<u>Meeting schedule</u>

Meetg will open ~8:40 begin at 9
"Formal" lecture portion end at or before 10:00

Check Questionnaire in email

Syllabus has been revised (website)

exams: take home, open book, turned in on Sakai

<u>Format:</u>

will give ~10 minute videos Tues/Fridays (most of the time)

& worksheets → guide discussions dury group meetgs

Some weekly HW's. via Sakai

Graph thy & epidemiology

geographic/spacial distribution

distance (cities) (houses)

continuous

graph thy

vertices — locations

edges (lengths) — neighbouring areas

gph thy used to give a language to describe proximity of areas & socioeconomic status

models distribution of medical care.

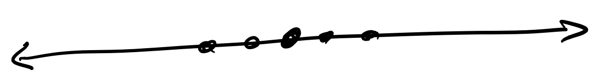
Recent epidemiological paper

Q: when do we expect actual exponential growth in a disease outbreak?

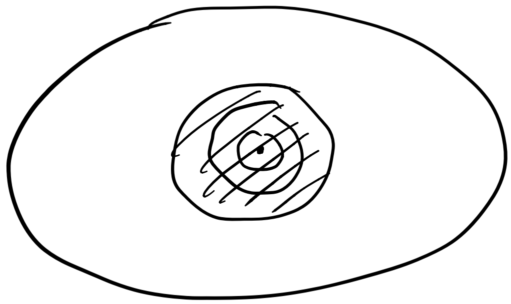
$$y' = \lambda y \rightsquigarrow y = Ce^{\lambda x}$$

assumption — "homogeneity"

at every pt in time, infected people are in contact w/ same # of uninfected.



$$y' = \lambda \rightsquigarrow y = Ax + B$$



$y = \text{Area}$

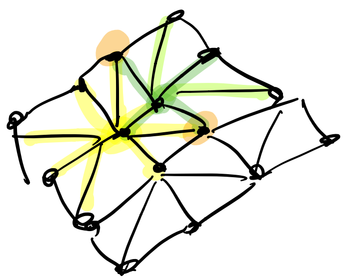
$y' = \text{perimeter}$

$y' = \lambda\sqrt{y}$

3

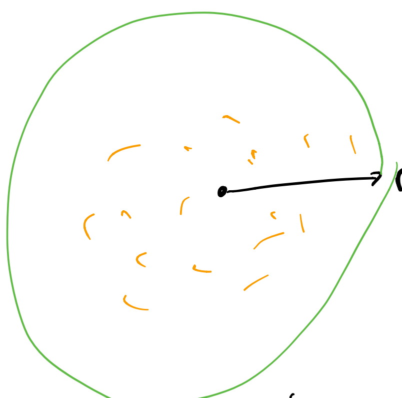
$y = Ax^2 + B$

dim n $\quad y = Ax^n + B$



paper computed "dimension" of graph of human interactions

~ 2.25



r

$\sim r^2$ dots in circle

crumple

"Fractal dimension"

"Hausdorff dimension"

$\sim r^k$ $\quad 2 \le k \le 3$

<u>Recall:</u> if $u,v \in V(G)$ $\partial(u,v)$ = minimum length of a u-v path in G

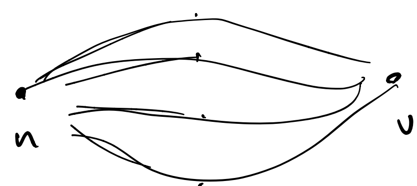
given v, can define $B_r(v) = \{u \in V(G) \mid \partial(v,u) \le r\}$

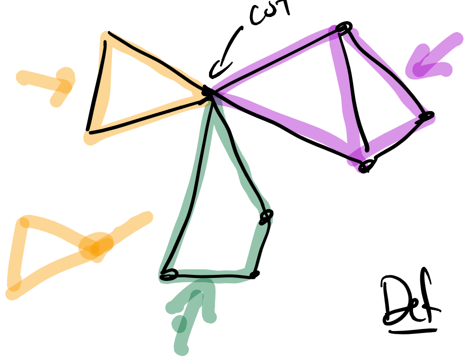
$\# B_r(v) \sim r^d$ some d = "dimension"

Goal: Menger's theorem

relates ideas of connectedness/separability

with throughput/flow capacity





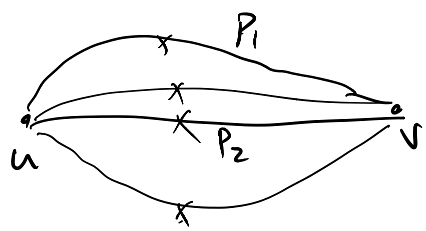
Vertex cut: (lecture 10)

a subset $S \subset V(G)$

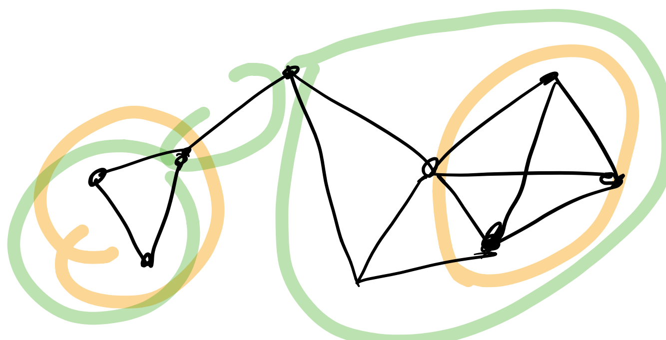
s.t. $G-S$ is disconnected

<u>Def</u> a u-v separating set is a vertex cut S s.t. u,v on different components of $G-S$ $(u,v \notin S)$

Theorem (Menger) let u & v be nonadjacent. The minimum size of a u-v separating set = the maximum # of mutually internally disjoint u-v paths.



P_1, P_2 share no vertices in common except u & v.



Previously:

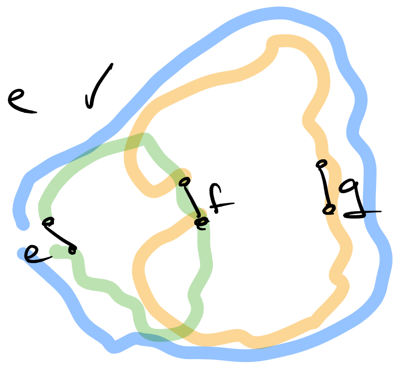
Def: A block = maximal nonseparable subgraph

Thm: A graph is nonseparable if and only if every pair of vertices lies on a common cycle.

Define an equivalence relation on edges of a graph:

we say $e \sim f$ if e & f lie on a common cycle.
or $e = f$

- reflexive? $e \sim e$ ✓
- symmetric? $e \sim f \Rightarrow f \sim e$ ✓
- transitivity? nontrivial.



Magical Result:

equivalence classes $\longleftrightarrow$ blocks
are maximal nonseparable subgraphs.

$[e] = \{ f \in E(G) \mid f \sim e \}$

e in H, nonseparable, $e \sim f$ can add stuff to H, including f, to get a possibly larger nonsep. subgraph.

Conversely, can show any e, f in same block must be equivalent ($e \sim f$)