

1.2

Forms and Validity

Deductive logic is the study of methods for determining whether or not an argument is valid. This section introduces the concept of an argument form and explains how an understanding of argument forms can help establish the validity of an argument.

Argument Forms

Consider the following two arguments:

- 31.** 1. If Pepé is a Chihuahua, then Pepé is a dog.
2. Pepé is a Chihuahua.
So, 3. Pepé is a dog.

32. 1. If Clinton is a U.S. president, then Clinton is a U.S. citizen.
 2. Clinton is a U.S. president.
 So, 3. Clinton is a U.S. citizen.

In each case, lines 1 and 2 are the premises and line 3 is the conclusion. Both of these arguments are valid: It is necessary that, if the premises are true, then the conclusion is true. Moreover, both of these arguments have the same *argument form*, where an **argument form** is simply a pattern of reasoning.

An **argument form** is a pattern of reasoning.

The particular form of reasoning exhibited by arguments (31) and (32) is so common that logicians have given it a special name: ***modus ponens***, which means “the mode or way of positing.” (Notice that, in each of them, the second premise posits or affirms the if-part of the first premise.) This pattern of reasoning can be represented as follows:

Modus Ponens

1. If A, then B.
 2. A.
 So, 3. B.

Here, the letters A and B are **variables** that stand in for statements. To illustrate how these variables work, suppose that we erase each appearance of A in the form above and write the same statement in both blanks (any statement will do). Next, suppose that we erase each appearance of B and write down the same statement in both blanks. We will then have a *substitution instance* of the argument form *modus ponens*. For example, if we replace each appearance of A with the statement “Pepé is a Chihuahua” and we replace each appearance of B with the statement “Pepé is a dog,” we arrive at (31). Similarly, if we substitute “Clinton is a U.S. president” for A and “Clinton is a U.S. citizen” for B, we are left with (32). Thus, both arguments are substitution instances of the argument form *modus ponens*. Generalizing, we can say that a **substitution instance** of an argument form is an argument that results from uniformly replacing the variables in that form with statements (or terms).*

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*The reader should ignore the parenthetical comment at this point. We will discuss forms that result from replacing terms, rather than statements, in section 1.3.

We will look at further examples of argument forms and substitution instances in a moment. But let's first use the concepts to understand how an argument's validity can be entirely due to its form.

Consider the following argument:

- 33.** 1. If A.J. Ayer is an emotivist, then A.J. Ayer is a noncognitivist.
 2. A.J. Ayer is an emotivist.
 So, 3. A.J. Ayer is a noncognitivist.

Argument (33), like (31) and (32), is an instance of *modus ponens* (it results from replacing A with "A.J. Ayer is an emotivist" and B with "A.J. Ayer is a noncognitivist"). Moreover, (33), like (31) and (32), is a valid argument. This much should be clear, even if some of the words in (33) are unfamiliar and even if one has no idea who A.J. Ayer is. Suppose it's true that A.J. Ayer is an emotivist (whatever that is). And suppose it's also true that, if A.J. Ayer is an emotivist, then he is a noncognitivist (whatever that is). Given those assumptions, it must follow that A.J. Ayer is a noncognitivist as well. That is just to say that it is impossible for the premises of (33) to be true while the conclusion is false. So it is valid.

Arguments (31), (32), and (33) illustrate the fact that the validity of an argument that has the form of *modus ponens* is guaranteed by that form alone; its validity does not depend on its subject matter (or content). Hence, every substitution instance of *modus ponens* will be a valid argument no matter what its content happens to be. In this sense, *modus ponens* is a *valid argument form*. More generally, we can say that a **valid argument form** is an argument form in which every substitution instance is a valid argument.



A **valid argument form** is one in which every substitution instance is a valid argument.

(Note that this is a definition of a *valid argument form*, which should not be confused with the definition of a *valid argument* from section 1.1.) The crucial point is this: It is no coincidence that all of the arguments we have looked at so far in section 1.2 are valid. They are valid because each of them is an instance of a valid argument form, namely *modus ponens*. In this sense, each of the arguments we have looked at is a *formally valid argument*, where a **formally valid argument** is one that is valid in virtue of its form.



