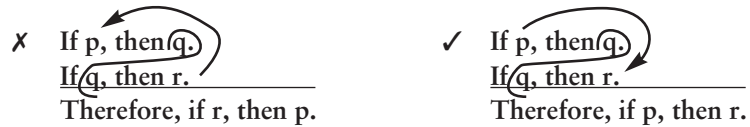
I think the American people maybe were not constitutional experts but they began to feel, down in the recesses of their hearts and souls where common sense resides, that something had gone astray, that this was a tortured and wretched interpretation of the constitution that Madison, Jefferson, and other great men of that period could not have meant.

(John P. East from US Senate Debate, March 6, 1984 “The Framers would not have Banned Payer,” as rpt. in George McKenna and Stanley Feingold, *Taking Sides: Clashing Views on Controversial Political Issues*, 4th edn, 1985)

### 3.4 Backward chain

✗ If p, then q.  
If q, then r.  
 Therefore, if r, then p.

You’ll see that in this case, the chain is there, but in the end, the conclusion is drawn backward from the last point (r) to the first point (p) instead of forward from the first point (p) to the last point (r):



Here's an example of a backward chain:

If you read the book, you'll know how the story ends. And if you know how the story ends, you won't enjoy the movie. So if it turns out you don't enjoy the movie, I'll know you've read the book.

The argument in standard form shows how the conclusion goes backward instead of forward:

If you read the book, you'll know how the story ends.	If p, then q.
<u>If you know how the story ends, you won't enjoy the movie.</u>	<u>If q, then r.</u>
Therefore, if you don't enjoy the movie, you have read the book.	Therefore, if r, then p.

### 3.4a Practice identifying the invalid form of a backward chain

Which of the following five arguments have the invalid form of a backward chain?

1. When the real estate, I mean houses, when the price of houses goes up, people, or at least, homeowners feel rich. As a consequence, they spend more. They go out and upgrade their home entertainment systems, their computers, and most of all they probably buy a new car. And then they suddenly realize they're not so rich. The bills for those purchases start coming in . . . so they think about selling the house. Crazy, I know. But it just goes to show that if people even *think* about selling their houses, the price of houses will go up!
2. When we put growth hormones into cattle feed, of course it gets into their muscle tissue—which is the beef we eat, so of course the growth hormones will get into us. It stands to reason that if we ingest growth hormones, our cattle will too.
3. Since there cannot be a gene for every element of our personality, we must have free will.
4. If I run, then I'll want to eat salty things, to replenish what I've lost through sweat, and if I eat salt, I'll crave sugar, and so then I'll eat sweets, but then I'll feel like I'm getting fat, and when that happens, guess what: I'll want to



go for a run. So the bottom line is this: if I want to go for a run, I'll go for a run.

5. If there is no god, there is no creation or beginning, and therefore, time is infinite. The number of things and arrangements of things is finite. Therefore, events must repeat themselves, infinitely—hence eternal recurrence.

(Based on Nietzsche, *The Will to Power*, 1968)

### 3.5 Affirming a disjunct

$\times$ p or q. <u>p.</u> Therefore, not-q.	$\times$ p or q. <u>q.</u> Therefore, not-p.
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Note that the second premise says that p (or q) is the case—it affirms one of the disjuncts; hence, its name.

Recall that generally speaking, the disjunction requires *at least one* term to be true—it doesn't mean *only one* term can be true. So, if both can be true, then you can't conclude not-q from p—it could be both p and q. (Similarly, you can't conclude not-p from q.)

Here's an example of this particular error, affirming a disjunct:

Either you cheated on the test or you failed. I know you cheated. So I guess you didn't fail.

Guess again! Look at the form of the argument:

You cheated or you failed. <u>You cheated.</u> Therefore, you didn't fail.	p or q. <u>p</u> Therefore, not-q.
--	--

It's certainly possible that the person cheated and still failed! Don't forget that "p or q" doesn't mean it can't be both "p and q"!

#### 3.5a Practice identifying the invalid form of affirming a disjunct

Which of the following five arguments affirm a disjunct?

1. It's not safe to walk on the streets of New York. I'm glad I live in Toronto.
2. Should we pay surrogate mothers or not? Well, do we say babies cannot be bought and sold or do we say women's labor and the use of their bodies

should not be free? I for one say babies cannot be bought and sold. So, I guess women just have to go on providing their labor and bodies free of charge.

