Directions: You may work to solve these problems in groups, but all written work must be your own. **Show your work**; See "Guidelines and advice" on the course webpage for more information.

1. The mint where you work is really having problems. They downsized their operation so that they have just 6 machines called $M_1, M_2, \ldots, M_6$. Each machine is supposed to mint 5 gram coins, but sometimes the machines break and mint coins weighing only 4 grams. One day, the boss losses confidence in all of the machines, and wants to test them all. They may all be working perfectly, or they may all be broken, or it may be somewhere inbetween. There is a scale available, but the boss insists that it can only be used just once to generate a single reading. Again, there is no limit to the number of coins that can be used from each machine. How should you use the scale to determine which (if any) machines are broken?

2. [S 1.5.23] A *magic square* is an $n \times n$ array that contains each of the numbers from 1 to n^2 exactly once and has the property that every row and every column, and both of the main diagonals, sums to the same number. For example

8	1	6
3	5	7
4	9	2

   is a 3×3 magic square. Note that each row and column has sum 15. Find a formula for the magic sum of an $n \times n$ magic square.