*Introduction to Formal Logic with Philosophical Applications*
Instructor's Manual
Chapter 1

## Chapter 1 – Introducing Logic

**Chapter 1 Summary:**

- Logic is the study of argument. It may also be thought of as the rules of what follows from what, of which consequences derive from which assumptions.
- An argument is a set of statements, called premises, together with a claim, called the conclusion, which the premises are intended to support or establish.
- A conclusion is an argument's main claim. It is what the argument seeks to establish.
- Premises are statements that intend to provide the support necessary to establish an argument's conclusion.
- To establish a claim is to justify or provide evidence for it.
- A proposition is a statement, often expressed by a declarative sentence, which has a truth value. The propositions belonging to the languages studied in this text will be interpreted as having only two possible truth values; they are either true or false, and not both.
- Arguments can be evaluated in two distinct ways: (1) we can see whether the conclusion follows from the premises, and (2) we can see whether the premises are all true.
- If the conclusion of a deductive argument follows from the premises, the argument is valid. This means that the conclusion is a logical consequence of the premises (regardless of whether the premises are true or not).
- In a valid argument, if all of the premises are true, then the conclusion must be too. It is this truth-preserving feature of valid arguments that makes them such powerful tools.
- If all of the premises of an argument are true and the form is valid, then the argument is said to be sound. This means that the argument has succeeded in establishing its conclusion.
- If any of the premises of an argument are false, the argument is said to be unsound.
- The first step in analyzing arguments is to identify a conclusion, and separate it from the premises.
- Premise indicators are words or phrases such as 'since', 'because', 'for', and 'given that', which often—though not always—precede an argument's premise. They can be useful for helping us to separate an argument's conclusion from its premises.
- Conclusion indicators are words or phrases such as 'therefore', 'thus', 'hence', and 'it follows that', which often—though not always—precede an argument's conclusion. They can be useful for helping us to separate an argument's conclusion from its premises.
- A regimentation is a way of rewriting an argument to better reveal its logical structure. This can be done either by putting the argument into numbered premise-conclusion form or by translating the argument into a formal language.
- Natural languages are the languages we all grow up speaking, such as English, Spanish, or Swahili.
- Object languages are formal languages, such as those studied in this book. They are useful for gaining precision and for clarifying ambiguities present in natural languages.
- Meta-languages are combinations of natural languages with additional symbols and technical terms. They are useful for studying and speaking about formal languages.
- Syntax specifies the vocabulary of a given language and its rules of grammar. It tells us which expressions are well formed.
- Semantics specifies how a given language is to be interpreted. It tells us the meaning or truth conditions of any and all well-formed expressions.

**Chapter 1 Key Terms**

- Argument
- Conclusion

- Premise
- Proposition
- Regimentation
- Sound Argument
- Unsound Argument
- Valid Argument

**Chapter 1 Instructor Test Bank**

(Please note this test bank is unique from the self quizzes we provide to students on the ARC and unique from the material in our Dashboard software)

Chapter 1 Multiple Choice

*Section 1.4*

**Instructions:** Identify the conclusion of each of the following arguments. Remember to remove any conclusion indicators.

1. If your mind were organized, your desk would be organized. Thus, your mind isn't organized. This is true because your desk isn't.

A. Your mind is organized.
B. Your desk is organized.
C. Your mind isn't organized.
D. Your desk isn't organized.
E. This is true because your desk isn't.

Answer: C

2. Some judges have been subjected to corrupting influences. Anyone who has practiced law has been subjected to corrupting influences. Some judges have practiced law.

A. Some judges have practiced law.
B. Some judges have been subjected to corrupting influences.
C. Anyone who has practiced law has been subjected to corrupting influences.

Answer: B

3. If we want to combat AIDS, then we must prevent drug users from sharing dirty needles. If we must prevent the sharing of dirty needles, then the ban on selling needles should be lifted. And obviously, we do want to combat AIDS. The ban on selling hypodermic needles should be lifted.

A. The ban on selling hypodermic needles should be lifted.
B. We must prevent drug users from sharing dirty needles.
C. If we want to combat AIDS, then we must prevent drug users from sharing dirty needles.
D. If we must prevent the sharing of dirty needles, then the ban on selling needles should

be lifted.
E. We do want to combat AIDS.

