Discrete Mathematics --- Day 10 --- September 17, 2004

Sets- A collection of objects.

- Sets are well defined- Know what elements are in the set and are not unambiguously.

Sets are written two ways
Explicitly- X={a,b,x,y,t}
This means set X contains five elements which are a,b,x,y,t

We use braces before each element and after the last element in a set.
Set Y=**{** 13,31,40,4 **}**

X is a set

eg. X+Y=? This makes no sense because X and Y are sets and we haven't defined "+" for sets.

Set Builder Notation

$$A=\{x\in X \mid p(x)\}$$

A= set's name
x=dummy variable(only in loop)
X=Universe of discourse for P's variable
p(x)=predicate

$\in$ = If A is a set and a is an element of the set A, we write it
$a\in A$ (English : a is an element of A)

eg. $A=\{x\in X \mid p(x)\}$ born in May
A={Jason, Ryan}
(same set, with definitions written differently)

Jason and Ryan are the ones born in May, in our class.

If X is a set, the |X| denotes the number of elements of x, called the "size" or "cordinality" of X.

For example above |X|=5, |Y|=4, |A|=2

eg.

$X=\{\text{integers } x \mid x^2=4\} = \{-2,2)$(to make $x^2=4$, -2 and 2 can be squared to equal 4 so therefore the size of the set would be:
|X|=2

Some common sets:
N = {0,1,2,3...} natural numbers
Z = {...-2,-1,0,1,2...} integers
Q = {p/q | pEZ, qEZ, a≠0} rational numbers
R ={all numbers on the number line} real numbers

FYI: **Z** is short for the German word Zahlen

Is $(\sqrt{2})^{\sqrt{2}}$ rational?

Suppose the answer is YES-
Then I have an irrational number to an irrational power being rational
Suppose the answer is NO-
The $(\sqrt{2})^{\sqrt{2}}$ is irrational. So raise it to the √2 power and it equals 2
So again we have irrational to an irrational power being rational.

Real answer: Nobody knows

{ x∈**Z** | x/2∈**Z**} = x= set of even numbers (multiples of 2)
(size of |X|=infinity (bigger than any natural number)
*note: infinity is not a number
*note: the symbol for infinity "∞"

subsets: If A and B are sets, and each element of A is also an element of B, then we say <u>A is a subset of B</u>, written A ⊆ B

also say
- B contains all of A's elements

eg. {1,2,3} ⊆ {1,2,3,4,5}= True
{2,4,6} ⊆ {1,2,3,4,5}= False because of 6

Suppose A ⊆ B and B ⊆ A. Then the sets are equal A=B.

We need to define what it means for two sets to be equal.
Definition: For sets A,B, we say A=B if
For all x (x(A↔ x∈B)

↔ = if and only if