A **formally valid argument** is one that is valid in virtue of its form.

While most valid arguments in ordinary life are formally valid, not every valid argument is formally valid. That is, some arguments are valid, but they are not valid in virtue of their form. For example, consider the following argument:

34. All philosophers are nerds. So, no squares are circles.

The conclusion of this argument is an example of what philosophers call a “necessary truth,” because it *must* be true, that is, it is impossible for anything to be both a square and a circle at once. But if it is impossible for the conclusion to be false, then it is also impossible for the premise to be true while the conclusion is false. That is to say, it is impossible for all philosophers to be nerds while some squares are circles. Argument (34) is, therefore, valid. Its validity, however, has nothing to do with its form and everything to do with the content of its conclusion. Although (34) is unusual, it highlights the fact that an argument can be valid without being formally valid.

Even though an argument can be valid without being formally valid, the crucial point to grasp is that *if an argument is a substitution instance of a valid form, then the argument is valid*. Thus, if we determine an argument’s form and tell that the form is valid, we can establish that the argument is valid.

In the remainder of section 1.2, we will begin the task of learning to recognize argument forms, which we will continue in later chapters. For now, we will present five “famous” valid forms and then use them to provide an initial method for determining the validity of arguments. But before we get started, we must pause to make an important observation. If-then statements play an important role in many of the arguments and argument forms we will be looking at in this chapter and beyond. Consequently, it is worthwhile to discuss them in some detail before going on.

Famous Valid Forms

We have already been introduced to the first of our famous valid forms, *modus ponens*. We must now meet its sibling, *modus tollens*. Consider the following pair of arguments:

- 41.** 1. If it is raining, then the ground is wet.
2. The ground is not wet.
So, 3. It is not raining.

- 42.** 1. If there is fire in the room, then there is air in the room.
2. There is no air in the room.
So, 3. There is no fire in the room.

In each case, lines 1 and 2 are the premises and line 3 is the conclusion. Both arguments are clearly valid: It is necessary that, if the premises are true, the conclusion is true also. Moreover, each argument is formally valid: It is valid because it is an instance of the argument form *modus tollens*, which means “the mode or way of removing.” (Notice that, in arguments (41) and (42), the second premise removes or denies the truth of the consequent of the first premise.) We can represent **modus tollens** as follows:

Modus Tollens

1. If A, then B.
2. Not B.
So, 3. Not A.

No matter what A and B are, the result will be a valid argument.

Modus tollens is related to *modus ponens*. They both have a premise that is a conditional statement. The key difference lies in the negative nature of the last two lines. “Not A” and “Not B” stand for *negations*. The **negation** of a statement is its denial. For example, in (41), “The ground is not wet” plays the role of Not B and “It is not raining” plays the role of Not A, while in (42), “There is no air in the room” plays the role of Not B and “There is no fire in the room” plays the role of Not A. The negation of a statement can be formed in various ways. For example, each of the following is a negation of the statement “The ground is wet”:

- a. *It is not the case that* the ground is wet.
- b. *It’s false that* the ground is wet.
- c. *It is not true that* the ground is wet.
- d. The ground is *not* wet.

Three general points can be illustrated with *modus ponens* and *modus tollens*. First, whether an argument is an instance of an argument form is not affected by the order of the premises. For example, both of the following count as *modus tollens*:

43. If Shakespeare was a physicist, then he was a scientist. Shakespeare was not a scientist. So, Shakespeare was not a physicist.
44. Shakespeare was not a scientist. If Shakespeare was a physicist, then he was a scientist. So, Shakespeare was not a physicist.

In other words, arguments of the form *Not A; if A, then B; so, Not B* count as examples of *modus tollens*. Similarly, arguments of the form *A; if A, then B; so B* count as examples of *modus ponens*. In the remainder of this chapter, keep in mind that the general point here—that the order of the premises does not matter—applies to all of the argument forms that we will discuss.

Second, the conditionals involved in an argument can be rather long and complex. For example:

45. If every right can be waived in the interests of those who have those rights, then euthanasia is permitted in those cases in which the person to be “euthanized” waives his or her right to life. Moreover, every right can be waived in the interests of those who have those rights. Hence, euthanasia is permitted in those cases in which the person to be “euthanized” waives his or her right to life.