Answer: A

4. We should be committed to the entities hypothesized by the mathematics in question. There exist genuine mathematical explanations of empirical phenomena. We should be committed to the theoretical posits hypothesized by these mathematical explanations. (Paolo Mancosu)

A. We should be committed to the entities hypothesized by the mathematics in question.
B. There exist genuine mathematical explanations of empirical phenomena.
C. We should be committed to the theoretical posits hypothesized by these mathematical explanations.

Answer: A

5. The government should not provide school vouchers. If they do, money will be directed away from the public schools. If the public schools have less money, they will deteriorate even further. And we don't want public schools to deteriorate.

A. The government should not provide school vouchers.
B. Money will be directed away from the public schools.
C. If the government provides school vouchers, money will be directed away from the public schools.
D. If the public schools have less money, they will deteriorate even further.
E. We don't want public schools to deteriorate.

Answer: A

6. The legalization of drugs is not unwise, because by legalizing drugs we would eliminate the drug trade. By legalizing drugs, we would rid our nation of all the violence that goes along with the illegal drug trade. Furthermore, the legalization of drugs is not immoral because it can be combined with a massive program of moral education. The legalization of drugs is neither unwise nor immoral.

A. The legalization of drugs is not unwise, because by legalizing drugs we would eliminate the drug trade.
B. By legalizing drugs we would eliminate the drug trade.
C. By legalizing drugs, we would rid our nation of all the violence that goes along with the illegal drug trade.
D. The legalization of drugs is not immoral because it can be combined with a massive program of moral education.
E. The legalization of drugs is neither unwise nor immoral.

Answer: E

7. The universe is cooling off, and we are made of wet and messy materials. So computers have an

advantage to us when it comes to evolution. That's because consciousness is just a matter of formal processes. And in computers, these formal processes can go on in substances that are much better able to survive.

A. The universe is cooling off, and we are made of wet and messy materials.
B. Computers have an advantage to us when it comes to evolution
C. That's because consciousness is just a matter of formal processes.
D. Consciousness is just a matter of formal processes.
E. In computers, these formal processes can go on in substances that are much better able to survive.

Answer: B

8. Understanding a language involves more than just manipulating a bunch of formal symbols. For, by virtue of implementing a formal computer program, I could behave exactly as if I understood Chinese. But I don't understand a word of Chinese. And if going through the appropriate computer program for understanding Chinese is not enough to give me an understanding of Chinese, then it is not enough to give any other digital computer an understanding of Chinese.

A. Understanding a language involves more than just manipulating a bunch of formal symbols.
B. By virtue of implementing a formal computer program, I could behave exactly as if I understood Chinese.
C. I don't understand a word of Chinese.
D. If going through the appropriate computer program for understanding Chinese is not enough to give me an understanding of Chinese, then it is not enough to give any other digital computer an understanding of Chinese.
E. It is not enough to give any other digital computer an understanding of Chinese.

Answer: A

9. It is not necessary that of every affirmation and opposite negation one should be true and the other false. It is necessary for there to be or not to be a sea battle tomorrow. But it is not necessary for a sea battle to take place tomorrow. Nor is it necessary for one not to take place.

A. Of every affirmation and opposite negation one should be true and the other false.
B. It is not necessary that of every affirmation and opposite negation one should be true and the other false.
C. It is necessary for there to be or not to be a sea battle tomorrow.
D. It is not necessary for a sea battle to take place tomorrow.
E. It is not necessary for one not to take place.

Answer: B

10. There is no purely logical analysis of conditionals. A counterfactual conditional is true if a certain connection obtains between the antecedent and the consequent. But the consequent seldom follows from the antecedent by logic alone. The assertion that a connection holds is made on the presumption that certain relevant circumstances not stated in the antecedent obtain. Even if we

specify the particular relevant conditions, the connection obtaining will not be a logical one, but a causal one.

A. There is no purely logical analysis of conditionals.
B. A counterfactual conditional is true if a certain connection obtains between the antecedent and the consequent.
C. The consequent seldom follows from the antecedent by logic alone.
D. The assertion that a connection holds is made on the presumption that certain relevant circumstances not stated in the antecedent obtain.
E. Even if we specify the particular relevant conditions, the connection obtaining will not be a logical one, but a causal one.

