QUIZ 3

1 > 2 > 3 > 4

→ 1: a > b > ∅
  2: c > a > d > ∅
  3: c > ∅
→ 4: a > b > ∅

①
  1: a
  2: c
  3: ∅
  4: b

②
  4: a
  3: c
  2: d
  1: b

1 − P(2:a) ²

④
  1: 11/24
  2: 2/24
  3: 0
  4: 11/24

③ 1/2

3   2   14
3   2   41

Networks

shorturl.at/hyAH8
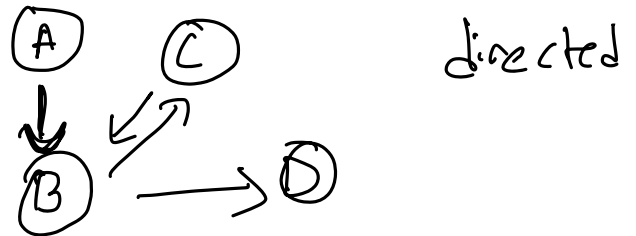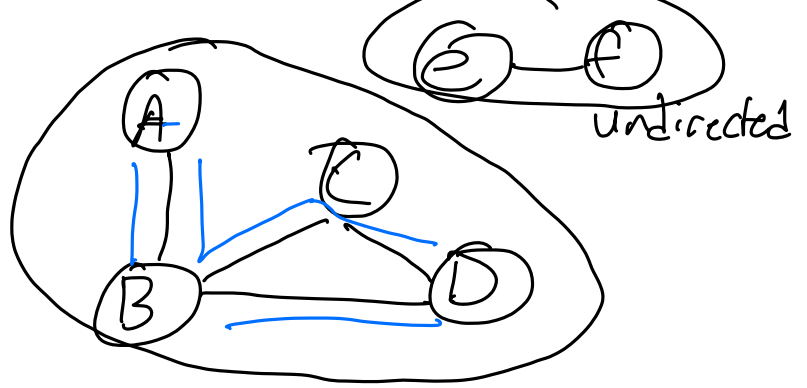
You have : 281

Your friend : 290

Friendship paradox = why your friends have
more friends than you do.

Intro to networks

Graphs/Networks

(V, E)

↑ vertices / Nodes

↑ edges

undirected

directed

- road network, subway
- friendship, follower
- the internet

Properties of graph

① Node: <u>degree</u> how many friends to you have?

in-degree: how many followers?

out- : you follow

② <u>Path</u>: sequence of nodes to go from one node to another

two nodes are <u>connected</u> if there's a path from one to the other

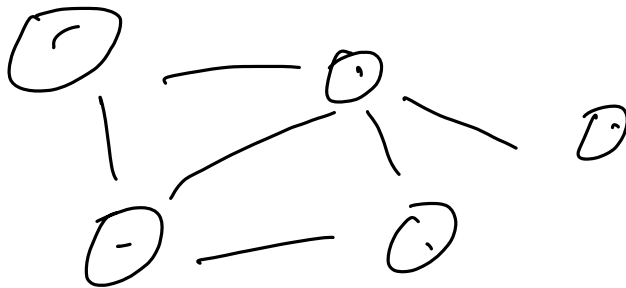③ graph is <u>connected</u> if all nodes

are connected to each other.

#connected components is low

FB: 90+ % , 15 %.
      >99.99 %

┌─────────────────────┐
│ giant component   │
└─────────────────────┘

⑤ distance b/w 2 nodes:
        length of the shortest path
             between them.

