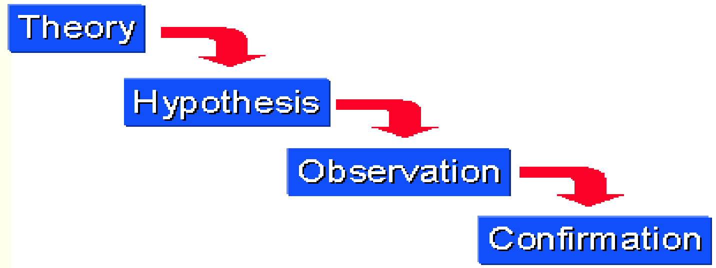
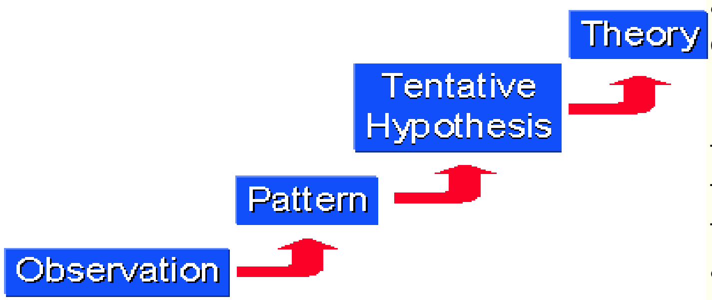
DEDUCTIVE vs. INDUCTIVE REASONING

Deduction & Induction

In logic, we often refer to the two broad methods of reasoning as the ***deductive*** and ***induct ive*** approaches.



Deductive reasoning works from the more general to the more specific. Sometimes this is informally called a "top-down" approach. We might begin with thinking up a *theory*about our topic of interest. We then narrow that down into more specific*hypotheses* that we can test. We narrow down even further when we collect *observations* to address the hypotheses. This ultimately leads us to be able to test the hypotheses with specific data -- a *confirmation* (or not) of our original theories.



Inductive reasoning works the other way, moving from specific observations to broader generalizations and theories. Informally, we sometimes call this a "bottom up" approach (please note that it's "bottom up" and *not* "bottom**s**up" which is the kind of thing the bartender says to customers when he's trying to close for the night!). In inductive reasoning, we begin with specific observations and measures, begin to detect patterns and regularities, formulate some tentative hypotheses that we can explore, and finally end up developing some general conclusions or theories.

Problem Solving

- **Logic** – The science of correct reasoning.
- **Reasoning** – The drawing of inferences or conclusions from known or assumed facts.

  When solving a problem, one must understand the question, gather all pertinent facts, analyze the problem i.e. compare with previous problems (note similarities and differences), perhaps use pictures or formulas to solve the problem.

Deductive Reasoning

- **Deductive Reasoning** – A type of logic in which one goes from a general statement to a specific instance.
- The classic example

All men are mortal. (major premise)

Socrates is a man. (minor premise)

Therefore, Socrates is mortal. (conclusion)

The above is an example of a ***syllogism***.

Deductive Reasoning

- **<u>Syllogism</u>**: An argument composed of two statements or premises (the major and minor premises), followed by a conclusion.
- For any given set of premises, if the conclusion is guaranteed, the arguments is said to be ***valid***.
- If the conclusion is not guaranteed (at least one instance in which the conclusion does not follow), the argument is said to be ***invalid***.
- ***BE CARFEUL, DO NOT CONFUSE TRUTH WITH VALIDITY!***

Deductive Reasoning

Examples:

1. *All students eat pizza.*
   Claire is a student at ASU.
   Therefore, Claire eats pizza.

2. *All athletes work out in the gym.*
   Barry Bonds is an athlete.
   Therefore, Barry Bonds works out in the gym.

Deductive Reasoning

3. All math teachers are over 7 feet tall.

Mr. D. is a math teacher.

Therefore, Mr. D is over 7 feet tall.