3. Once again, I can't start my car. Okay, I know from experience that either the battery is dead or the starter needs replacement. Since the lights go on and the engine is at least turning over, I can conclude the battery is not dead. So I must need a new starter.
4. Looking ahead, if China's consumption of raw materials and energy per person were to rise to the level of that in the rich countries, and in fairness, I don't see why it shouldn't, then we, the planet, will simply run out of resources. Do you have any idea how many people there are in China at the moment? But let's imagine they're smarter than the rest of us. Let's imagine they intend to limit their consumption. That would mean we won't run out!
5. I predicted she'd have her father's eyes or her mother's ears. And from the picture you sent, I can see that she did indeed get her father's eyes. She has a cute little hat on so I can't see her ears, but now that I'm taking some logic, I can conclude that she doesn't have her mother's ears.

### 3.6 Denying a conjunct

<p>✗ Not both p and q.  <u>not-p.</u>                  Therefore, q.</p>	<p>✗ Not both p and q.  <u>not-q.</u>                  Therefore, p.</p>
--	--

Note that in this case, the second premise says that not-p (or not-q) is the case—it denies one of the conjuncts; hence, its name.

This mistake occurs when you assume that “not both” means “one or the other”—it could mean neither. That's why just because not-p, you can't conclude q; it could be not-q as well—that would still make the postulated “Not both p and q” true. (Similarly, you can't conclude p from not-q.)

Here's an example of the error of denying the conjunct:

One's partner can't be both stimulating and challenging and, at the same time, easy to get along with. Yours is certainly not easy to get along with. So I assume he's at least stimulating.

Expressed as a syllogism, you'll see that the second premise denies the conjunct:

<p>One's partner can't be both stimulating and easy to get along with.</p>	<p>Not both p and q.</p>
--	--------------------------

He is not easy to get along with.  
Therefore, he is stimulating.

Not-q. \_\_\_\_\_  
Therefore, p.

It is possible that he is neither stimulating nor easy to get along with!

### 3.6a *Practice identifying the invalid form of denying a conjunct*

Which of the following five arguments deny a conjunct?

1. When the press decides whether to withhold or print the name of a rape victim, it has to decide between protecting privacy and sending the message that being raped is no more shameful than being otherwise assaulted. It can't do both. Most newspapers opt not to protect privacy. Therefore, they're obviously sending that message. Good for them!
2. He won't put a triple combination and a quad in his routine. He simply can't do both in a short program. So if there's not a triple, there will be a quad.
3. Perhaps the most telling evidence of Christians' lack of faith in their religion is the fact that they know so little about it. I have yet to meet anyone, apart from some who have a professional interest in it, who has actually read the Bible. Oh yes, the book is everywhere, but how many people read it? . . . If they really believed that this text was the "Word of God," could one not reasonably expect them to know it by heart, or, at least, to be constantly reading it, from cover to cover?  
(Henry Beissel, "Crisis in Civilization" *HiC* 36, Autumn 2003)
4. The way things are going, we will not be able to have both cheap energy and safe energy in the future. Nuclear power plants will become dominant, because available fossil fuels are being depleted more quickly than they're being formed, so obviously we won't be having safe energy. Oh well, at least it'll be cheap.
5. There is simply not enough money for both wage increases and new hires. The current increase in workload is probably temporary, so I advise against new hires. What sort of wage increase do you recommend?

# 4

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## Determining validity and invalidity

Truth tables can be used to determine whether arguments using propositional logic are valid.

Let's start with truth tables for the basic propositions outlined in Section 1.

**Conjunction: p and q.** Recall that in the case of a conjunction, both p and q must be true in order for the conjunction to be true, as the following table indicates:

$p$	$q$	$p \text{ and } q$
T	T	T
T	F	F
F	T	F
F	F	F

As you see, any combination of truth and falsity for p and q *except p and q both being true* leads to the conjunction being false.

**Disjunction: p or q.** For a disjunction, however, only one of the terms needs to be true, hence:

$p$	$q$	$p \text{ or } q$
T	T	T
F	T	T
T	F	T
F	F	F

And remember that for an inclusive disjunction, both terms could be true, hence the first row as shown. If, however, an exclusive disjunction is involved—“p or q but not both”—then the first row, in which both p and q are true, would show the disjunction as false (see Section 1.2).

