Extra Credit

This optional assignment is worth 5% of your final grade. So if you have an 86% in the class and get every question here correct, you will end up with a 91% as your final grade.

Try to solve as many problems as possible. To get any credit whatsoever, show your work! Cite any outside sources you used to help you solve the problem (for example, if you used a source online, provide a link to that webpage and explain the information and how that helped you solve the problem).

1. Solve this logic puzzle (a modification of the famous zebra puzzle made by Einstein).

   Five students with different majors who go to different schools live in consecutive houses on a street. These houses are painted different colors. The students use different TV streaming services and have different favorite foods. Determine who uses BitTorrent, given these clues:

   - The student who eats tacos lives next to a student who watches Crackle.
   - The computer science major lives in the leftmost house.
   - The student who eats hamburgers uses Amazon streaming service.
   - The math major goes to the University of Akron.
   - The biology major lives in the yellow house.
   - The green house is immediately to the right of the blue one.
   - The computer scientist lives next to the red house.
   - The owner of the white house eats pancakes.
   - The history major watches Netflix.
   - The art major eats waffles.
   - The student who watches Hulu lives next to the student who eats pancakes.
   - The center houses owner goes to Case Western Reserve.
   - The student who eats tacos lives next to the student who goes to Kent State University.
   - The owner of the blue house goes to Ohio State.
   - The Tri-C community college student eats lobster.

   Identify the student who uses BitTorrent by describing their major, favorite food, school, and house color. (Hint: Make a table where the columns represent the houses and students who live in it, and the rows represent the color of their houses, their majors, what school they go to, their favorite food, and what streaming services they use. Then use logical reasoning to determine the correct entries in the table.)

2. Five married couples (including a host and hostess) attend a party together. At the end of the party, the host asks each of the nine others how many people he or she met for the first time that evening. He receives nine different answers. What did the hostess answer? Explain why.

3. An elevator starts on the top floor of a 100-floor building and in its descent to the bottom (first) floor, stops at at least 40 floors, counting both the top and bottom floors as stops. Show that somewhere in its travel, the elevator had to stop at two floors that were exactly 9, 10, or 19 floors apart.

4. Sir Arthur de Templar was paid 9 gold coins for the information he provided in the last known location of the Holy Grail. Soon later, from highly trusted sources, he learns that one of the 9 gold coins is not fully gold (it has some admixture of other elements and so its weight differs, either heavier or lighter, from the weight of the other 8 true gold coins). Sir Arthur pays a visit to his closest friend drug-maker Mr. Drugless and within a few seconds they identify the fake coin. Legend says that they used just an old weighing device (shown in figure) and could identify the fake coin in only 3 weighings. A weighing is an operation of putting k coins on one plate of the device and k other coins on the other plate ($k = 1, 2, 3, ...$) and checking if the device is in equilibrium, and if not, which plate is heavier or lighter.

Repeat and clearly describe the procedure used by Sir Arthur and Mr. Drugless for identifying the fake coin among 9 gold coins in just 3 weighings.