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| **EindTotaal**: / 20 | **Naam**: Artiushenko |

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**Logic and Computational Thinking**

# Logic and computer science

## Introduction to Formal logic

### 1 Multiple Choice

Which three of the following are parts of an argument? (choose 3)

Premise

A numeral

Conclusion

Consequent

Logical relation

2 Multiple choice

Examine this argument:  
Premise 1: All programmers are coders  
Premise 2: All coders are math specialists  
Therefore  
Which one of the following statements would most likely be the conclusion of this argument (the word 'some' means 'at least one'):

All programmers use computers

Some math specialists code

No math specialists are JavaScript programmers

All programmers are math specialists

3 Multiple choice

Which two of the following statements could represent the proposition: **All your data is in the cloud**

All data is somewhere above the Empire State Building

All your data is stored in large collections of servers accessible over the internet

How your data is stored is ambiguous and unclear

All the data you manage is stored in data storage services on systems like Microsoft's Azure or Amazon's AWS

All data you manage is stored on your computer

4 Multiple choice

Which three of the following could be a statement in logic? (choose 3)

All mammals give live birth to their offspring

Stop it!

Would you shut the door please?

Pluto is the third planet from the sun

All computer programs are not created equal

5 Multiple choice

Consider the following argument:  
Premise 1: If the dog has fleas, the dog scratches itself  
Premise 2:  
Conclusion: Therefore, the dog scratches itself

Which of the following would be the most likely second proposition to complete the argument?

Fleas are biting the dog

Dogs like to scratch fleas

The dog has fleas

The dog does not have fleas

6 Multiple choice

The following is not an argument.  
Premise 1: If Tuesday is bagel day, then I will eat a bagel tomorrow  
Premise 2: Wednesday is taco day  
Conclusion: Therefore, I will have pizza

What is it missing?

A premise

A logical relation between the premises and conclusion

Statements

Premises with truth value

# Deductive and Inductive Arguments

## Types of Arguments

1.Multiple choice

A burglar broke into the Gotrocks home and stole the family jewels. Witnesses reported seeing an unusually tall man with long, red hair and a long, red beard running from the residence at about the time of the burglary. Joe Blow’s fingerprints were found at the scene of the crime. Hair matching Joe’s hair was found at the crime scene. Joe Blow is unusually tall and has long, red hair and a long, red beard. The day after the crime, Joe tried to hawk the Gotrocks jewels at the local pawn shop, claiming he found them in the street. Since no other suspects fit the evidence, the best explanation is that Joe is the burglar. It is therefore very likely Joe is the burglar.

Inductive Argument

Deductive Argument

If time has no beginning, then the present moment of time is the endpoint of an infinite series of past moments of time. But it is impossible that an infinite series of things has an actual endpoint. Therefore, there must have been a first moment of time.

Inductive Argument

Deductive Argument

3.Multiple choice

It is true today, right now, that tomorrow either you will eat a burrito for lunch or you will not eat a burrito for lunch. If it is true (right now) that tomorrow you will eat a burrito for lunch, then tomorrow at lunch you must eat a burrito; you cannot do anything else but that, for nobody can alter the truth. On the other hand, if it is true (right now) that tomorrow you will not eat a burrito for lunch, then tomorrow at lunch you won’t and can’t eat a burrito, for nobody can change the truth. Either way then, what you do tomorrow at lunch has already been determined or fixed ahead of time, and there is nothing you can do about it; there is no way you can deviate from what must be. But this reasoning applies to every moment of the future. Therefore, it follows with complete certainty that the future has already been fixed or determined and nobody has free will.

Inductive Argument

Deductive Argument

4.Multiple choice

Drug X cures heart disease in monkeys. But monkey hearts are similar in many relevant ways to human hearts. Therefore, drug X will probably cure heart disease in humans

Inductive Argument

Deductive Argument

5.Multiple choice

We polled one thousand people at random around the city of Centerville and asked them if they approve or disapprove of the job the mayor is doing. We questioned people from all walks of life, all ethnic and racial groups, and all genders, at all times of the day. Over 80 percent said they disapprove. Therefore, it is very likely that most citizens of Centerville disapprove of the job the mayor is doing

Inductive Argument

Deductive Argument

6.Multiple choice

We’ve observed one hundred possums at random, and each one had a short, pointy tail. Thus, it is probable that the next possum we observe will have a short, pointy tail.