**Negation: Not-p.** This one is simple: if p is true, not-p is false, and vice-versa:

$p$	$\text{not-}p$
T	F
F	T

**Conditional: If p, then q.** This one’s a little tricky: if p is true, and q is true, the conditional is true—that’s what it indicates, that if p is the case, then q is the case. And if p is true, and q is false, the conditional is false. If I said to you “If p, then q” and you experienced p, but q didn’t happen, then what I said to you was obviously false. So much for the first two rows of the table.

$p$	$q$	$\text{If } p, \text{ then } q.$
T	T	T
T	F	F
F	T	T
F	F	T

You’d be thinking quite reasonably if you said that in the case of the next two rows, when p is false, the conditional, if p then q, is “not applicable” or “neither true nor false”: the conditional starts with “If p is the case” so if we don’t have p to start with, we can’t go anywhere. Suffice to say that “neither true nor false” is not an option in propositional logic, so regardless of whether q is true or false, as long as p is false, the conditional is considered true. This might help: “If p, then q” is false only when p is true, but nevertheless q doesn’t follow (q is false)—which is the second row of the table, the only one marked false.

Now, let’s see how we can prove the validity of propositional syllogisms using truth tables.

Consider this syllogism:

If p, then q.  
p.  
 Therefore, q.

First, set up the truth table to account for all possible combinations of p and q:

<i>p</i>	<i>q</i>
T	T
T	F
F	T
F	F

If your syllogism had three terms, you'd set it up for all three (so you'd need eight lines, because there are eight possible combinations).

Then, add a column to the table for your first premise (you can simply copy from the tables above or figure it out again as explained above):

<i>p</i>	<i>q</i>	<i>If p, then q</i>
T	T	T
T	F	F
F	T	T
F	F	T

Then, add your second premise (in this case, it's just "p"—which you've already got in your table as your first column, so just repeat that column, but be sure to repeat it exactly as initially set out):

<i>p</i>	<i>q</i>	<i>If p, then q</i>	<i>p</i>
T	T	T	T
T	F	F	T
F	T	T	F
F	F	T	F

Lastly, put your conclusion into your table (again, in this case this step involves just copying from the initial suppositions):

$p$	$q$	$If\ p,\ then\ q$	$p$	$q$
T	T	T	T	T
T	F	F	T	F
F	T	T	F	T
F	F	T	F	F

Now, if it's a valid argument, there will be no rows in which the premises are both true and the conclusion false. Recall that a valid deductive argument is defined as one in which if the premises are true, the conclusion must be true. Since in this case the only row with true premises has a true conclusion, this is a valid argument.

$p$	$q$	$If\ p,\ then\ q$	$p$	$q$
T	T	T	T	T
T	F	F	T	F
F	T	T	F	T
F	F	T	F	F

Let's try another one:

$p$  or  $q$ .  
 $\underline{p}$ .  
 Therefore, not- $q$ .

Again, first list your terms and all the possibilities:

$p$	$q$
T	T
F	T
T	F
F	F

Then add a column for the first premise:

<i>p</i>	<i>q</i>	<i>p or q</i>
T	T	T
F	T	T
T	F	T
F	F	F

Then add the second premise:

<i>p</i>	<i>q</i>	<i>p or q</i>	<i>p</i>
T	T	T	T
F	T	T	F
T	F	T	T
F	F	F	F

And then add the conclusion (since it's not-q, be sure to enter exactly the opposite of what you have for q):

<i>p</i>	<i>q</i>	<i>p or q</i>	<i>p</i>	<i>not-q</i>
T	T	T	T	F
F	T	T	F	F
T	F	T	T	T
F	F	F	F	T

Is the argument valid? No, because the very first row has both premises as true, but the conclusion as false.

<i>p</i>	<i>q</i>	<i>p or q</i>	<i>p</i>	<i>not-q</i>
T	T	T	T	F
F	T	T	F	F
T	F	T	T	T
F	F	F	F	T

One more?

If *p*, then *q*.  
 If *q*, then *r*.  
not-*p*  
 Therefore, not-*r*.



