Welcome

CSCI 150

course web site: http://www.cs.hunter.cuny.edu/~saad/courses/dm

email: saad@hunter.cuny.edu

office hours: TBA

Important things: CUNYfirst email (make sure you read it)

Gradescope: 1) Sign up as student gradescope.com

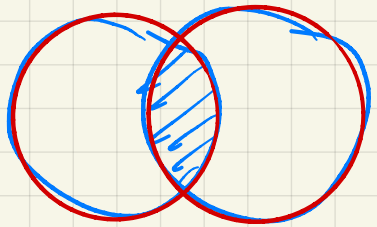
2) Add yourself to course code: M5GXYK

Discrete Math

Math of computing / algorithms

Math for everyday / puzzles

- counting / combinatorics
- Proofs (no math without proofs)
- Number theory (study of integers and their properties)
- Functions / relations / set theory



- Graph theory

Some Questions / topics in Discrete Math

1) Birthdays

In a room full of people, what's the prob. of finding two with the same birthday

(counting)

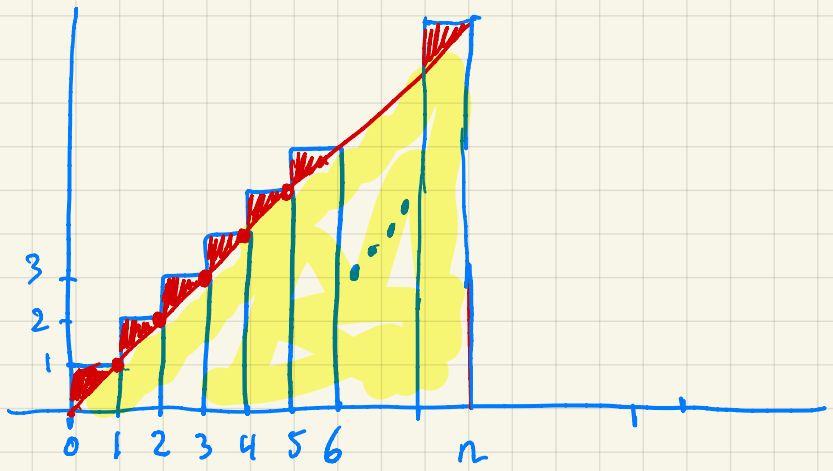
2) Primes (finite or infinite ?)

(proof)

3) Fibonacci Series: 0, 1, 1, 2, 3, 5, 8, 13, 21, ...

Recurrences / Proof by Induction

4) Sums: $1+2+3+\cdots+n$



$f(x)=x$

$$\int_0^n f(x)\,dx = \frac{n^2}{2} \neq$$

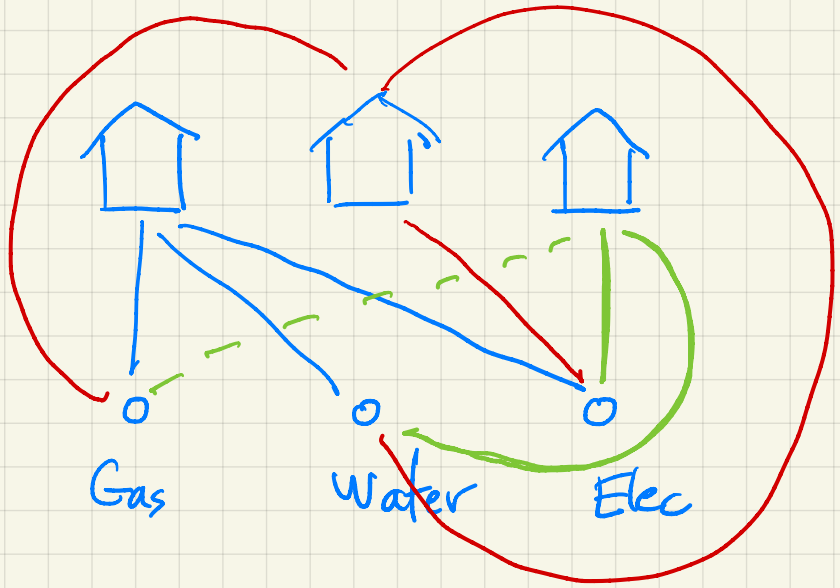
total area: $\frac{n^2}{2} + n \times \frac{1}{2}$

$$= \frac{n^2+n}{2} = \frac{n(n+1)}{2}$$

$$1+2+3+\cdots+n = \frac{n(n+1)}{2}$$

Example: $n=5$: $1+2+3+4+5 = \frac{5\times 6}{2} = 15$

5)



Connect all houses to all utilities with no overlap

Puzzle is unsolvable

We need math to prove it.

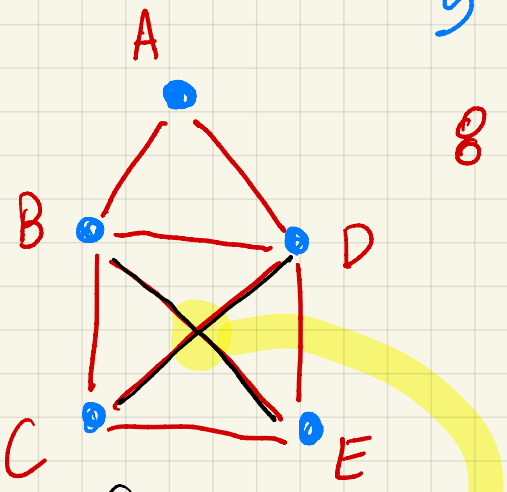
Planar Graphs.

