This homework assignment is due at the beginning of class on Wednesday, January 22. Please bring a neat, legible hard copy of your work with you to class. If your homework is multiple pages long, please staple the pages in the correct order.

Homework guidelines: While you are welcome to discuss the homework problems with your classmates and you are strongly encouraged to seek help from me, after discussing the problems with others, you must write your own solutions. On work you turn in, you should acknowledge your collaborators by writing their names next to any problems you discussed with them. Write clearly and neatly (or type), giving thorough solutions that could be understood well by your classmates. Note that carefully communicating a solution is one of the most important parts of mathematics: if we can't convince others that our solution is correct, then our solution will not be accepted by the mathematical community.

After each solution, write a few sentences about your solution process: what was clear to you from the beginning, what did you have to think about more, what approaches did you take, what virtues of the ones we've discussed in *Math for Human Flourishing* did you feel were cultivated as you thought the problem and wrote your solution, etc. You do not need to answer all of these questions, but you should give a thoughtful explanation. Solutions without a sufficient reflection will earn an R.

Write solutions to THREE of the FOUR problems below.

1. A genie gives you given nine coins that look exactly the same, but one is fake. The fake one is a tiny bit heavier than the real coins. The genie also gives you a balance scale (such as pictured below) that disappears after exactly two uses. If you can correctly determine which coin is fake, you get to keep the remaining coins (note: the real coins are from an ancient shipwreck and are each worth one semester's tuition). How do you figure out which coin is the fake coin?

image credit: `https://www.flickr.com/photos/61056899@N06/5751301741`

2. Three pirates and three pastors come to a river bank and find a boat that will carry only two people at a time. They must all cross the river, but at no point (not even when some of them are in the boat at the shore and some are on the shore) can the pirates outnumber the pastors (if they do, the pirates will overpower the pastors and take them hostage). How can they all get across the river?

3. You're on a long journey and you come to a fork in the road. A sign there says that down one road is the City of Lies, the citizens of which always lie, and to down the other road is the City of Truth, the citizens of which alway tell the truth (the sign is certified by the Council of Truthtellers from the City of Truth). The sign also says that the person standing by it is from one of the cities (but does not specify which one) and will answer one question. What question can you ask this person to find out which way to go to get to the City of Truth?

4. Elwood paints a solid four-inch wooden cube orange on all sides and then cuts the cube into 1 inch by 1 inch cubes. Some of these have orange paint on 3 sides, some have orange paint on 2 sides, some have orange paint on 1 side, and some have orange paint on 0 sides. How many of each type are there?