1. Solve Problem 5 on the midterm (Drunken Debs)

2. Solve Problem 2 on the midterm (Amortized Analysis with counter)

3. Problem 17-2 (Making Binary Search Dynamic)

4. Problem 22-4 (Reachability) ¹

5. Professor Curly conjectures that if we do union by rank, without path compression, the amortized cost of all operations is $o(\log n)$. Prove him wrong by showing that if we do union by rank without path compression, there can be $m$ MAKESET, UNION and FINDSET operations, $n$ of which are MAKESET operations, where the total cost of all operations is $\theta(m \log n)$.

6. Assume you are given a connected graph $G$. Give an algorithm that returns a vertex $v$ in $G$, such that if $v$ is removed, $G$ is still connected. Motivation: $G$ might represent a social network at a company and you want to choose some unlucky person to fire whose removal will not disconnect the company network.

7. Professor Moe conjectures that for any graph $G$, the set of edges $\{(u,v) : \text{there exists a cut } (S,V-S) \text{ such that } (u,v) \text{ is a light edge crossing } (S, V-S)\}$ always forms a minimum spanning tree. Given a simple example of a connected graph that proves him wrong.

8. Exercise 23.1-2 (“Professor Sabatier conjectures”)

9. Exercise 23.1-3 (“Show that if an edge $(u,v)$ is contained in some minimum spanning tree”)

¹The answer to this problem can be used in an efficient randomized algorithm for estimating the *number* of vertices that are reachable - we may see this later in this class.
10. Exercise 22.2-6 / 22.2-7 ("There are two types of professional wrestlers")