The conditional premise in this argument is relatively long and complex, but the form is still *modus ponens*. “Every right can be waived in the interests of those who have those rights” replaces A; “euthanasia is permitted in those cases in which the person to be euthanized waives his or her right to life” replaces B.

Third, putting an argument into explicit form helps to focus attention on the key issues. For example, according to some physicists who endorse the Big Bang theory, the universe cannot be infinitely old. The second law of thermodynamics tells us that in a closed physical system entropy always tends to increase; that is, energy gets diffused over time. (For instance, the radiant energy of a star will gradually become spread out evenly into the space surrounding it.) According to these physicists, if the physical universe has existed for an infinite period, there are now no concentrations of energy (e.g., no stars or planets). But obviously, there are stars and planets, so the physical universe has not existed for an infinite period. We can put this reasoning explicitly into the *modus tollens* form as follows:

46. 1. If the physical universe has existed for an infinite period, then all the energy in the universe is spread out evenly (as opposed to being concentrated in such bodies as planets and stars).
2. It is not true that all the energy in the universe is spread out evenly (as opposed to being concentrated in such bodies as planets and stars).
- So, 3. It is not true that the physical universe has existed for an infinite period.

By putting the argument into explicit form, we are better able to focus our attention on the key issue. There is no debate whatsoever about the second premise of this argument. Stars and planets exist, so energy is not in fact spread out evenly throughout the physical universe. Nor is there any debate about the validity of the argument. Every argument having the form *modus tollens* is valid. The focus of the debate, therefore, must be on the first premise, and that is just where physicists have placed it. For example, some physicists think that the universe oscillates, that is, goes through a cycle of “Big Bangs” and “Big Crunches.” And if the universe can oscillate, then its diffuse energy can be reconcentrated into usable forms, in which case the first premise is doubtful.⁴

Our third famous valid form is *hypothetical syllogism*. Consider the following argument:

47. 1. If tuition continues to increase, then only the wealthy will be able to afford a college education.
2. If only the wealthy will be able to afford a college education, then class divisions will be strengthened.
- So, 3. If tuition continues to increase, then class divisions will be strengthened.

This is an instance of **hypothetical syllogism**, which we can represent as follows:

Hypothetical Syllogism

1. If A, then B.
2. If B, then C.
- So, 3. If A, then C.

The argument form is called *hypothetical syllogism* because it involves only hypothetical (i.e., conditional) statements. *Syllogism* comes from the Greek roots meaning “to reason together” or to put statements together into a pattern of reasoning. Every argument that exemplifies this form is valid. For example:

48. If I am morally responsible, then I can choose between good and evil. If I can choose between good and evil, then some of my actions are free. Therefore, if I am morally responsible, then some of my actions are free.

Note that the conclusion of a hypothetical syllogism is a conditional statement.

Thus far in this section, we have focused on argument forms that involve conditional statements. Not all argument forms are like this. Some use **disjunctions**, that is, statements of the form *Either A or B*, whose parts are called “**disjuncts**.” (For example, the disjuncts of “Either the Second Temple of Jerusalem was destroyed in 70 CE or my memory is failing me” are “the Second Temple of Jerusalem was destroyed in 70 CE” and “my memory is failing me.”) Now consider this pair of arguments:

49. 1. Either Pablo Picasso painted *Woman with a Guitar* or Georges Braque painted it.
2. Pablo Picasso did not paint *Woman with a Guitar*.
So, 3. Georges Braque painted *Woman with a Guitar*.
50. 1. Either experimentation on live animals should be banned or experimentation on humans should be permitted (e.g., the terminally ill).
2. Experimentation on humans should not be permitted.
So, 3. Experimentation on live animals should be banned.

Each of these arguments is valid. Each affirms a disjunction, denies one of the disjuncts, and then concludes that the remaining disjunct is true. They are each an instance of **disjunctive syllogism**, which comes in two versions:

Disjunctive Syllogism (in two versions)

- | | |
|-------------------|-------------------|
| 1. Either A or B. | 1. Either A or B. |
| 2. Not A. | 2. Not B. |
| So, 3. B | So, 3. A. |

Argument (49) is an instance of the first version; argument (50) is an instance of the second. All arguments of either version of disjunctive syllogism are valid.