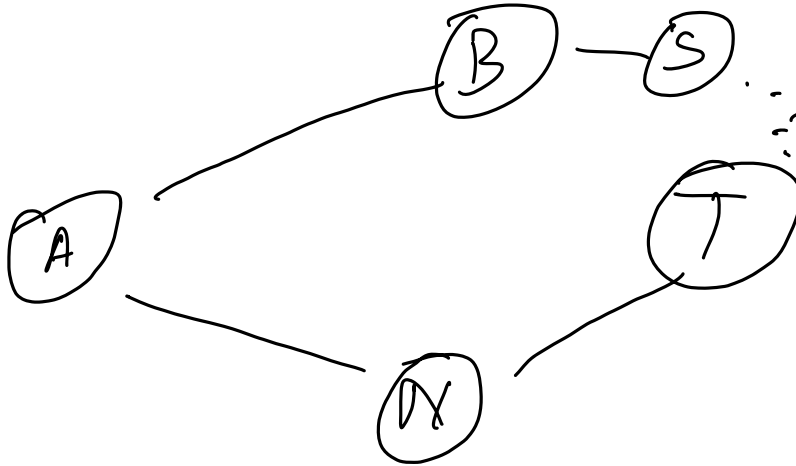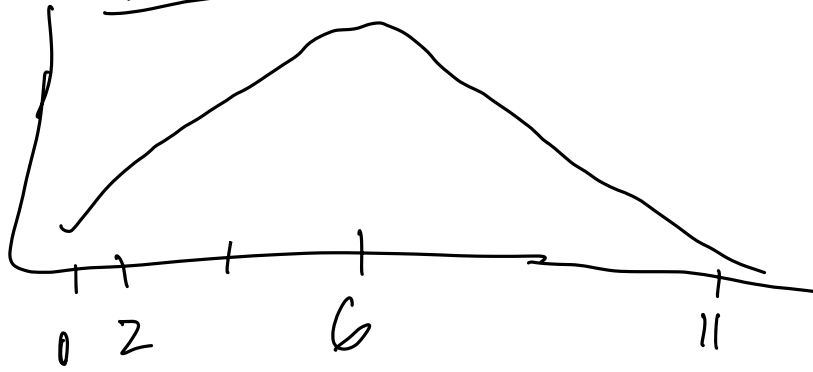   How far are you frm the farthest person
→)   in the component?

      → 4 or 5 or 6

1960s : ┌─────┐   ┌──────────────┐
         │ 296 │   │ target node │
         └─────┘   └──────────────┘
          Name,   Boston, Stock broker
          Boston
          Stock broker

200, 296, 250   SD

64

0 2   6   11
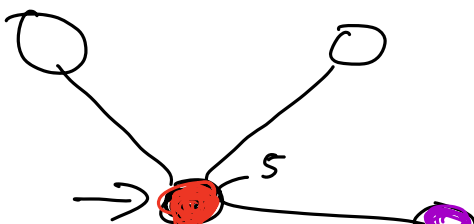

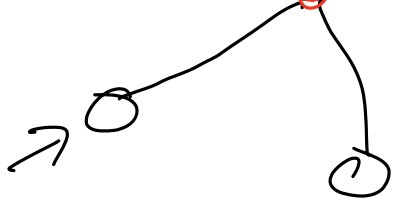→ ① do you know the graph?

②

⟹ Phd — at most weekly

⟹ 3x/week

Friendship paradox.   12/21

"hub + spoke graph"
" star graph"

5

Each node has d_i friends

ratio of $\left[\dfrac{\#\ i\text{'s friends}}{\text{average }\#\text{ of }i\text{'s frnd's friends}}\right] = \dfrac{d_i = l}{\left\{\dfrac{5}{\ }\cdots\right\}}$

for all
i that is not
the center
for 5 ppl.

only for 1 person: $\dfrac{5}{\frac{1}{5}\left[1+1+4+1+1\right]}$

Classroom size paradox

→ • average class size 25

⇒ • most of your classes have 65-
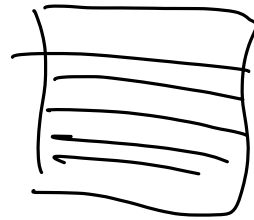200 ppl.

