CSCI 406
Final Programming Project: ALGOWARS

1   Problem Description

You are given a set of n tasks along with their processing times $t_1, t_2, \ldots, t_n$ and an integer m, the number of machines on which these tasks can be processed. The machines may have different processing speeds. The problem is to assign each of the n tasks to the m machines so that the completion time (the time at which all of the tasks are completed) is minimized.

The input format is as follows (I've only included the comments so that you understand the input. Comments should not be included in the actual inputs):

```
5   // n
2    // m
12 7 3 22 24 // task processing times
1 2  // machine speeds
```

Let's assume that the five tasks are respectively $T_1, \ldots, T_5$ and the two machines are M_1 and M_2. One possible solution is that tasks T_1, T_2, and T_3 are scheduled on M_1 and tasks T_4 and T_5 are scheduled on M_2. Machine M_1's completion time is then $\frac{12+7+3}{1} = 22$ and machine M_2's completion time is $\frac{22+24}{2} = 23$. The overall completion time (the cost of this solution) is given by $\max(22, 32) = 23$. A second possible solution might assign T_1, T_3, and T_5 to M_1 and T_2 and T_4 to M_2. This results in completion times of 39 on M_1 and 14.5 on M_2 with an overall completion time of 39. Clearly, Solution 1 is superior to Solution 2. Your job is to design an algorithm that finds as good an allocation of tasks to machines as possible.

Input Restrictions: No input will contain more than 1,000 tasks and 50 machines. Task processing times must be integers in [1,10000] and machine speeds must be integers in [1,20].

Output Format: Line 1 of your output will consist of task ids assigned to machine M_1, Line 2 will consist of task ids assigned to M_2, etc. The last line of your output will contain the completion time of your solution. To illustrate, the output for "Solution 1" would be

```
1 2 3
4 5
23
```

2   Deliverables

1. *Overview*: ALGOWARS is 10% of your total grade. Your grade will be based on two things: (1) Does your software work and produce correct solutions in a reasonable amount of time? (2) How do the solutions produced by your algorithm compare to those of other groups? (3) Your effort distribution within the group.

2. *Where/When?*: We will schedule a time for all of the groups to meet in the alamode lab in BB during the last week of class (either on Wed or Thurs) to demo the performance of your algorithm on several inputs. Ideally, all group members will be able to attend.

3. *Inputs*: Each group will post a single input file in the format described above on piazza at least 24 hours in advance of the ALGOWARS meeting.

4. *Showtime*: During ALGOWARS, each group will (1) run its program on each input file (2) output the results to a file and (3) get the output validated (see below).

5. *Validation*: each group will need to get its output *validated* by a member of the group that created the corresponding input file. This means that each group will need to develop validation code which will read the solution and verify that its cost has been reported correctly. One of the group members that provided the input must sign off on your outcomes form (see below).

6. *Written deliverables*: (1) The validated outcomes form that has been posted separately. (2) Print-outs of your results on each input.

Good Luck!!!