Here's the finished table.

<i>p</i>	<i>q</i>	<i>r</i>	<i>If p, then q.</i>	<i>If q, then r.</i>	<i>not-p</i>	<i>not-r</i>
T	T	T	T	T	F	F
T	T	F	T	F	F	T
T	F	T	F	T	F	F
T	F	F	F	T	F	T
F	T	T	T	T	T	F
F	T	F	T	F	T	T
F	F	T	T	T	T	F
F	F	F	T	T	T	T

Note that first, *p*, *q*, and *r* are listed, with all possible combinations of truth and falsity. The values of the first premise are derived from those of *p* and *q*, as per the table above. The values of the second premise are derived in the same way, but using the values of *q* and *r*. The values for *not-p* are derived from *p* (reversed), and the values for *not-r* are derived from *r* (reversed). As you can see, we have two lines that show the argument to be invalid: lines 5 and 7 both have all three premises as T but the conclusion as F.

#### 4a Practice determining validity and invalidity using truth tables

Use truth tables to determine whether or not each of the following syllogisms is valid.

1. If the government institutes a medical plan, people will be more apt to go for regular check-ups. If people become more health-conscious, people will be more apt to go for regular check-ups. Therefore, if the government institutes a medical plan, people will become more health-conscious.
2. Muffins are not sweetened with both sugar and honey. These muffins are not sweetened with sugar. Therefore, they must be sweetened with honey.
3. Migrants move as a result of push forces or pull forces. These migrants did not move as a result of pull forces. Therefore, they must have moved as a result of push forces.
4. If fraternity members are adults, then the university should not be held responsible for their behavior. The university should not be held responsible for their behavior. Therefore, fraternity members are adults.
5. If most juries impose the death penalty whenever it's a legal option, then the death penalty is acceptable to the general public. Most juries do not impose the death penalty whenever it's a legal option. Therefore, the death penalty is not acceptable to the general public.

6. If repeated viewing of violent acts desensitizes the viewer to violent acts, then watching a lot of television desensitizes the viewer to violent acts. If watching a lot of television desensitizes the viewer to violent acts, then heavy television viewers will be more apt to commit violent acts than light television viewers. Therefore, if heavy television viewers are more apt to commit violent acts than light television viewers, that proves that repeated viewing of violent acts desensitizes the viewer to violent acts
7. Most advertisements cannot be both completely truthful and effective. Most advertisements are effective. Therefore, most advertisements are not completely truthful.
8. The team has speed or endurance. If it has speed, it will do well on the short races. If it has endurance, it will do well on the long races. Therefore, the team will do well on the short races or the long races.
9. If “Stars on Ice” is on tonight, I’ll be watching figure skating. If that movie about suffrage is on tonight, then I’ll be watching the movie. I’m not watching figure skating, nor am I watching the movie. Therefore, neither “Stars on Ice” nor the suffrage movie is on tonight.
10. If the floating feeling of peace that people experience when they’re near death is due to being near God in Heaven, then only Heaven-bound people should experience it. If that feeling is due to oxygen deprivation, then it should happen not only when people are near death but also when they’re at high altitudes. Bad people experience the floating feeling of peace when they’re near death, as do people at high altitudes. Therefore, the feeling is not due to being near God in Heaven.

#### *4b More practice determining validity and invalidity using truth tables*

Write each of the following arguments into standard syllogism form and then use truth tables to determine whether or not the argument is valid.

1. Whenever the elevator is broken, I have to walk up ten flights of stairs. I had to walk up ten flights of stairs (and, guess what, I’m not as out of breath as I used to be), so you can draw your own conclusion. It starts with “The elevator is . . .!”
2. “For over 200 years the market has been devouring ‘the commons’ in two ways. First, it takes valuable stuff from the commons and privatizes it. This is called ‘enclosure.’ Second, it dumps bad stuff into the commons and says, ‘It’s not our problem.’ This is called ‘externalizing.’” (Peter Barnes, *Who Owns the Sky?*, quoted in *Adbusters* 55). I think external costs should be internalized. The cost of doing what business does, the full cost—including repair to the environment they damage—should be reflected in the prices charged for the product or service in question. That way, those who benefit,

pay. And pollution costs are no longer borne by those who receive no benefit, those outside the process. If we had such full-cost accounting, the world would be a different place. For example, organic food, without pesticides and other chemical additives, would cost half what non-organic food costs. So guess what food people would start buying?

