Project Option

As an alternative to the final exam, you can choose to do a project.

Canonical choices:

- Report / essay about further graph theory topic theoretical thing / application
- Writing a program to implement some algorithm using graph theory.
- Other ideas are fine

Procedure:

- Make a proposal to me.

Grading:

- If it is reasonable evidence that effort has been made towards project goals = A

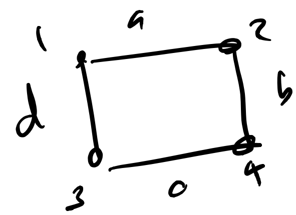
- Else final (in theory)

Projects due anytime between
2 wks after proposal & final exam date.

Graph theory, Level 3

Everyone has their own definition of what a graph is.

Def A graph is a pair (V, E) V a finite, nonempty set
and E a set together with an injective map
$E \to \mathcal{P}_2(V)$ such that . . . (stuff)



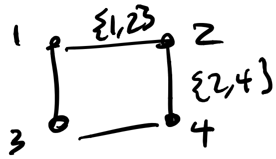
$\{a,b,c,d\} \to \mathcal{P}_2(\{1,2,3,4\})$

$a \mapsto \{1,2\}$

etc.

Def A graph is a pair (V,E) V a finite nonempty set.

$E \subset \mathcal{P}_2(V)$ such that . . .



Def A graph is a matrix ($n \times n$ some n) w/ entries 0, 1
s.t. $a_{ij} = a_{ji}$, $a_{ii} = 0$

Def A graph is a pair $(V, \sim)$ V a finite nonempty set
$\sim$ a relation on V $(\sim \subset V \times V)$
$\sim$ symmetric $a \sim b \Leftrightarrow b \sim a$
anti-reflexive $a \not\sim a$.

One approach to see these are "the same"
All have concept of "subgr*ph"
All have concept of "isomorphisms"

Def A morphism (arrow) between two gr*ph
$G \longrightarrow H$ is a subgr*ph $H' \subset H$
together with an isomorphism $G \underset{\varphi}{\cong} H'$

Q: Is there a gr*ph G such that it has no
morphisms $G' \longrightarrow G$ except when $G' \cong G$?
$G \cong \bullet$

$V(G)$ = morphisms $\bullet \to G$

<u>Edges?</u> $\bullet\!-\!\bullet$ G

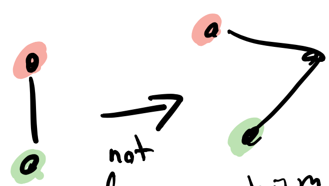
can say G is a graph w/ exactly two morphisms $\bullet \to G$

doesn't have the prop.

$v_1 \bullet \quad \bullet\, v_2$

property that any map $v_2\bullet \longrightarrow H$, $v_1\bullet \longrightarrow H$

determines a map $(v_1\bullet \quad v_2\bullet) \longrightarrow H$



not from a morphism.

The concept of a "category of graphs"

is encoded in

"objects" graph, graphs, . . .

"arrows" $G \to H$

Are we talking about an equivalent cat of graphs

__Def__ A category is a collection of objects & arrows (directed graph, but possibly __very__ infinite)
together with a composition law for arrows

$$\begin{tikzcd} G \arrow[r] \arrow[rr, bend right] & H \arrow[r] & K \end{tikzcd}$$