Inductive Argument

Deductive Argument

7.Multiple choice

If it rains, then the roof gets wet. But it is raining. Therefore, certainly the roof must be getting wet.

Inductive Argument

Deductive Argument

8.Multiple choice

Under the test conditions, blue litmus paper only turns red in the presence of an acid; never otherwise. We just dipped blue litmus paper into the unknown substance S, and the paper turned red. Therefore, substance S must be an acid.

Inductive Argument

Deductive Argument

9.Multiple choice

If Sue’s hypothesis is true, then we can expect to see the solution turn green when we add boric acid to it. We just added the acid, and the solution turned green. Therefore, Sue’s hypothesis is probably true.

Inductive Argument

Deductive Argument

10.Multiple choice

Four students got sick after lunch. The health department interviewed the students, and hot dogs were the only item they all ate in common. Therefore, the cause of the illness was probably the hotdogs or something in the hotdogs.

Inductive Argument

Deductive Argument

## Deductive Arguments

1.Multiple choice

No cat is a reptile. No reptile is a splurp. So, no cat is a splurp.

Using the intuitive test for validity, decide if the statement above is valid or invalid.

Valid

Invalid

2.Multiple choice

The United States House of Representatives has more members than there are calendar days in a leap year. Therefore, at least two members of the House must have the same birthday.

Using the intuitive test for validity, decide if the statement above is valid or invalid.

Valid

Invalid

3.Multiple choice

Father Flanagan’s Boys Town is located in Nebraska. Nebraska is located in the United States. So, Boys Town must be located in the United States.

Using the intuitive test for validity, decide if the statement above is valid or invalid.

Valid

Invalid

4.Multiple choice

Listening to loud music always ruins your hearing. Joe is hard of hearing. Therefore, Joe must have been listening to loud music.

Using the intuitive test for validity, decide if the statement above is valid or invalid.

Valid

Invalid

5.Multiple choice

The Monterey Pop Festival (1967) featured some of the greatest bands of the 1960s. The Beatles did not perform at Monterey. So, the Beatles must not have been among the greatest bands of the 1960s.

Using the intuitive test for validity, decide if the statement above is valid or invalid.

Valid

Invalid

6.Multiple choice

Figure A has four equal sides. Therefore, figure A must be a square.

Using the intuitive test for validity, decide if the statement above is valid or invalid.

Valid

Invalid

7.Multiple choice

All the members of the Ohio Southpaw Club are left-handed. Joe is left-handed. So, Joe must be a member of the Ohio Southpaw Club.

Using the intuitive test for validity, decide if the statement above is valid or invalid.

Valid

Invalid

8.Multiple choice

When a nonmetallic element forms more than one oxide, the oxide containing the most oxygen gives the strongest acid. Sulfur is a nonmetallic element and forms two oxides: sulfuric and sulfurous acid. Sulfuric acid contains more oxygen than sulfurous acid. Therefore, sulfuric acid is certainly stronger than sulfurous acid.

Using the intuitive test for validity, decide if the statement above is valid or invalid.

Valid

Invalid

9.Multiple choice

Which of the following combination will you *not* find in a valid deductive argument? (Choose one)

true premises and a false conclusion

true premises and a true conclusion

false premises and a false conclusion

false premises and a true conclusion

none of the above

10.Multiple choice

Which of the following combinations will you *not* find in an invalid deductive argument? (Choose one)

true premises and a false conclusion

true premises and a true conclusion

false premises and a false conclusion

false premises and a true conclusion

none of the above, for *any* combination is possible in an invalid argument

1.Multiple choice

Which of the following symbolizes a disjunctive syllogism? (Choose one)

p --> (q v r); p; therefore, q v r

(p & q) v (r v t); ~(r v t); therefore p & q

p --> q; q; therefore p

p --> q; ~q; therefore p

2.Multiple choice

Which of the following symbolizes a modus tollens syllogism? (Choose one)

p --> (q v r); p; therefore, q v r

(p & q) v (r v t); ~(r v t); therefore p & q

p --> q; q; therefore p

(p & r) --> q; ~q; therefore ~(p & r)