Some brief remarks about disjunctions are in order here. First, we will take statements of the form *Either A or B* to mean *Either A or B (or both)*. This is called the **inclusive** sense of “or.” For instance, suppose a job announcement

reads: “Either applicants must have work experience or they must have a bachelor’s degree in the field.” Obviously, an applicant with *both* work experience *and* a bachelor’s degree is not excluded from applying.

Second, some authors speak of an **exclusive** sense of “or,” claiming that statements of the form *Either A or B* sometimes mean *Either A or B (but not both)*. For example, in commenting on a presidential election, one might say, “Either Smith will win the election or Jones will win,” the assumption being that not both will win. However, it is a matter of controversy whether there really are two different meanings of the word “or” *as opposed to* there simply being cases in which the context indicates that A and B are not both true. Rather than let this controversy sidetrack us, let us simply assume with most logicians that statements of the form *Either A or B* mean *Either A or B (or both)*.

Third, having made this assumption, however, we must immediately add that arguers are free to use statements of the form *Either A or B (but not both)*. This is equivalent to the combination of two statements: *Either A or B, and not both A and B*. Consider the following argument:

51. Either Millard Fillmore was the 13th president of the United States, or Zachary Taylor was the 13th president of the United States (but not both).
Millard Fillmore was the 13th president. So, Zachary Taylor was not the 13th president.

We can represent the form of this argument as *Either A or B; not both A and B; A; so, not B*. This form is valid, but notice that it differs from disjunctive syllogism.

Fourth, note that disjunctive syllogism differs from the following form of argument:

52. Either Hitler was a Nazi, or Himmler was a Nazi. Hitler was a Nazi.
Therefore, it is not the case that Himmler was a Nazi.

The form of this argument can be best represented as *Either A or B; A; therefore, not B*. As a matter of historical fact, the premises of (52) are true, but its conclusion is false; therefore, this argument form is invalid, unlike disjunctive syllogism.

Let’s look at one more famous valid argument form: **constructive dilemma**. It combines both conditional and disjunctive statements. Here is an example:

53. 1. Either Donna knew the information on her tax returns was inaccurate, or her tax preparer made a mistake.
2. If Donna knew the information was inaccurate, she should pay the fine.
3. If her tax preparer made a mistake, then he should pay the fine.
So, 4. Either Donna should pay the fine or her tax preparer should pay the fine.

The form of this argument is as follows:

Constructive Dilemma

1. Either A or B.
 2. If A, then C.
 3. If B, then D.
- So, 4. Either C or D.

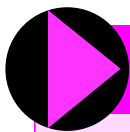
Arguments of this form are always valid. The age-old problem of evil can be put in the form of a constructive dilemma:

- 54.** Either God cannot prevent some suffering or God does not want to prevent any of it. If God cannot prevent some suffering, then God is weak. If God does not want to prevent any suffering, then God is not good. So, either God is weak or God is not good.

This dilemma nicely illustrates how logic can be used to formulate a problem in a revealing way. Because argument (54) is valid, it is not possible for all of the premises to be true and the conclusion false. Theists, against whom the argument is directed, can hardly deny the first (disjunctive) premise. (If God can prevent some suffering, then God must not want to do so for some reason.) And the second premise seems undeniable. (After all, even we can prevent some suffering.) Historically, the third premise has been the focus of debate, with theists suggesting that God does not want to eliminate any suffering because permitting it is the necessary means to certain good ends (e.g., the personal growth of free creatures).

The Famous Forms Method

At this point, we have introduced five famous valid argument forms, which are summarized in the following table:



Summary of Famous Valid Forms

Modus ponens: If A, then B. A. So, B.

Modus tollens: If A, then B. Not B. So, Not A.

Hypothetical syllogism: If A, then B. If B, then C. So, if A, then C.

Disjunctive syllogism (in two versions): Either A or B. Not A. So, B.
Either A or B. Not B. So, A.

Constructive dilemma: Either A or B. If A, then C. If B, then D. So, either C or D.

We can now use these forms to determine the validity of many arguments, by employing the following method. Here's how.