- The argument is valid, but is certainly not true.
- The above examples are of the form

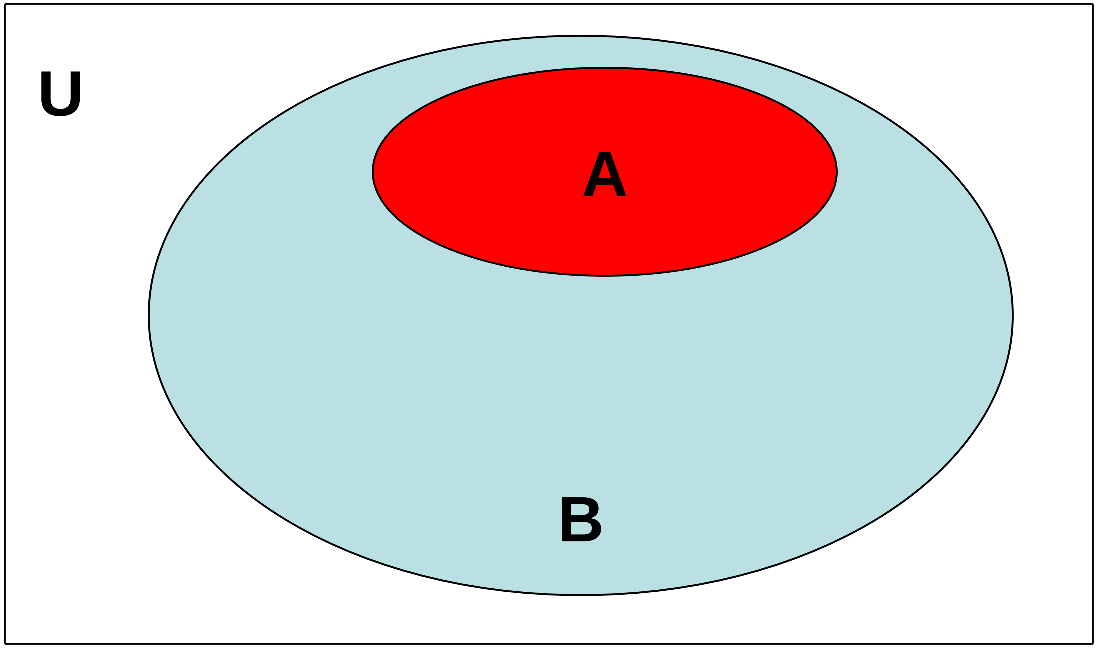
If p, then q. (major premise)

x is p. (minor premise)

Therefore, x is q. (conclusion)

Venn Diagrams

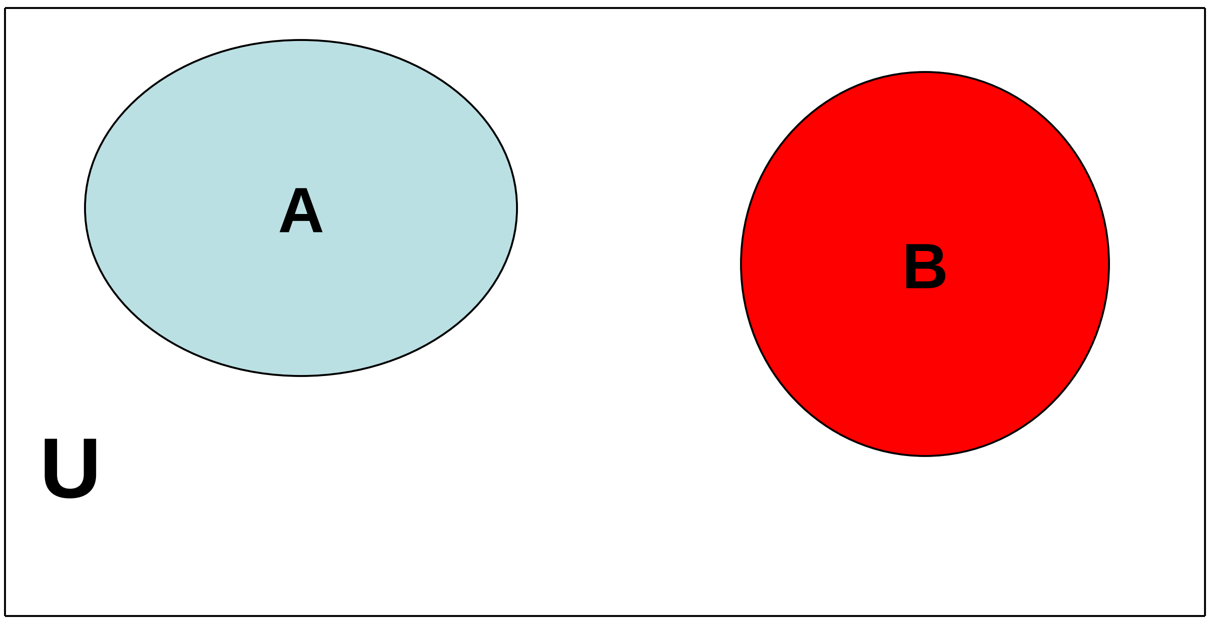
- **<u>Venn Diagram</u>**: A diagram consisting of various overlapping figures contained in a rectangle called the universe.



