Greedy Algorithms - Programming Assignment 3
Due: Monday, October 23rd and Tuesday, October 24th

Directions: Your code will be due by 8pm, Tuesday, October 24th on PolyLearn. You may use either Python 3.4.3 or Java 8.

Your friend is working as a camp counselor, and she is in charge of organizing activities for a set of campers. One of her plans is the following mini-triathlon exercise:

Each camper must swim 20 laps of a pool, then bike 10 miles, then run 3 miles. The plan is to send the campers out in a staggered fashion, via the following rule:

- The campers must use the pool one person at a time.

    - In other words, first one camper swims the 20 laps, gets out, and starts biking.
    - As soon as this first camper is out of the pool, a second camper begins swimming the 20 laps.
    - As soon as the second camper is out and starts biking, a third camper begins swimming, and so on.

- **Note:** Multiple persons may be biking or running at the same time.

For each camper i, there is:

- A projected swimming time, s_i (the expected time it will take him or her to complete the 20 laps).

- A projected biking time, b_i (the expected time it will take him or her to complete the 10 miles of bicycling).

- And a projected running time, r_i (the time it will take him or her to complete the 3 miles of running).

Your friend wants to decide on a schedule for the triathlon: an order in which to sequence the starts of the campers. The *completion time* of a schedule is the earliest time at which all campers will be finished with all three legs of the triathlon, assuming they each spend exactly their projected swimming, biking, and running times on the three parts. (Again, note that campers can bike and run simultaneously, but at most one camper can be in the pool at any time.) How would you determine the best order for sending n campers out if you want the whole competition to be over as early as possible?

Your program should return the sequence of campers, and the completion time.

You will be given a set of campers and expected times as triples.

For example:

Suppose there are 3 campers.

- Camper 1 is expected to take 30 minutes to swim, 80 minutes to bike and 40 minutes to run.

- Camper 2 is expected to take 25 minutes to swim, 40 minutes to bike, and 20 minutes to run.

- Camper 3 is expected to take 40 minutes to swim, 50 minutes to bike, and 18 minutes to run.

This scenario would be given to you as:

1: (30,80,40)

2: (25,40,20)

3: (40,50,18)

Your solution should be:

sequence: 1,3,2

completion time: 155

What to bring with you to lab:

- What measure were you greedy over?

- Your pseudocode (handwritten or printed).

What to turn in on PolyLearn:

- Your algorithm should take a set of three projected times for each of n campers and return the optimal sequence and the total completion time.

- Submit all of your source code along with a shell script driver named "asgn3.sh". I should be able to run your program by typing, "./asgn3.sh <input file name>". Your program must read input from a file and write output to stdout. Your output will be tested using diff, so it must match exactly. Please don't zip your files.

  You will be provided with a working example with sample input and output.

Excellent extension to think about:

There is nothing to turn in for this section. The following is an extension of the above problem.

Credit: A previous 349 student, Justin Zaman, created this extension.

Suppose there is another activity at camp that all campers must attend, friendship bracelet making. The friendship making activity takes one hour and can only accomodate half of the campers at a time. Therefore the camp director has told your friend that she will have the campers divided into two groups: those who will attend the friendship bracelet making session during the first hour of the triathlon and those who will attend during the second hour of the triathlon.

Your goal is the same, to determine the best order for sending n campers out to minimize completion time. However now your campers are divided into the two groups mentioned above. Note: the camp director divided the campers into two groups already (you have no say in which campers attend the friendship bracelet making session when).