"Inspection paradox"
↗

2 classes   100   2

→ website: $\dfrac{102}{2} = 51$

⇒ you $\dfrac{100}{102}\cdot 100 + \dfrac{2}{102}\cdot 2$

Algorithms on graphs

- tabular data
- image data
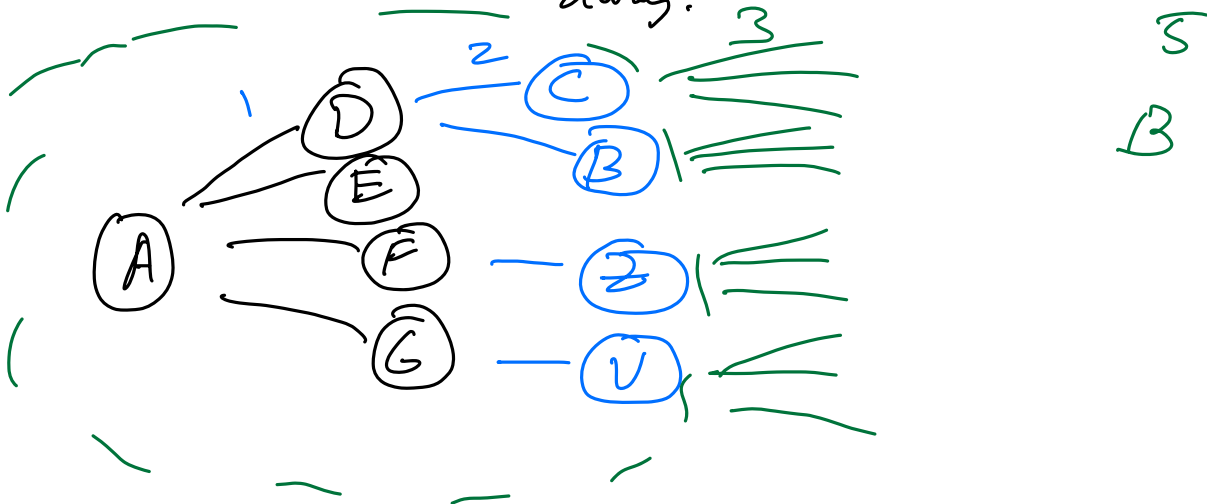- text data
- graph data

Breadth first search

→ ① starting at node A, who all can I reach? ("who am I connected to")

→ ② How many people are at most 2 hops away from me?

→ ③ Is node B less then 5 hops away?
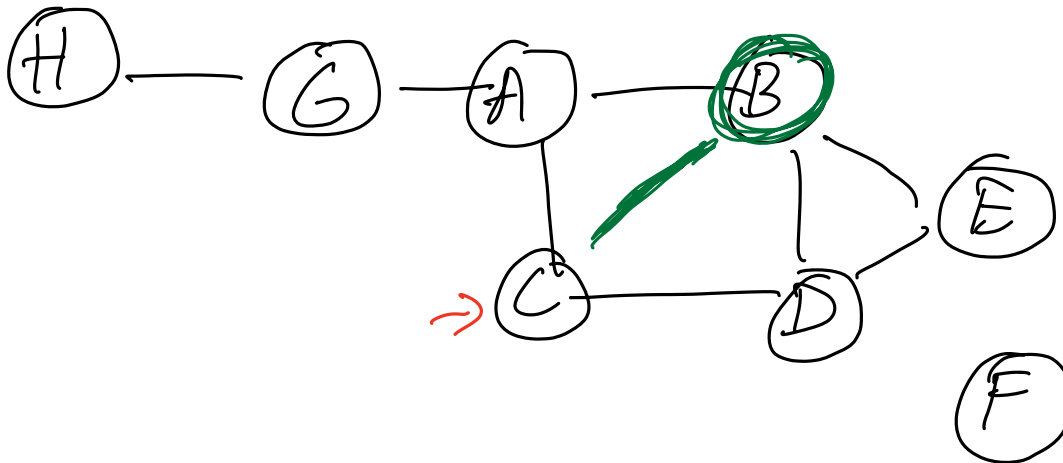
A*

Facebook — "mutual friends"

"Social graph"

Recommendations using graphs.