3. You can't argue for humane treatment of animals used in experiments and for using animals for medical experiments (but not for cosmetic research). Since the potential medical benefits are so much greater—more far-reaching, more long-term—than the pain caused to a few individual animals, I can't see how you can opt for the former at the expense of the latter. We must continue to condone the use of animals, humans included, in medical experiments.
4. If the consequences of treatment affect people other than the patient, then people other than the patient should have a say in whether the treatment is accepted or not. Since treatment generally costs money which is often not completely provided by the individual patient in question (and in almost every case, treatment is to some extent paid for by the state, which often means that if treatment is provided for this patient, another patient may be denied treatment), and since the future well-being of the patient, whether that refers to future care needs or to the patient's death, certainly affect others in the patient's life, it is certainly the case that the consequences of treatment *do* affect people other than the patient. Therefore, when a physician is seeking consent for treatment, the consent of people other than the patient should also be sought.
5. Groups like the FRC use the term "Christian" in a reckless manner. They seem to imply that there is a universal collection of Christian teachings with which most Americans agree. There isn't. If that were the case, we would not have hundreds of distinct Christian denominations operating in the country today. Christian denominations disagree on how the Bible is to be interpreted; on the relationship of Jesus to God; on whether salvation is obtained through good acts, faith alone, or a combination of both; on whether worship and communion with those of other beliefs is acceptable; on the question of salvation outside the faith; and many other doctrinal issues. These are not minor differences that can cavalierly be papered over. They mean something to people.  
(Robert Boston, *Close Encounters with the Religious Right*, 2000)
6. The use of contraception indicates that one thinks it's okay to deliberately choose whether to have a child. So why isn't it okay to deliberately choose what attributes it has, or at least to choose that it does not have any debilities? We have a choice. We can either use genetic engineering to determine our children's attributes or we can refuse to use it and play roulette with their

lives. Genetic engineering is nothing more than utilizing our knowledge for good, for who wouldn't say it's incredibly cruel to deliberately, knowingly, bring into the world a child that has a disease that will cause it to experience excruciating pain and severe incapacities? How is that different from deliberately torturing it once it's born?

7. I have been giving this a lot of thought. If I continue my studies at the School of Ballet, I can have a career in ballet. The instructors there say I have the potential. And if I enroll in the college's dance program, I can have a career in jazz. I passed the audition last week. And I've just checked out my bank account. I can afford at least one of them. Especially if I continue to teach classes at the studio after my own classes and on the weekends. So it looks like I can afford to have a career in ballet or one in jazz.
8. Either patriotism is morally right or it's morally wrong. Let's assume it's morally right. But if patriotism is morally right, then that implies that it's right to give more consideration to some people's interests (those who happen to live in your country) than to other people's interests. But that's unequal treatment—and that can't be right. So it's morally wrong to be patriotic.
9. I think we should bring back the possibility of failing in school. Starting from grade one. If kids knew they wouldn't be allowed into the next grade until they had achieved some basic level of competency in the previous grade, they'd come to realize that just "being there" isn't enough. And then it would occur to them that they actually have to *work at* learning stuff; it's not all fun. There'd be a lot of less fooling around—partly because they'd be paying attention and trying to learn and partly because they would, therefore, *be* learning and wouldn't have to clown around trying to cover up their ignorance. Teachers could be teachers instead of parents and police. The conclusion of my argument is that if kids actually work at what they're supposed to be learning, they won't fail.
10. Most people are hired for reasons that have nothing to do with merit: they knew someone who got them an interview, they attended the right schools, they were from the right part of the country, they were members of the right class, the right nationality, the right fraternity, or they just got lucky—they were in the right place at the right time. Of course they had to be adequate as well, but they didn't have to be the best; it would take too long to winnow out the best and, since adequate will do, why bother? Given that, it seems indefensible to object to affirmative action because it bypasses merit as a criterion.