Consider the following argument:

55. Tom is old *only if* he is over eighty. But Tom is not over eighty, and so he is not old.

First, we identify the component statements in the argument, uniformly labeling them with capital letters as we have throughout this section. To avoid errors, write the capital letter by each instance of the statement it stands for, taking negations into account, like this:

55. Tom is old *only if* he is over 80. But Tom is not over 80, and so he is not old.

Second, we rewrite the argument using capital letters instead of English statements and eliminate any stylistic variants (in this case, we replace “only if” with the standard “if . . . , then . . . ” construction). The result is this:

1. If A, then B.
 2. Not B.
- So, 3. Not A.

Third, we check to see whether the form is taken from our list of famous valid forms. In this case, it is *modus tollens*, so we conclude that argument (55) is valid.

Let’s call the method just indicated the **famous forms method**. Here it is in action again. Consider the following argument:

56. If Ty knows he has a book in front of him, then he knows he is outside the Matrix. Ty knows he has a book in front of him. So, Ty knows he is outside the Matrix.

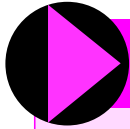
First, we identify and label the component statements in the argument, uniformly labeling them as follows:

56. If Ty knows he has a book in front of him, then he knows he’s outside the Matrix. Ty knows he has a book in front of him. So, Ty knows he’s outside the Matrix.

Next, we rewrite the argument using capital letters instead of English statements and eliminate any stylistic variants, arriving at this form:

1. If A, then B.
 2. A.
- So, 3. B.

Finally, we ask whether this form is one of our famous valid forms. In this case, it is *modus ponens*. Thus, argument (56) is valid.



The Famous Forms Method

Step 1. Identify the component statements in the argument, uniformly labeling each with a capital letter.

Step 2. Rewrite the argument using capital letters instead of English statements and eliminate any stylistic variants.

Step 3. Check to see whether the pattern of reasoning is taken from our list of famous forms. If it is, then the argument is valid.

It will be helpful at this time to highlight a complication of the famous forms method. It can be seen by considering the following argument:

57. Frances is a fast runner ^A if she can run the mile in under four minutes. ^B Frances can run the mile in under four minutes. Therefore, Frances is a fast runner.
- ^B ^A

When we rewrite the argument using capital letters and eliminate stylistic variants, we get this form:

1. If B, then A.
 2. B.
- So, 3. A.

Our labeling results in *If B, then A* rather than *If A, then B*. But this is not a problem. There is no need to try to make the letters appear in alphabetical order. The important thing is that the second premise affirms the antecedent of the conditional premise, while the conclusion affirms the consequent. Thus, we have an instance of *modus ponens*, and the argument is valid.

It is now time to acknowledge two limitations of the famous forms method. The first one can be seen through arguments like this:

58. Fred likes neckerchiefs. Daphne likes neckerchiefs. So, Fred likes neckerchiefs and Daphne likes neckerchiefs.

Even though this argument is trivial, it is formally valid. It is an instance of this valid argument form:

Form 1

1. A.
 2. B.
- So, 3. A and B.

It is not possible for the conclusion, A and B, to be false while the premises, A and B, are true. The problem is that this valid form is not a famous form from our list, so

the famous forms method does not tell us that (58) is valid. Similarly, in our discussion of these disjunctions, we noted that the form of argument (51) was this:

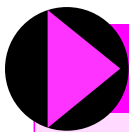
Form 2

1. Either A or B.
 2. Not both A and B.
 3. A.
- So, 3. Not B.

Form 2 is valid, but it is not on our list. This is a genuine limitation of the famous forms method. Although it is true that *many* valid arguments are instances of our five famous valid forms, there are also many other formally valid arguments, like arguments (51) and (61), that are not. Hence, the fact that the famous forms method does not show that an argument is formally valid does not mean that it is not formally valid. Of course, we could deal with this problem by adding Forms 1 and 2 to our list. While this solution contains a grain of wisdom (in essence, the proof systems we develop later are built on this insight), we would have to add infinitely many forms to cover all the possible valid forms, a daunting task indeed.

A second limitation of the famous forms method is that it does *nothing* to help us show that any invalid argument is invalid. It is concerned only with showing the validity of arguments.