3.Multiple choice

Which of the following symbolizes a hypothetical syllogism? (Choose one)

p --> (q v r); p; therefore, q v r

[(p & q) v (r v t)] --> r; r --> (s & t); therefore [(p & q) v (r v t)] --> s & t

p --> q; q; therefore p

[(p & q) v (r v t)] --> r; ~r; therefore ~[(p & q) v (r v t)]

4.Multiple choice

Which of the following symbolizes a modus ponens syllogism? (Choose one)

p --> (q v r); p; therefore, q v r

(p & q) v (r v t); ~(r v t); therefore p & q

p --> q; q; therefore p

p --> q; ~q; therefore p

## Inductive Arguments

**Review Questions**

1.Multiple choice

Examine this argument:  
The bank robber accidentally left behind his checkbook. He also dropped his wallet that contained his driver’s license. Both items were traced to Joe Doakes, who was trying to hide $10,000 in his coat when the police arrived. The bank robber escaped with $10,000 but was also covered with red dye when the dye pack exploded. Joe Doakes was found to be covered with red dye. The obvious conclusion is that Joe robbed the bank.

Does this inductive argument seem to be strong or weak?

Strong

Weak

2.Multiple choice

Examine this argument:  
Exercising daily helps prevent heart attacks. Don exercises daily. Therefore, Don will probably never suffer a heart attack.

Does this inductive argument seem to be strong or weak?

Strong

Weak

3.Multiple choice

Examine this argument:  
It was sunny in Seattle yesterday for the first time in four weeks. Therefore, it will probably be sunny in Seattle all next week.

Does this inductive argument seem to be strong or weak?

Strong

Weak

4.Multiple choice

Examine this argument:  
Ed is walking the twelve miles to downtown. He just left five minutes ago. He walks at an ordinary pace. Therefore, probably he has not arrived yet.

Does this inductive argument seem to be strong or weak?

Strong

Weak

5.Multiple choice

Examine this argument:  
Few cats are orange colored. I hear a cat meowing across the street. The cat meowing is probably not orange.

Does this inductive argument seem to be strong or weak?

Strong

Weak

# Categorical Logic

## Introduction to Categorical Logic

1.Multiple choice

Classify the statement below as A, E, I, or O.

All adult male Spartans are highly trained soldiers.

A (Universal Affirmative)

E (Universal Negative)

I (Particular Affirmative)

O (Particular Negative)

2.Multiple choice

Classify the statement below as A, E, I, or O.

No Athenian citizens are Spartans.

A (Universal Affirmative)

E (Universal Negative)

I (Particular Affirmative)

O (Particular Negative)

3.Multiple choice

Classify the statement below as A, E, I, or O.

Some Athenians are not philosophers.

A (Universal Affirmative)

E (Universal Negative)

I (Particular Affirmative)

O (Particular Negative)

4.Multiple choice

Classify the statement below as A, E, I, or O.

No Students of Socrates are professional Sophists

A (Universal Affirmative)

E (Universal Negative)

I (Particular Affirmative)

O (Particular Negative)

5.Multiple choice

Classify the statement below as A, E, I, or O.

Some Athenians are farmers.

A (Universal Affirmative)

E (Universal Negative)

I (Particular Affirmative)

O (Particular Negative)

6.Multiple choice

Classify the statement below as A, E, I, or O.

All philosophers are logicians.

A (Universal Affirmative)

E (Universal Negative)

I (Particular Affirmative)

O (Particular Negative)

7.Multiple choice

Classify the statement below as A, E, I, or O.

No Spartan warriors are philosophers

A (Universal Affirmative)

E (Universal Negative)

I (Particular Affirmative)

O (Particular Negative)

8.Multiple choice

Classify the statement below as A, E, I, or O.

All logicians at Aristotle's school are philosophers.

A (Universal Affirmative)

E (Universal Negative)

I (Particular Affirmative)

O (Particular Negative)

9.Multiple choice

Classify the statement below as A, E, I, or O.

All priests who work at the temple at Delphi are professionals.