## Review of terms

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Define the following terms:

- conjunction
- disjunction
- negation
- conditional
- affirming the antecedent (modus ponens)
- affirming the consequent
- denying the consequent (modus tollens)
- denying the antecedent
- reductio ad absurdum
- chain argument
- disjunctive syllogism
- conjunctive syllogism
- constructive dilemma
- destructive dilemma

## Thinking critically about what you see

Think critically about each of these photographs. Propositional logic will help you.

1.



2.



## Thinking critically about what you hear

Do Only Fools Pay for Online Dating Sites?

<http://www.youtube.com/watch?v=AjFU5o6GUHQ>

## Thinking critically about what you read

Think critically about each of the following, paying special attention to deductive validity.

If you can express the argument as a syllogism, you'll be completing steps one and two of the template (which is provided on page 49). Always keep step three in mind.

Whether the argument is valid or invalid (step four), consider steps five, six, and seven.

1. When a country has an army, this army will continuously seek means to justify its existence and to intervene at the first opportunity. The USA has an army. So no wonder a military response is always the first response to any sort of problem.
  
2. When the arts and sciences flourish in a civilization, that means that the civilization must be producing a surplus—they must have extra time and resources available for such activities. In the Mayan culture, the arts and sciences did indeed flourish. So the Mayans must have been producing more than enough food, shelter, and other basic goods.
  
3. Surely an absence of employment can make crime an attractive option, and so enhanced job opportunities ought to make it less so.
 

. . . One would think that limited job options would mean more to a man approaching 30 than to a teenager. But conviction rates for men between 25 and 30 are about one-third the rates for boys between 14 and 16. Similarly, a man with a family faces more urgent economic imperatives than a single man, and yet his inclination to crime is far less. It is noteworthy that women, despite various economic barriers, are invariably less prone to crime than men."

(David Rubinstein, "Don't Blame Crime on Joblessness,  
*The Wall Street Journal*, November 9, 1992)
  
4. The Arabs must struggle for a national truth; they cannot achieve true liberty without nationalism and the struggle towards Arab unity.
 

(Saddam Hussein in interview with Fuad Matar 1980, reported in  
*The Saddam Hussein Reader: Selections from Leading Writers on Iraq*, 2002)
  
5. Jeffry House's strategy is bold: He is challenging the very legality of the Iraq war, based on the Nuremberg principles. Those principles, adopted by a U.N. commission after World War II in response to the Nazis' crimes, hold that military personnel have a responsibility to resist unlawful orders. They also declare wars of aggression a violation of international law.
 

(David Goodman, "Breaking Ranks," *Mother Jones*, October 11, 2004)
  
6. It might at this point be worthwhile asking . . . whether . . . Gargiulo's pictures of the revolt [painted circa 1656] may have been originally commissioned by another collector

and then acquired by Piscicelli on the secondary market sometime prior to 1690. We can be reasonably certain that this was not the case, however, since the inventory establishes that Gargiulo's pictures of the revolt occupied a central place in Piscicelli's collection, which contains an unusually consistent and chronologically focused group of paintings by artists active in the 1640s and 1650s. Conspicuously absent from the collection are works by artists active during the 1660s through the 1680s, whose presence we would expect were the collection still being assembled at this date.

(Christopher Marshall, "'Causa Di Stravaganze': Order and Anarchy in Domenico Gargiulo's Revolt of Masaniello," *Art Bulletin*, 80.3, September 1998)

7. Miracles mean God has changed his own laws, and that would mean his laws had been mistaken, and that would mean he's not really God. So there aren't any miracles.
8. Salt and sugar increase the tastiness of food. So if salt and sugar is put in baby food, babies will prefer it, and so parents will buy it. But babies don't develop taste buds until they're five or six months old. And they eat baby food before then.
9. Either there is a God or there is not a God. Let's assume there is a God. If you believe in Him, you will be rewarded with eternal bliss in heaven, but if you don't believe in God, you suffer in Hell forever. Now let's assume there isn't a God. If you believe in Him nevertheless, you will have lost the earthly pleasures you may have chosen to forego because of that belief, and if you don't believe in Him, well it's of no consequence. What is losing some earthly pleasures against the fires of Hell? Don't you see? It makes more sense to believe in God! What have you got to lose? (a paraphrase of "Pascal's Wager")
10. Suppose a brave officer to have been flogged when a boy at school, for robbing an orchard, to have taken a flag from the enemy in his first campaign, and to have been made a general in advanced life: suppose also, which must be admitted to be possible, that, when he took the standard, he was conscious of his having been flogged at school, and that when made a general he was conscious of his taking the standard, but had absolutely lost the consciousness of his flogging. If it is true that, as Locke says, our personal identity depends on our consciousness or memory of our thoughts and actions and can be extended backwards only as far as that consciousness or memory goes, then the officer is the same person as the boy, and the general is the same person as the officer, but the general is *not* the same person as the boy. And yet logic indicates that the general *is* the same person as the boy (if  $A = B$  and  $B = C$ , then  $A = C$ ).