If the famous forms method suffers from these limitations, why bother learning it? Well, despite its limitations, we should not lose sight of the fact that the famous forms method is simple, straightforward, and all that is needed in many cases. Moreover, understanding it and its limitations constitutes an



Summary of Definitions

An **argument form** is a pattern of reasoning.

A **substitution instance** of an argument form is an argument that results from uniformly replacing the variables in that form with statements (or terms).

A **valid argument form** is one in which every substitution instance is a valid argument.

A **formally valid argument** is one that is valid in virtue of its form.

The **negation** of a statement is its denial.

A **conditional statement** is an if-then statement, often simply called a “conditional.”

The if-clause of a conditional is its **antecedent**.

The then-clause of a conditional is its **consequent**.

A **disjunction** is an either-or statement.

The statements comprising a disjunction are its **disjuncts**.

important first step toward grasping some basic logical concepts and appreciating more complete methods for assessing arguments.

The following exercise gives you an opportunity to use your knowledge of the famous valid forms to assess the validity of arguments.

EXERCISE 1.2

PART A: True or False? Which of the following statements are true? Which are false?

- * 1. A substitution instance of an argument form is an argument that results from uniformly replacing the variables in that form with statements (or terms).
- 2. A conditional is an “if-then” statement.
- 3. The parts of a disjunction are disjuncts.
- * 4. In logic, we treat statements of the form “Either A or B” as saying the same thing as “Either A or B, but not both A and B.”
- 5. The if part of a conditional is the antecedent.
- 6. A valid argument form is one in which every substitution instance is a valid argument.
- * 7. The consequent of “If it was reported in the *Daily Prophet*, then it’s true” is “It was reported in the *Daily Prophet*.”
- 8. In logic, we treat statements of the form “Either A or B” as saying the same thing as “Either A or B, or both A and B.”
- 9. “Either Hermione gets Ron or she gets Harry” is a conditional.
- * 10. The inclusive sense of “or” means “Either A or B, or both.”
- 11. “Either Fritz is a philosopher or a gambler” is a disjunction.
- 12. An argument form is a pattern of reasoning.
- * 13. The then part of a conditional is the consequent.
- 14. If the successful candidate has a PhD in English literature or at least five years of university teaching experience, it follows that the successful candidate does not have both a PhD in English literature and at least five years of university teaching experience.
- 15. The antecedent of “If Professor Dumbledore died in Book Six, then he won’t make an appearance in Book Seven” is “Professor Dumbledore died in Book Six.”
- * 16. The negation of a statement is its denial.
- 17. A formally valid argument is one that is valid in virtue of its form.
- 18. The antecedent of “If Professor Snape was a disciple of Voldemort, then he should be imprisoned in Azkaban” is “He should be imprisoned in Azkaban.”

- * 19. The consequent of “If Dolores Umbridge despises Harry, then she’s a disciple of he-who-shall-not-be-named” is “She’s a disciple of he-who-shall-not-be-named.”
- 20. A disjunction is an “either-or” statement.
- 21. “There is no God” is the denial of “There is a God.”
- * 22. The exclusive sense of “or” means “Either A or B, but not both.”
- 23. In determining whether an argument is a substitution instance of an argument form, we must be careful to take the order of the premises into account.
- 24. The antecedent of “Either humans evolved from amoebas or humans were specially created by God” is “Humans evolved from amoebas.”
- * 25. The antecedent of “The Sonics will move to Oklahoma only if the league permits it” is “The Sonics will move to Oklahoma.”
- 26. The antecedent of “Bill will behave better in the future if Hillary forgives Bill” is “Bill will behave better in the future.”
- 27. The consequent of “There is air in the room if there is fire in the room” is “There is air in the room.”
- * 28. The following argument is a substitution instance of disjunctive syllogism: Jill is in love with Sam or Henry; she is in love with Henry; so Jill is not in love with Sam.
- 29. Although the famous forms method does not allow us to show that an argument is invalid, it does allow us to show the validity of every valid argument.
- 30. The consequent of “There is fire in the room *only if* there is air in the room” is “There is air in the room.”