This is an example of **all A are B**. (If A, then B.)

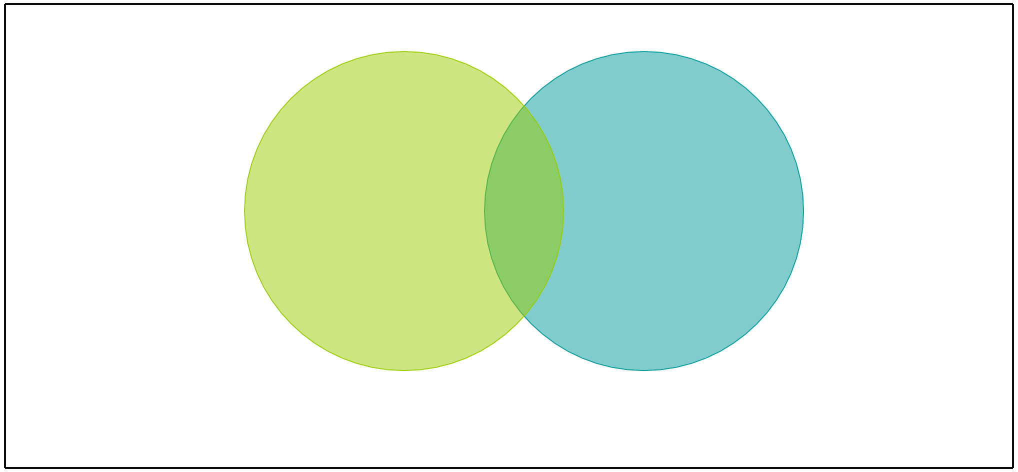
Venn Diagrams

This is an example of No A are B.



Venn Diagrams

This is an example of some A are B. (At least one A is B.)



The yellow oval is A, the blue oval is B.

Example

- Construct a Venn Diagram to determine the validity of the given argument.