Answer: A

*Section 1.5*

1. Cats have whiskers. Cats have toes. So, cats have whiskers and toes.

A. Valid and sound
B. Valid and unsound
C. Invalid

Answer: A

2. Some mules are donkeys. Some mules are horses. Hence, some donkeys are horses.

A. Valid and sound
B. Valid and unsound
C. Invalid

Answer: C

3. All koalas are bears. All bears hibernate in the winter. Hence, all koalas hibernate in the winter.

A. Valid and sound
B. Valid and unsound
C. Invalid

Answer: B

4. All presidents of the United States have been wealthy. Trump is a man. Therefore, Trump is wealthy.

A. Valid and sound
B. Valid and unsound
C. Invalid

Answer: C

5. All eagles are birds. Eagles are endangered species. So, birds are endangered species.

A. Valid and sound
B. Valid and unsound
C. Invalid

Answer: C

6. All rectangles are rhombuses. All rhombuses are parallelograms. So, all rectangles are parallelograms.

A. Valid and sound
B. Valid and unsound
C. Invalid Answer: A

7. Some theories of truth are inflationary. Some theories of truth are deflationary. All theories of truth include the T-schema. So, all deflationary theories of truth include the T-schema.

A. Valid and sound
B. Valid and unsound
C. Invalid Answer: C

8. All penguins are birds. All birds have wings. All winged creatures can fly. So, it follows that penguins can fly.

A. Valid and sound
B. Valid and unsound
C. Invalid Answer: B

9. Only white rats are used in genetic experiments. Ben is a rat used in a genetic experiment. So, Ben is white.

A. Valid and sound
B. Valid and unsound
C. Invalid Answer: B

10. Descartes corresponded with Queen Christina. Queen Christina corresponded with Gian Lorenzo Bernini. So, Descartes corresponded with Gian Lorenzo Bernini.

A. Valid and sound
B. Valid and unsound
C. Invalid Answer: C

Chapter 1 Traditional

(Please note the solution sets follow the problem sets)

*Section 1.4*
**Instructions:** Regiment each of the following arguments into premise/conclusion form.

1. If your mind were organized, your desk would be organized. Thus, your mind isn't organized. This is true because your desk isn't.

2. Some judges have been subjected to corrupting influences. Anyone who has practiced law has been subjected to corrupting influences. Some judges have practiced law.

3. The ban on selling hypodermic needles should be lifted. If we want to combat AIDS, then we must

prevent drug users from sharing dirty needles. If we must prevent the sharing of dirty needles, then the ban on selling needles should be lifted. And obviously, we do want to combat AIDS.

4. We should be committed to the entities hypothesized by the mathematics in question. There exist genuine mathematical explanations of empirical phenomena. We should be committed to the theoretical posits hypothesized by these mathematical explanations. (Paolo Mancosu)

5. The government should not provide school vouchers. If they do, money will be directed away from the public schools. If the public schools have less money, they will deteriorate even further. And we don't want public schools to deteriorate.

6. The legalization of drugs is not unwise, because by legalizing drugs we would eliminate the drug trade. By legalizing drugs, we would rid our nation of all the violence that goes along with the illegal drug trade. Furthermore, the legalization of drugs is not immoral because it can be combined with a massive program of moral education. The legalization of drugs is neither unwise nor immoral.

7. The universe is cooling off, and we are made of wet and messy materials. So computers have an advantage to us when it comes to evolution. That's because consciousness is just a matter of formal processes. And in computers, these formal processes can go on in substances that are much better able to survive.

8. Understanding a language involves more than just manipulating a bunch of formal symbols. For, by virtue of implementing a formal computer program, I could behave exactly as if I understood Chinese. But I don't understand a word of Chinese. And, if going through the appropriate computer program for understanding Chinese is not enough to give me an understanding of Chinese, then it is not enough to give any other digital computer an understanding of Chinese.

9. It is not necessary that of every affirmation and opposite negation one should be true and the other false. It is necessary for there to be or not to be a sea battle tomorrow. But it is not necessary for a sea battle to take place tomorrow. Nor is it necessary for one not to take place.

10. There is no purely logical analysis of conditionals. A counterfactual conditional is true if a certain connection obtains between the antecedent and the consequent. But the consequent seldom follows from the antecedent by logic alone. The assertion that a connection holds is made on the presumption that certain relevant circumstances not stated in the antecedent obtain. Even if we specify the particular relevant conditions, the connection obtaining will not be a logical one, but a causal one.

