CS 473 Fall 2013	Marceline Abadeer (mabadeer)
Homework 0 Problem 1	Finn Mertens (fmertens)
Return section: M4	Simon Petrikov (petrikov)

(a) Prove that every balanced string is erasable.

(b) Prove that every erasable string is balanced.

(a) **Solution (induction):** Let x be an arbitrary balanced string. There are several cases to consider:

- Blah
- Snort
  - Squee
  - Flub
- Kronk

In all cases, x is erasable, as required. ■

(b) **Solution (combinatorial):** This result follows immediately from Flobbersnort's Fundamental Theorem of negative-dimensional motivic k-schemes, which is in turn an obvious consequence of Flibbertygibbet's Cocohohomomolology Lemma, as described in footnote 17 on the back of page 213 of Jeff's induction notes. ■

CS 473 Fall 2013	Marceline Abadeer (mabadeer)
Homework 0 Problem 2	Finn Mertens (fmertens)
Return section: M4	Simon Petrikov (petrikov)

(a) Prove that every tournament contains a Hamiltonian path.

(b) Prove that every tournament contains either *exactly one* Hamiltonian path or a directed cycle of length three.

Solution (Lazy Sunday): You thinkin' what I'm thinkin? **NARNIA!** Man, it's happenin'!

> But first my hunger pains are stickin' like duct tape.
> Let's hit up Magnolia and mack on some cupcakes.
> (No doubt that bakery's got all da bomb frostings)[1]

$$2 \rightsquigarrow 6 \rightsquigarrow 12 \rightsquigarrow 13$$

I told you that I'm crazy for these cupcakes, cousin!

(a) Yo, where's the movie playin'? Upper West Side, dude.

- Well, let's hit up Yahoo! Maps to find the dopest route.
- I prefer MapQuest. That's a good one, too.
- Google Maps is the best. True that. DOUBLE TRUE!

(b) Yo, stop at the deli. The theater's over-priced. You've got the backpack? Gonna pack it up nice. Don't want security to get suspicious.

$$\boxed{\text{Mr. Pibb} + \text{Red Vines} = \textit{crazy delicious!}}$$

(c) I'll reach in my pocket, pull out some dough. Girl actin' like she never seen a ten before. **It's all about the Hamiltons, baby.** Throw the snacks in a bag, and I'm ghost like Swayze.

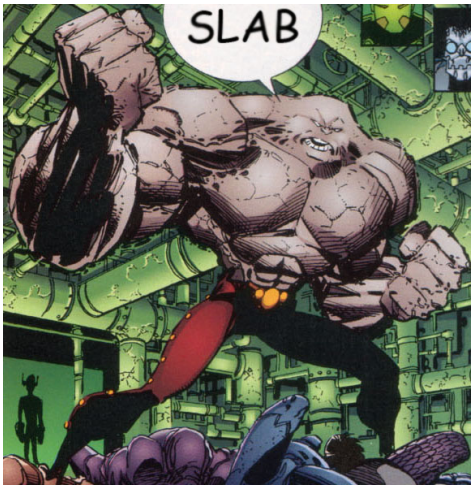
Roll up to the theater, Ticket buying, what we're handlin'. You can call us Aaron Burr from the way we're droppin' Hamiltons. ■

[1] I love those cupcakes like McAdams loves Gosling

CS 473 Fall 2013	Marceline Abadeer (mabadeer)
Homework 0 Problem 3	Finn Mertens (fmertens)
Return section: M4	Simon Petrikov (petrikov)

Describe and analyze a data structure for a set P of points in the plane that can quickly answer queries asking for the highest point in P inside a given vertical slab.

Solution: Here is a description of our data structure, which clearly has exponential size:



And here is a description of our query algorithm, which clearly runs in $O(1)$ time:

■