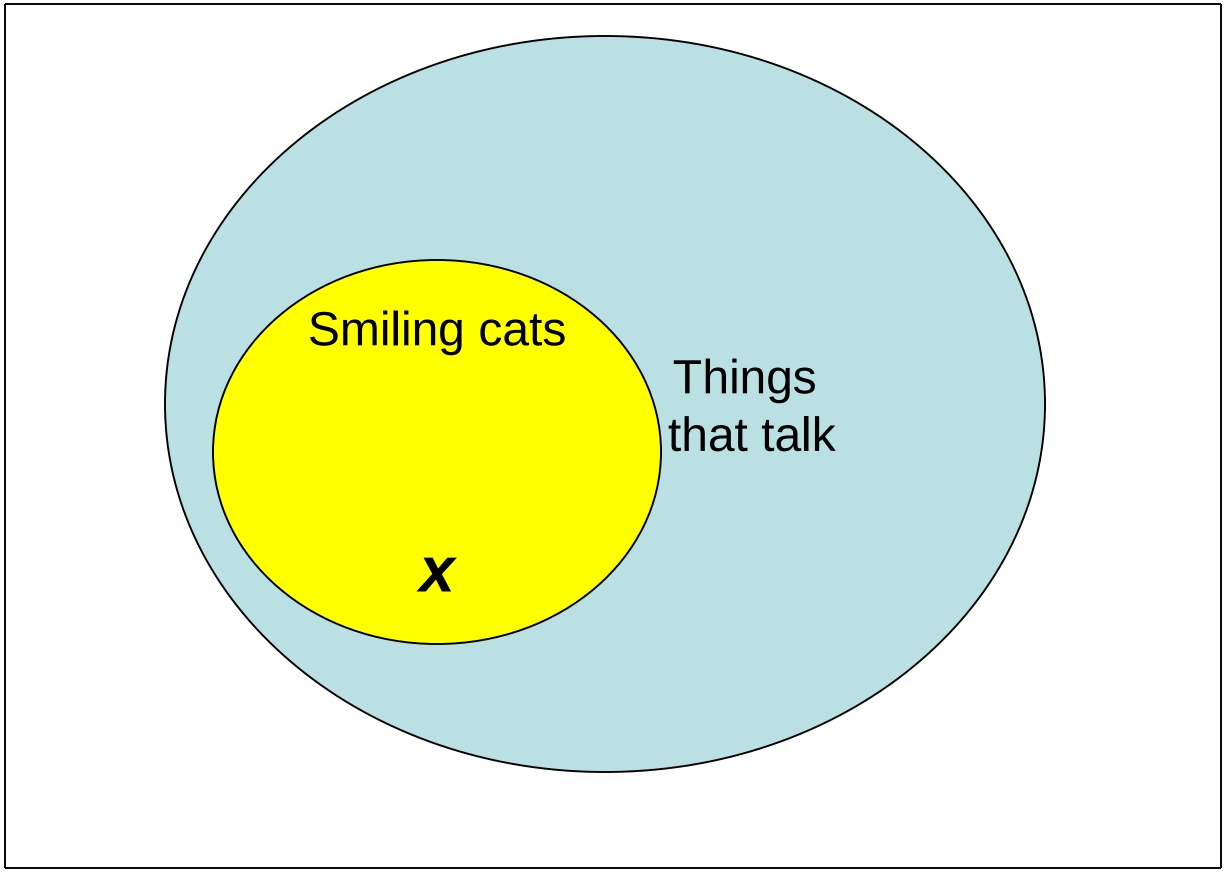
#14 All smiling cats talk.

The Cheshire Cat smiles.

Therefore, the Cheshire Cat talks.

VALID OR INVALID???