PART B: Identify the Forms Identify the forms of the following arguments, using capital letters to stand for statements and eliminating any stylistic variants. If the argument form is one of the “famous” valid forms, give its name. If the argument form is not one of the “famous” valid forms, write “none.”

- * 1. If the solution turns blue litmus paper red, then the solution contains acid. The solution turns blue litmus paper red. So, the solution contains acid.
- 2. If the solution turns blue litmus paper red, then the solution contains acid. The solution does not contain acid. So, the solution does not turn blue litmus paper red.
- 3. Lewis is a famous author only if he knows how to write. But Lewis is not a famous author. Hence, Lewis does not know how to write.
- * 4. If Susan is a famous author, then she knows how to write. Moreover, Susan knows how to write. So, she is a famous author.
- 5. Souls transmigrate. But it is wrong to eat animals if souls transmigrate. Hence, it is wrong to eat animals.

6. Either Jones is an innocent bystander, or Jones fired a shot at the mayor. Jones is not an innocent bystander. Therefore, Jones fired a shot at the mayor.
- * 7. Rilke is a dreamer if he is a poet. Therefore, Rilke is a poet.
8. Either you marry young, or you wait. If you marry young, you incur a high risk of divorce. If you wait, the field of available partners grows ever smaller. So, either you incur a high risk of divorce, or the field of available partners grows ever smaller.
9. It is not wrong to kill spiders. But if spiders have eternal souls, then it is wrong to kill them. Thus, it is false that spiders have eternal souls.
- * 10. If you study hard, you refine your communication skills. If you refine your communication skills, then your job opportunities increase. Hence, if you study hard, your job opportunities increase.
11. If Mubarak is from Egypt, then he is from Africa. Therefore, if Mubarak is not from Egypt, then he is not from Africa.
12. Ben is a rat. Ben is a rat only if Ben is a mammal. So, Ben is a mammal.
- * 13. Sam is wealthy if he has more than a billion dollars. But Sam does not have more than a billion dollars. Therefore, Sam is not wealthy.
14. There is life on Mars given that there is life on Earth. Hence, there is life on Mars.
15. It is true that corrupt institutions are hard to reform. It is false that individuals are totally depraved. Therefore, if corrupt institutions are hard to reform, then individuals are totally depraved.

PART C: More Forms to Identify Identify the forms of the following arguments, using capital letters to stand for statements and eliminating any stylistic variants. If the argument form is one of the “famous” valid forms, give its name. If the argument form is not one of the “famous” valid forms, write “none.”

- * 1. The sky is blue. The sky is cobalt blue only if it is blue. Hence, the sky is cobalt blue.
2. Abortion in the case of ectopic pregnancy is not wrong. But if it is always wrong to kill an innocent human being, then abortion in the case of ectopic pregnancy is wrong. So, it is not always wrong to kill an innocent human.
3. Kidnapping is wrong if society disapproves of it. Kidnapping is wrong. So, society disapproves of kidnapping.
- * 4. Eating meat is unhealthy if meat contains a lot of cholesterol. Meat does contain a lot of cholesterol. Therefore, eating meat is unhealthy.
5. Either the “eye for an eye” principle is interpreted literally, or it is interpreted figuratively. If it is interpreted literally, then the state should torture torturers, maim maimers, and rape rapists. If the “eye for an eye” principle is interpreted figuratively, then it does not necessarily demand death for murderers. So, either the state should torture torturers, maim maimers, and rape

rapists, or the “eye for an eye” principle does not necessarily demand death for murderers.