*Section 1.4 Solutions*

1. P1. If your mind were organized, your desk would be organized.
   P2. Your desk isn't organized.
   C. Your mind isn't organized.

2. P1. Anyone who has practiced law has been subjected to corrupting influences.
   P2. Some judges have practiced law.
   C. Some judges have been subjected to corrupting influences.

3. P1. If we want to combat AIDS, then we must prevent drug users from sharing dirty needles.
   P2. If we must prevent the sharing of dirty needles, then the ban on selling needles should be lifted.
   P3. Obviously, we do want to combat AIDS.

C. The ban on selling hypodermic needles should be lifted.

4. P1. There exist genuine mathematical explanations of empirical phenomena.
P2. We should be committed to the theoretical posits hypothesized by these mathematical explanations.
C. We should be committed to the entities hypothesized by the mathematics in question.

5. P1. If government provides school vouchers, money will be directed away from the public schools.
P2. If the public schools have less money, they will deteriorate even further.
P3. We don't want public schools to deteriorate.
C. The government should not provide school vouchers.

6. P1. The legalization of drugs is not unwise, because by legalizing drugs we would eliminate the drug trade.
P2. By legalizing drugs, we would rid our nation of all the violence that goes along with the illegal drug trade.
P3. The legalization of drugs is not immoral because it can be combined with a massive program of moral education.
C. The legalization of drugs is neither unwise nor immoral.

7. P1. The universe is cooling off, and we are made of wet and messy materials.
P2. Consciousness is just a matter of formal processes.
P3. In computers, these formal processes can go on in substances that are much better able to survive.
C. Computers have an advantage to us when it comes to evolution.

8. P1. By virtue of implementing a formal computer program, I could behave exactly as if I understood Chinese.
P2. I don't understand a word of Chinese.
P3. If going through the appropriate computer program for understanding Chinese is not enough to give you an understanding of Chinese, then it is not enough to give any other digital computer an understanding of Chinese.
C. Understanding a language involves more than just manipulating a bunch of formal symbols.

9. P1. It is necessary for there to be or not to be a sea battle tomorrow.
P2. It is not necessary for a sea battle to take place tomorrow.
P3. It is not necessary for one not to take place.
C. It is not necessary that of every affirmation and opposite negation one should be true and the other false.

10. P1. A counterfactual conditional is true if a certain connection obtains between the antecedent and the consequent.
P2. The consequent seldom follows from the antecedent by logic alone.
P3. The assertion that a connection holds is made on the presumption that certain relevant circumstances not stated in the antecedent obtain.
P4. Even if we specify the particular relevant conditions, the connection obtaining will not be a logical one, but a causal one.
C. There is no purely logical analysis of conditionals.

*Section 1.5*

**Instructions:** Determine whether each of the following arguments is intuitively valid or invalid. For valid arguments, determine whether they are sound (if you can).

1. Cats have whiskers. Cats have toes. So, cats have whiskers and toes.

2. Some mules are donkeys. Some mules are horses. Hence, some donkeys are horses.

3. All koalas are bears. All bears hibernate in the winter. Hence, all koalas hibernate in the winter.

4. All presidents of the United States have been wealthy. Trump is a man. Therefore, Trump is wealthy.

5. All eagles are birds. Eagles are endangered species. So, birds are endangered species.

6. All rectangles are rhombuses. All rhombuses are parallelograms. So, all rectangles are parallelograms.

7. Some theories of truth are inflationary. Some theories of truth are deflationary. All deflationary theories of truth include the T-schema. So, all theories of truth include the T-schema.

8. All penguins are birds. All birds have wings. All winged creatures can fly. So, it follows that penguins can fly.

9. Only white rats are used in genetic experiments. Ben is a rat used in a genetic experiment. So, Ben is white.

10. Descartes corresponded with Queen Christina. Queen Christina corresponded with Gian Lorenzo Bernini. So, Descartes corresponded with Gian Lorenzo Bernini.

*Section 1.5 Solutions*

1. Valid and sound

2. Invalid

3. Valid, but unsound

4. Invalid

5. Invalid

6. Valid and sound

7. Invalid

8. Valid, but unsound

9. Valid, but unsound

10. Invalid