Example
Valid argument; ***x*** is Cheshire Cat



Examples

- #6 *No one who can afford health insurance is unemployed.*

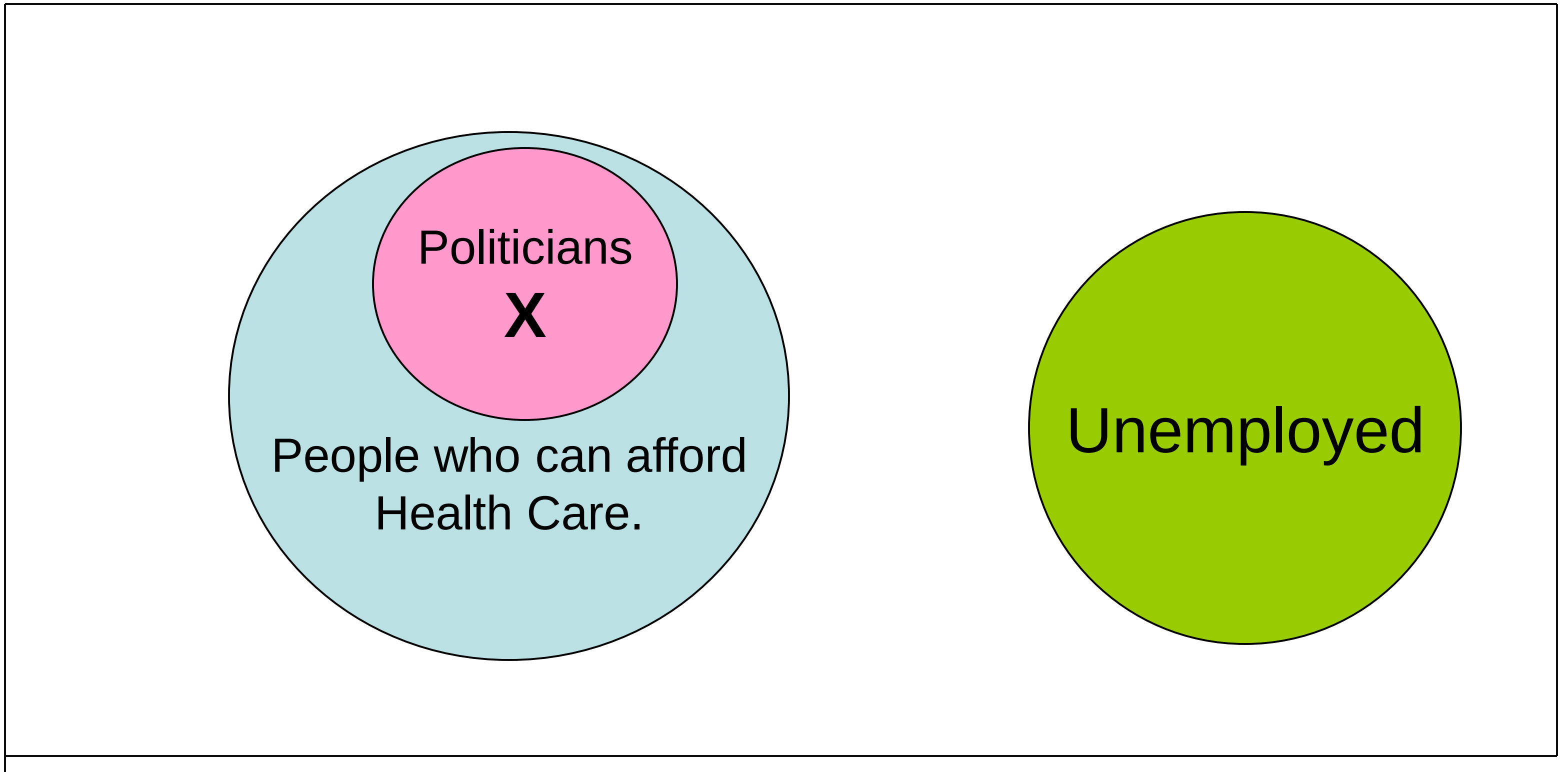
  All politicians can afford health insurance.

  Therefore, no politician is unemployed.

VALID OR INVALID?????

Examples

X=politician. The argument is valid.



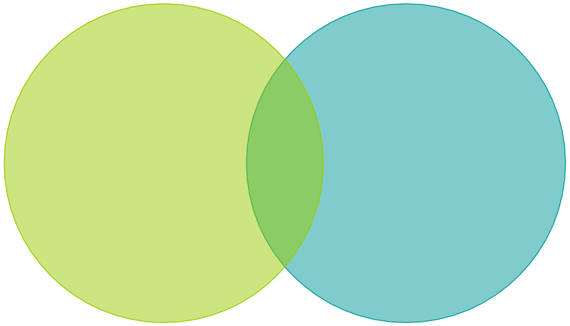
Example

- #16 *Some professors wear glasses.*

  Mr. Einstein wears glasses.

  Therefore, Mr. Einstein is a professor.

  Let the yellow oval be professors, and the blue oval be glass wearers. Then x (Mr. Einstein) is in the blue oval, but not in the overlapping region. The argument is invalid.



Inductive Reasoning

Inductive Reasoning, involves going from a series of specific cases to a general statement. The conclusion in an inductive argument is never guaranteed.

Example: What is the next number in the sequence 6, 13, 20, 27,…

There is more than one correct answer.

Inductive Reasoning

- Here's the sequence again 6, 13, 20, 27,…
- Look at the difference of each term.
- 13 – 6 = 7, 20 – 13 = 7, 27 – 20 = 7
- Thus the next term is 34, because 34 – 27 = 7.
- However what if the sequence represents the dates. Then the next number could be 3 (31 days in a month).
- The next number could be 4 (30 day month)
- Or it could be 5 (29 day month – Feb. Leap year)
- Or even 6 (28 day month – Feb.)