6. Affirmative action is preferential treatment of disadvantaged groups, and preferential treatment of disadvantaged groups is reverse discrimination. If affirmative action is preferential treatment of disadvantaged groups and preferential treatment of disadvantaged groups is reverse discrimination, then affirmative action is wrong. Hence, affirmative action is wrong.
- * 7. If the zygote lacks a brain, then the zygote lacks a soul. If the zygote lacks a soul, then killing the zygote is permissible. So, if the zygote lacks a brain, then killing the zygote is permissible.
8. If Mary is a psychiatrist, then she is a physician. Mary is not a physician. Therefore, Mary is a psychiatrist.
9. If you want to ruin your life, you should take hard drugs. But you don’t want to ruin your life. So, you should not take hard drugs.
- * 10. Lying causes social discord. Hence, lying is wrong.
11. It is not true that acts are right because God approves them. But either acts are right because God approves them, or God approves of acts because they are right. Therefore, God approves of acts because they are right.
12. If Dracula is a vampire, then he is dangerous. But Dracula is not a vampire. Hence, he is dangerous.
- * 13. Either the animals used in research are a lot like humans, or they are not a lot like humans. If the animals are a lot like humans, then experimenting on them is morally questionable. If the animals are not a lot like humans, then experimenting on them is pointless. So, either experimenting on animals is morally questionable, or it is pointless.
14. The state cannot uphold the value of life by taking it. And if the state cannot uphold the value of life by taking it, then the death penalty should be abolished. Therefore, the death penalty should be abolished.
15. If my society approves of genetic engineering, then genetic engineering is right. But my society does not approve of genetic engineering. Hence, genetic engineering is not right.

PART D: Still More Forms to Identify Identify the forms of the following arguments, using capital letters to stand for statements and eliminating any stylistic variants. If the argument form is one of the “famous” valid forms, give its name. If the argument form is not one of the “famous” valid forms, write “none.”

- * 1. Overeating is foolish only if it causes disease. Overeating does not cause disease. So, overeating is not foolish.
2. Either films depicting graphic violence have caused the increase in violent crime or bad parenting has caused it (or both). Movies depicting graphic

violence have caused the increase in violent crime. Therefore, bad parenting has not caused the rise in violent crime.

3. Corporations contribute huge sums of money to political campaigns. If that is so, then corporations exert undue influence on elections. So, corporations exert undue influence on elections.
- * 4. You will win the chess tournament if you are very good at chess. Unfortunately, you are not very good at chess. Hence, you will not win the chess tournament.
5. Either virtue is good for its own sake, or it is good as a means to an end. It is not the case that virtue is good for its own sake. So, virtue is good as a means to an end.
6. You should be an optimist if pessimists are less likely to succeed than optimists. And it is a fact that pessimists are less likely to succeed than optimists. Therefore, you should be an optimist.
- * 7. If God can arbitrarily decide what is morally right, then God can make cruelty right. And if God cannot arbitrarily decide what is morally right, then morality is not entirely in God's control. But either God can arbitrarily decide what is morally right, or God cannot arbitrarily decide what is morally right. Therefore, either God can make cruelty right, or morality is not entirely in God's control.
8. The dinosaurs vanished due to a sudden, extreme drop in temperature. The earth must have suffered some sort of cataclysm millions of years ago, assuming that the dinosaurs vanished due to a sudden, extreme drop in temperature. So, the earth must have suffered some sort of cataclysm millions of years ago.
9. Assuming that you treat like cases alike, you are fair. Hence, you are fair only if you treat like cases alike.
- * 10. The death penalty is inequitably applied to the poor and to minorities. And given that the death penalty is inequitably applied to the poor and to minorities, it is unjust. Therefore, the death penalty is unjust.
11. Philosophy is important if ideas are important. And assuming that ideas change lives, ideas are important. Hence, if philosophy is important, then ideas change lives.
12. If you join the military, you give up a lot of freedom. If you go to college, you incur enormous debts. However, either you join the military, or you go to college. Therefore, either you give up a lot of freedom, or you incur enormous debts.
- * 13. Mercy killing is morally permissible only if it promotes a greater amount of happiness for everyone affected than the alternatives do. And mercy killing does promote a greater amount of happiness for everyone affected than the alternatives do. Therefore, mercy killing is morally permissible.
14. You must either love or hate. If you love, then you suffer when your loved ones suffer. If you hate, then you suffer when your enemies flourish. Hence,

either you suffer when your loved ones suffer, or you suffer when your enemies flourish.

15. A severe depression will occur given that the economy collapses. The economy collapses if inflation soars. So, inflation soars only if a severe depression will occur.

PART E: Constructing Arguments Construct your own substitution instances for each of the following argument forms: *modus ponens*, *modus tollens*, hypothetical syllogism, disjunctive syllogism, and constructive dilemma. If the substitution instance is not a sound argument, explain why. If you think that it is a sound argument, do you find it satisfying, compelling, or useful? Defend your answer.