INDUCTIVE REASONING

Definition. Basing a conclusion on specific examples.

Examples:

All crows are black.
The sun will rise tomorrow.
All Islamic people are terrorists.
Gravity: Things fall down.

Scientific Method is based on induction. If you perform an experiment over and over with the same results each time, you begin to formulate general laws to explain your observations.

Medical Experiments.

All even numbers > 2 are composite: Look at 4, 6, 8, 10
All odd numbers > 1 are prime: Look at 3, 5, 7
\( x^2 > x \): Look at 1, 2, 3, 4, \ldots

DEDUCTIVE REASONING

We consider four types of rules.

Rule 1. Direct Reasoning

Premises: if \( p \) then \( q \)
\( p \) is true
Conclusion: therefore, \( q \) is true
Examples:

If Kerry Wood and Mark Prior stay with the Cubs, then the Cubs will win the World Series next year.
Kerry Wood and Mark Prior sign contracts to stay in Chicago next year.
Therefore, the Cubs will win the World Series next year.

If a number is prime, then it is odd.
11 is prime.
Therefore, 11 is odd.

If a number is prime, then it is odd.
2 is prime.
Therefore, 2 is odd.

Rule 2. Indirect Reasoning

Premises: \( \text{if } p \text{ then } q \)
\[ q \text{ is false} \]
Conclusion: therefore, \( p \) is false

Observe that indirect reasoning is really direct reasoning using the contrapositive of “\( p \) implies \( q \).”

Examples:

If the Afghan leaders hand over bin Laden, then the U. S. will not attack their country.
The U. S. attacked Afghanistan.
Therefore, the Afghan leaders did not surrender bin Laden.

The murderer was left handed.
I am not left handed.
Therefore, I am not the murderer.
If a number > 2 is prime, then it is odd.
12 is not odd.
Therefore, 12 is not prime.

If a person gets older, then they get wiser.
I am not getting any wiser.
Therefore, I am getting younger.

**Rule 3. Transitivity**

Premises: if $p$ then $q$
            if $q$ then $r$
Conclusion: if $p$ then $r$

*Classic Example:*

For the want of a nail, the shoe was lost.
For the want of a shoe, the horse was lost.
For the want of a horse, the rider was lost.
For the want of a rider, the battle was lost.
(All because of a single nail.)

If Mark Prior pitches well in Game 7, then the Cubs will win the game.
If the Cubs wins game 7, then they will win the World Series.
Therefore, if Mark Prior pitches well in Game 7, then the Cubs will win the World Series.

If you are anorexic, then you won’t eat.
If you don’t eat, then you will die.
Therefore, if you are anorexic, then you will die.
Rule 4. The “or” rule

Premises:  
\[ p \lor q \]

\[ q \text{ is false} \]

Conclusion:  
\[ p \text{ must be true} \]

Example:

Either the man is stupid or he is lying.
He is not stupid.
Therefore, he is lying.

Find positive solutions to \( x^2 - 2x - 3 < 0 \).

Summary

Rule 1. Direct Reasoning

Premises:  
\[ \text{if } p \text{ then } q \]

\[ p \text{ is true} \]

Conclusion:  
\[ \text{therefore, } q \text{ is true} \]

Rule 2. Indirect Reasoning

Premises:  
\[ \text{if } p \text{ then } q \]

\[ q \text{ is false} \]

Conclusion:  
\[ \text{therefore, } p \text{ is false} \]

Rule 3. Transitivity

Premises:  
\[ \text{if } p \text{ then } q \]

\[ \text{if } q \text{ then } r \]

Conclusion:  
\[ \text{if } p \text{ then } r \]

Rule 4. The “or” rule

Premises:  
\[ p \lor q \]

\[ q \text{ is false} \]

Conclusion:  
\[ p \text{ must be true} \]
What is the best conclusion you can reach from the following premises?

Either relief supplies are sent by U. S. or seven million Ethiopians starve.
If the U. S. sends relief supplies, government controlled areas can be reached.
If government controlled areas can be reached, the fighting has declined.
The fighting has escalated.

Timber thieves seek personal gain over public good.
People who steal artifacts from Indian sites do not appreciate history.
You are educated.
Those who don’t steal artifacts from Indian sites do not seek personal gain over public good.
People who do not appreciate history are not educated.
FORMAL FALLACIES

An invalid argument is one in which the conclusion does not follow logically from the premises.

Determine whether the following arguments are valid or invalid.

Premises: All mothers are women.
Hillary Clinton is a mother.

Conclusion: Hillary Clinton is a woman.

Premises: All mothers are women.
Janet Reno is a woman.

Conclusion: Janet Reno is a mother.

Premises: Some jugglers are women.
Janet Reno is a woman.

Conclusion: Janet Reno is a juggler.

Premises: Some jugglers are women.
Cindy is a juggler.

Conclusion: Cindy is a woman.

Premises: Some men are tumblers.
Some jugglers are women.
No women are tumblers.

Conclusion: Some men are jugglers.
Premises: Some men are tumblers.
Some jugglers are women.
No women are tumblers.
Some people are both tumblers and jugglers.

Conclusion: Some men are jugglers.

Premises: If bleebs are quills then blarbs are snarfs.
If blarbs are snarfs then blairs are mares.
Blairs are not mares.

Conclusion: Bleebs are not quills.

Premises:

If Harry lands the Johnson account, then he will get a raise.
Harry got a raise.

Conclusion: Harry landed the Johnson account.

Premises: If I hit my thumb with a hammer, then my thumb will hurt.
My thumb hurts.

Conclusion: I hit my thumb with a hammer.

*Must a logically minded person accept the conclusion of a valid argument?*

**Only if you accept all the premises.**

If a person gets older, then they get wiser.
I am not getting any wiser.
Therefore, I am getting younger.
Premises: All innocent human beings have a right to live.
A human fetus is a human being.

Conclusion: Abortion is wrong.

*Must a person accept the conclusion of a valid argument, if they accept as true all the premises?*

*Only if you choose to act logically.*