- What are graphs.

  pairwise relations

  vertices: objects

  edges: connections, relation.



(overlap)

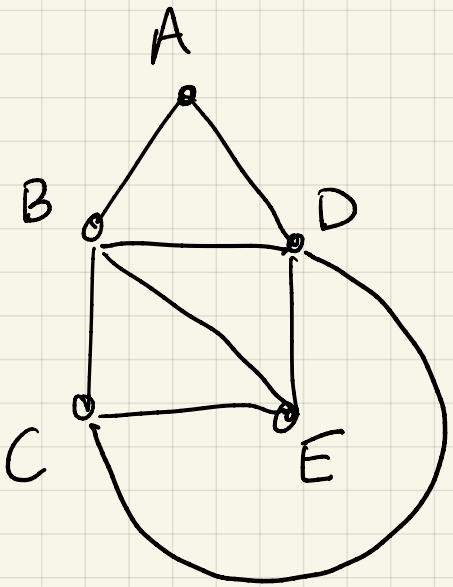
5 vertices

8 edges

List edges: (A,B), (A,D), (B,D)

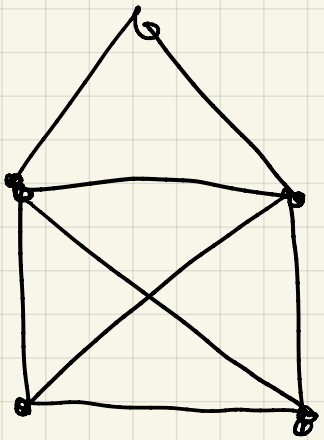
(B,E), (B,C), (C,D)

(C,E), (D,E)

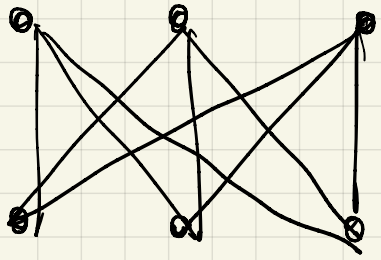


(no overlap)

A graph is planar if you can draw it with no overlap

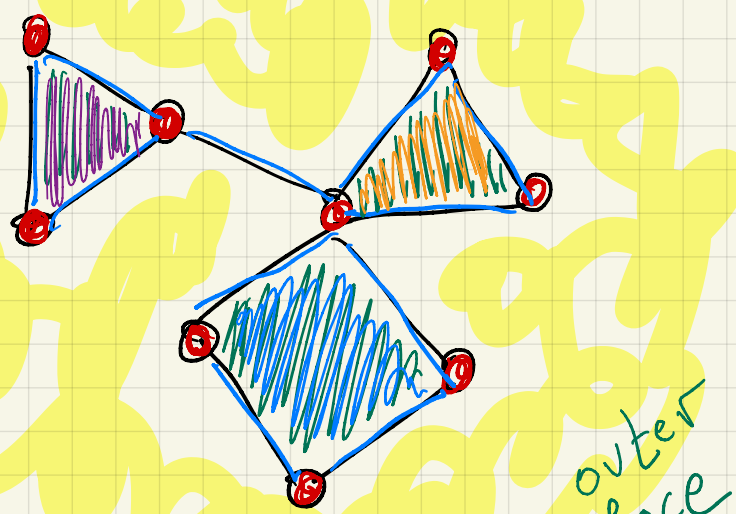


This graph is planar because I can redraw it with no overlap



this graph is NOT planar because no matter how hard you try you cannot redraw it without overlap

A Property of Planar Graphs: Euler's Formula



Face:
Area on plane where you can move without crossing any edges

Count:

9 vertices

$V = 9$

11 edges

$e = 11$

4 faces

$f = 4$

$V - e + f =$

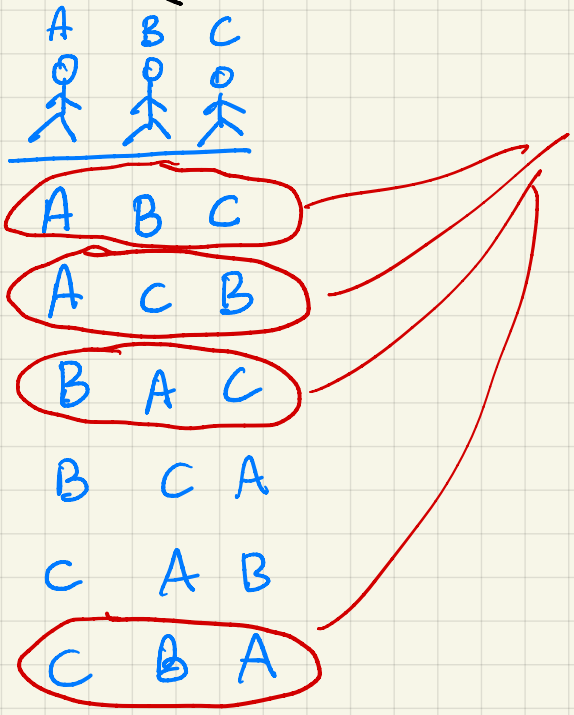
$9 - 11 + 4 = 2$

Planar Graphs:

$$V - e + f = 2$$

Always true for planar graph

6) Lazy Professor (Doesn't want to grade, permute tests among the students)



$3! = 6$

In general:
What is the prob. that we end up with bad permutations?

Listing all permutations is NOT feasible.

permutations for n objects:

$$1 \times 2 \times 3 \times \cdots \times n = n!$$ (n factorial)

Example: $n=3$: $1 \times 2 \times 3 = 6$