

# Discrete Mathematics - Class 7- Feb. 3, 2004

Logic: Deals with proofs. Givens- $\rightarrow$ Argue- $\rightarrow$  Conclusions

For example: Gravity has a downward pull

Weight is subject to gravity

An object has weight

The object will fall down if released above the floor

Another example: **Givens**

1. God is Love
2. Love is Blind
3. Ray Charles is Blind

**Argument:** (Supports Conclusion)

**Conclusion:** Ray Charles is God.

*Additional Givens:*

1. If you are Ray Charles, then you are blind.
2. If you are love you are blind.
3. If you are God you are love

- *If I further accept as given that Ray Charles is the only blind person/thing/being then the conclusion does follow.*

**Definition:** A proposition is a sentence (statement) which is unambiguously true or unambiguously false.

## **Propositions**

1.  $2+2=4$
2.  $13<7$
3. There exists positive integers (a,b,c) and an integer n such that  $a^n+b^n=c^n$
4. There exists positive integers (a,b,c) such that  $a^2+b^2=c^2$
5. All even numbers are the sum of 2 prime numbers except for two.

## **Not Propositions**

1.  $3 + X = Y^2$
2. All fish = 19
3.  $a^2 > 13$
4. What time is it?
5. Read this carefully.

**An argument consists of a series of logical steps (generally, syllogisms) which derive the truth of some proposition from the assumed truth of some given propositions.**

Example:

**Given:** Bill Clinton is 3ft tall.

You have to be at least 4'6" to ride the wonder-whirl.

**Conclusion:** Bill Clinton can not ride the wonder-whirl.

There is a valid argument here even though in reality one (or both) of the givens are false.

**Note: Propositions are one thing.  
Arguments are another.**

**Example:**

- I. Either THIS or THAT is true.
- II. The OTHER THING is false.
- III. THAT is false.
- IV. Either THIS or THE OTHER THING is true.

**Conclusion:** THIS is true.

Argument: III says that THAT is false so by I, THIS must be true. Similarly, II says that the OTHER THING is false so by IV, THIS is true.

**Another example:**

- I. If THIS is true, then THAT is true.
- II. Not both THAT and IT are true.
- III. Either IT is true or THE OTHER THING is true.
- IV. THE OTHER THING is false.

**Conclusion:** By IV THE OTHER THING is false, so by III, IT is true. So by II, THAT is false.

**Reverse implication by switching true and false**

By switching true and false you can reverse the direction of the arrow. For example If you are promised an "A" from the professor if you study hard, then if you don't get an A you can assume that you did not study hard.