A (Universal Affirmative)

E (Universal Negative)

I (Particular Affirmative)

O (Particular Negative)

10.Multiple choice

Classify the statement below as A, E, I, or O.

No hoplites serving in the Athenian infantry are logic teachers

A (Universal Affirmative)

E (Universal Negative)

I (Particular Affirmative)

O (Particular Negative)

## Categorical Form and Syllogism

**Review Questions**

1.Multiple choice

Consider this colloquial (common) statement:  
"Any drop of seawater is salty"

Which one of the following is the proper translation of the above statement into **standard A form**

Some drops of seawater are salty things

Most drops of seawater are salty

All drops of seawater are salty things

A drop of seawater is salty thing

2.Multiple choice

Consider this colloquial (common) statement:  
"Olives are a good source of cooking oil"

Which one of the following is the proper translation of the above statement into **standard A form**

All olives are things that are a good source of cooking oil

All olives are used for cooking oil

Olives are things used in cooking

An olive is a good source of cooking oil

3.Multiple choice

Consider this colloquial (common) statement:  
"Any critical thinker accepts criticism calmly and rationally"

Which one of the following is the proper translation of the above statement into **standard A form**

Some critical thinkers are calm and rational

All critical thinkers are calm and rational when faced with criticism

All critical thinkers are persons who accept criticism calmly and rationally

Any calm and rational person when faced with criticism is a critical thinker

4.Multiple choice

Consider this colloquial (common) statement:  
"Any irrational person is a person who does not accept criticism calmly"

Which one of the following is the proper translation of the above statement into **standard E form**

No irrational person accepts criticism calmly

No irrational person are persons who accept criticism calmly

All irrational persons are persons who do not accept criticism calmly

No rational persons accepts criticism calmly

5.Multiple choice

Consider this colloquial (common) statement:  
"Rocks are not a good source of cooking oil"

Which one of the following is the proper translation of the above statement into **standard E form**

No rocks are a good source of cooking oil

No rocks are things that are a good source of cooking oil

No rocks are things and no rocks are a good source of cooking oil

Some rocks are not things that are a good source of cooking oil

6.Multiple choice

Consider this colloquial (common) statement:  
"Several citizens voted"

Which one of the following is the proper translation of the above statement into **standard I form**

Some citizens are people that voted

Some people are voting citizens

All citizens are people that voted

Some citizens are people that did not vote

7.Multiple choice

Consider this colloquial (common) statement:  
"There are fashionable computer programmers"

Which one of the following is the proper translation of the above statement into **standard I form**

All computer programmers are fashionable

Some fashionable people program computers

Some computer programmers are fashionable

Some computer programmers are fashionable people

8.Multiple choice

Consider this colloquial (common) statement:  
"There are critical thinkers who aren’t artists"

Which one of the following is the proper translation of the above statement into **standard O form**

No critical thinkers are artists

Some non-artists are critical thinkers

Some critical thinkers are not artistic people

Some artists are not critical thinkers

## Venn Diagrams

**Review Questions**

1. Multiple choice

Use a Venn diagram to test the argument below for validity.  
Some logicians are lawyers. All lawyers are extemporaneous speakers. So, some extemporaneous speakers are logicians.

According to the Venn diagram, is this argument valid or invalid?

Valid

Invalid

2. Multiple choice

Use a Venn diagram to test the argument below for validity.  
All chariot racers are musicians. Some chariot racers are soldiers. Therefore, some musicians are soldiers.

According to the Venn diagram, is this argument valid or invalid?

Valid

Invalid

3. Multiple choice

Use a Venn diagram to test the argument below for validity.  
All philosophers are lovers of truth. No lovers of truth are closed-minded people. Thus, no philosophers are closed-minded people.

According to the Venn diagram, is this argument valid or invalid?

Valid

Invalid

4. Multiple choice

Use a Venn diagram to test the argument below for validity.  
All goats are cute. All small mammals are cute. So, all small mammals are goats.

According to the Venn diagram, is this argument valid or invalid?

Valid

Invalid

5. Multiple choice

Use a Venn diagram to test the argument below for validity.  
Some musicians are not poets. All musicians are happy persons. Therefore, some happy persons are not poets.

According to the Venn diagram, is this argument valid or invalid?

Valid

Invalid