(Based on Thomas Reid, *Essays on the Intellectual Powers of Man*, 1785. As edited by A.D. Woozley, 1941)



## Template for critical analysis of arguments

1. What's the point (claim/opinion/conclusion)?
  - Look for subconclusions as well.
2. What are the reasons/what is the evidence?
  - Articulate all unstated premises.
  - Articulate connections.
3. What exactly is meant by . . . ?
  - Define terms.
  - Clarify all imprecise language.
  - Eliminate or replace “loaded” language and other manipulations.
4. Assess the reasoning/evidence:
  - **If deductive, check for truth/acceptability and validity.**
  - If inductive, check for truth/acceptability, relevance, and sufficiency.
5. How could the argument be strengthened?
  - Provide additional reasons/evidence.
  - Anticipate objections—are there adequate responses?
6. How could the argument be weakened?
  - Consider and assess counterexamples, counterevidence, and counterarguments.
  - Should the argument be modified or rejected because of the counterarguments?
7. If you suspend judgment (rather than accepting or rejecting the argument), identify further information required.

## Thinking critically about what you write

See your instructor for instructions.

## Thinking critically when you discuss

See your instructor for instructions.

## Reasoning test questions

1. Carl's Coffee Emporium stocks only two decaffeinated coffees: French Roast and Mocha Java. Yusef only serves decaffeinated coffee, and the coffee he served after dinner last night was far too smooth and mellow to have been French Roast. So, if Yusef still gets all his coffee from Carl's, what he served last night was Mocha Java.

The argument above is most similar in its logical structure to which one of the following?

- (A) Samuel wants to take three friends to the beach. His mother owns both a sedan and a convertible. The convertible holds four people so, although the sedan has a more powerful engine, if Samuel borrows a vehicle from his mother, he will borrow the convertible.
- (B) If Anna wants to walk from her house to the office where she works, she must either go through the park or take the overpass across the railroad tracks. The park paths are muddy, and Anna does not like using the overpass, so she never walks to work.
- (C) Rose can either take a two-week vacation in July or wait until October and take a three-week vacation. The trail she had planned to hike requires three weeks to complete but is closed by October, so if Rose takes a vacation, it will not be the one she had planned.
- (D) Werdix, Inc. has offered Arno a choice between a job in sales and a job in research. Arno would like to work at Werdix but he would never take a job in sales when another job is available, so if he accepts one of these jobs, it will be the one in research.
- (E) If Teresa does not fire her assistant, her staff will rebel and her department's efficiency will decline. Losing her assistant would also reduce its efficiency, so, if no alternative solution can be found, Teresa's department will become less efficient.

*(The Official LSAT PrepTest XXIV, Section 2, #13)*

2. Allowing more steel imports would depress domestic steel prices and harm domestic steel manufacturers. Since the present government will not do anything that would harm the domestic steel industry, it will not lift restrictions on steel imports.

The pattern of reasoning in the argument above is most similar to that in which one of the following?

- (A) Building construction increases only when people are confident that the economy is doing well. Therefore, since people are now confident in the economy we can expect building construction to increase.
- (B) Since workers are already guaranteed the right to a safe and healthful workplace by law, there is no need for the government to establish further costly health regulations for people who work all day at computer terminals.
- (C) In countries that have deregulated their airline industry, many airlines have gone bankrupt. Since many companies in other transportation industries are in weaker economic condition than were those airlines, deregulating other transportation industries will probably result in bankruptcies as well.
- (D) The chief executive officer of Silicon, Inc., will probably not accept stock in the company as a bonus next year, since next year's tax laws will require companies to pay a new tax on stock given to executives.
- (E) The installation of bright floodlights on campus would render the astronomy department's telescope useless. The astronomy department will not support any proposal that would render its telescope useless; it will therefore not support proposals to install bright floodlights on campus.

