MA111: Contemporary mathematics

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Schedule:

• Exam 3 is Monday, Oct 24th, during class.

Today we will introduce some graphs and Euler circuits.

Chapter 5 overview

- Graphs have vertices and edges between the vertices
- Vertices can be virtually anything; a graph only knows which pairs are related and which are not
- We'll be looking at a chain of relations:

$$(A,B) \rightarrow (B,C) \rightarrow (C,D) \rightarrow (D,A) \rightarrow (A,C) \rightarrow (C,E) \rightarrow \dots$$

- If the chain includes all the relations (exactly once, and no non-relations), then we call it an Euler path
- Very easy way to tell if they exist
- Reasonable ways to find them when they exist

5.1: Example problems

- When I move to a new place, I need to walk through every doorway
- It loses some newness if I go through a doorway more than once
- Can I tour the doors of the house without repeats?



5.1: Example problems

- I forgot the toilets and closets.
- Can I tour the doors of the house without repeats now?

а	А	С	E e
b	В	D	F f

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- If we only let the people in this room play, how many times can you get rid of the toy?
- Can the toy get stuck before everyone has gotten rid of the toy?



On patrol again

- Can the postal carrier walk every street exactly once
- They should start and end at the Post Office



These are all the same question

- Mathematics looks at many different problems and finds the common structure
- A strategy to win all similar games
- The house has doors that connect rooms
- The Mr. Blik game has exchanges between people
- The postal carrier has roads between intersections
- The generic has **edges** between **vertices** we want to travel over all edges

The house as a graph

• A simpler picture



• The connections are the same in both pictures

The house with toilets as a graph

• A simpler picture



• The connections are the same in both pictures

The mean way to play the game



• What if you got points for how many times you got rid of the toy?

- "Give it to Jack" is a terrible strategy, since it'll get stuck (And Jack will get 70 points!)
- Get in groups of 4 to 5 and figure out how to pass the toy for the maximum number of points

• Be prepared to draw your solution at the board

The postal patrol



• Draw a graph that can be traced

• Draw a graph that obviously can't be traced

• Draw a graph that can't be traced, but that might take a 5 yr old a little time to figure out

• Be prepared to draw at the board!

Can these be traced?





Can these be traced?