[Triadic closure]

- How do you recommend a friend to someone?

- "who to follow"
- "People you may know"
-

$\approx v_A \cdot v_B$

$$\begin{array}{c} \\ A \\ B \\ C \\ D \\ E \\ F \end{array} \begin{array}{c} A\,B\,C\,D\,E\,F\,G... \\ \left[\begin{array}{c} \textcircled{1} \\ 10^9 \times 10^9 \end{array} \right] 10^{18} \end{array}$$

$$\begin{array}{c} & 10 \\ A & [\,-\,\cdot\,\cdot\,\cdot\,] \\ B & [\,\cdot\,{}^{10}\cdot\,] \\ C & [\quad 10\quad] \\ \vdots & [\,10\,] \end{array}$$
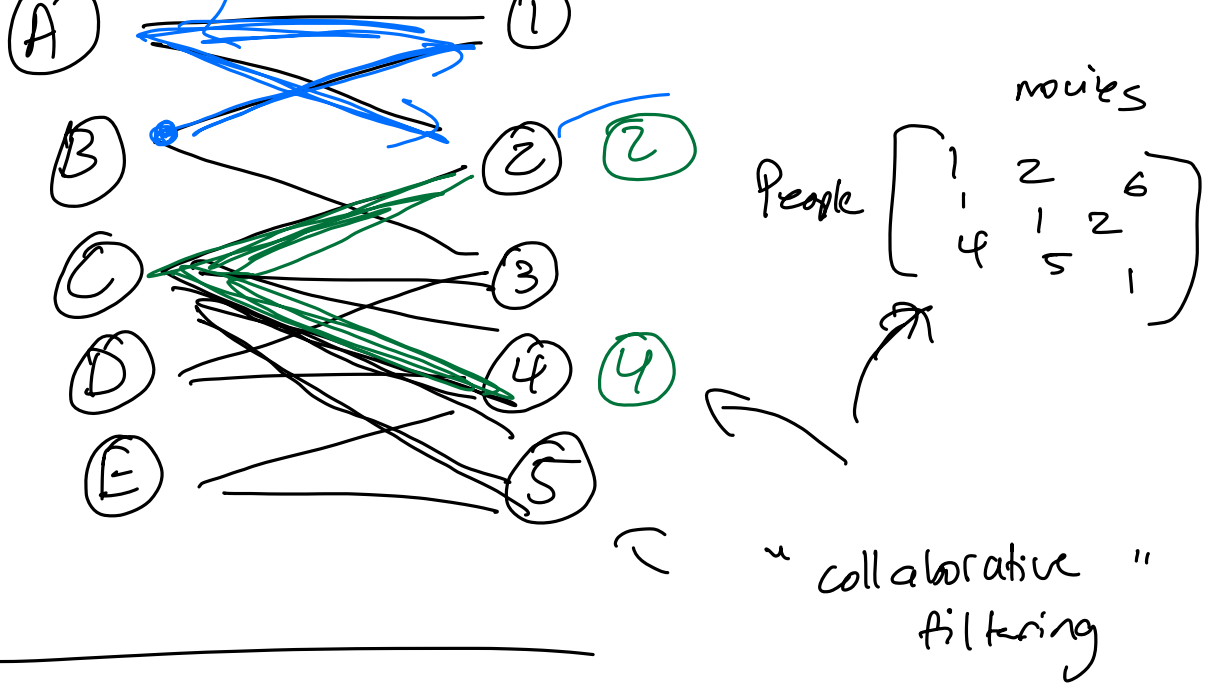
• Social networks have way more triangles than they should.

$10 \cdot 10^9$

Product recommendation

⌄ People   movies

movies

People $\begin{bmatrix} 1 & 2 & 6 \\ 4 & 1 & 2 \\ & 5 & 1 \end{bmatrix}$

"collaborative" filtering

Page rank

Lacry Page

content - based

sneakrs.corrmg

walmart

Nike

amazon

nikhit's Sneaker Store