*(The Official LSAT Prep Test XXII, Section 2, #16)*

3. Several carefully conducted studies showed that 75 percent of strict vegetarians reached age 50 without developing serious heart disease. We can conclude from this that avoiding meat increases one's chances of avoiding serious heart disease. Therefore, people who want to reduce the risk of serious heart disease should not eat meat.

The flawed pattern of reasoning exhibited by which one of the following is most similar to that exhibited by the argument above?

- (A) The majority of people who regularly drive over the speed limit will become involved in traffic accidents. To avoid harm to people who do not drive over the speed limit, we should hire more police officers to enforce the speed laws.
- (B) Studies have shown that cigarette smokers have a greater chance of incurring heart disease than people who do not smoke. Since cigarette smoking increases

one's chances of incurring heart disease, people who want to try to avoid heart disease should give up cigarette smoking.

- (C) The majority of people who regularly drink coffee experience dental problems in the latter part of their lives. Since there is this correlation between drinking coffee and incurring dental problems, the government should make coffee less accessible to the general public.
- (D) Studies show that people who do not exercise regularly have a shorter life expectancy than those who exercise regularly. To help increase their patients' life expectancy, doctors should recommend regular exercise to their patients.
- (E) Most people who exercise regularly are able to handle stress. This shows that exercising regularly decreases one's chances of being overwhelmed by stress. So people who want to be able to handle stress should regularly engage in exercise.

*(The Official LSAT PrepTest XII, Section 2, #23)*

4. If a mechanical aerator is installed in a fish pool, the water in the pool can be properly aerated. So, since John's fish pool does not have a mechanical aerator, it must be that his pool is not properly aerated. Without properly aerated water, fish cannot thrive. Therefore, any fish in John's fish pool will not thrive.

Which one of the following arguments contains an error of reasoning that is also contained in the argument above?

- (A) If alum is added to pickle brine, brine can replace the water in the pickles. Therefore, since Paula does not add alum to her pickle brine, the water in the pickles cannot be replaced by brine. Unless their water is replaced with brine, pickles will not stay crisp. Thus, Paula's pickles will not stay crisp.
- (B) If pectin is added to jam, the jam will gel. Without a setting agent such as pectin, jam will not gel. So in order to make his jam gel, Harry should add a setting agent such as pectin to the jam.
- (C) If stored potatoes are not exposed to ethylene, the potatoes will not sprout. Beets do not release ethylene. Therefore, if Sara stores her potatoes together with beets, the potatoes will not sprout.
- (D) If a carrot patch is covered with mulch in the fall, the carrots can be left in the ground until spring. Without a mulch cover, carrots stored in the ground can suffer frost damage. Thus, since Kevin covers his carrot patch with mulch in the fall, the carrots can safely be left in the ground.

- (E) If tomatoes are not stored in a dark place, their seeds sometimes sprout. Sprouted seeds can make tomatoes inedible. Therefore, since Maria does not store her tomatoes in a dark place, some of Maria's tomatoes could be inedible.

*(The Official LSAT PrepTest XXI, Section 2, #21)*

5. To classify a work of art as truly great, it is necessary that the work has both originality and far-reaching influence upon the artistic community.

The principle above, if valid, most strongly supports which one of the following arguments?

- (A) By breaking down traditional schemes of representation, Picasso redefined painting. It is this extreme originality that warrants his work being considered truly great.
- (B) Some of the most original art being produced today is found in isolated communities, but because of this isolation these works have only minor influence, and hence cannot be considered truly great.
- (C) Certain examples of the drumming practiced in parts of Africa's west coast employ a musical vocabulary that resists representation by Western notational schemes. This tremendous originality, coupled with the profound impact these pieces are having on musicians everywhere, is enough to consider these works to be truly great.
- (D) The piece of art in the lobby is clearly not classified as truly great, so it follows that it fails to be original.
- (E) Since Bach's music is truly great, it not only has both originality and a major influence on musicians, it has broad popular appeal as well.

*(The Official LSAT PrepTest XXII, Section 2, #18)*