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## CS29003 Algorithms Laboratory

### Assignment 4: Greedy Algorithms

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#### General instruction to be followed strictly

1. Do not use any global or static variable unless you are explicitly instructed so.
2. Do not use Standard Template Library (STL) of C++.
3. Use proper indentation in your code and comment.
4. Name your file as `<roll_no>_<assignment_no>`. For example, if your roll number is 14CS10001 and you are submitting assignment 3, then name your file as `14CS10001_3.c` or `14CS10001_3.cpp` as applicable.
5. Write your name, roll number, and assignment number at the beginning of your program.
6. Make your program as efficient as possible. Follow best practices of programming.
7. Submit your program on Moodle before deadline. Submissions by email or any other means will NOT be considered for evaluation.

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Suppose we have  $n$  jobs with positive lengths  $\ell_1, \dots, \ell_n$  and positive deadlines  $d_1, \dots, d_n$ . In a schedule  $\sigma$  (which is a permutation of  $\{1, \dots, n\}$ ), let  $C_j(\sigma)$  be the finish time of job  $j$  in the schedule  $\sigma$ . The lateness  $\lambda_j(\sigma)$  of a job  $j$  in the schedule  $\sigma$  is defined as  $\max\{0, C_j(\sigma) - d_j\}$ . Write a greedy algorithm to compute a schedule which minimizes maximum lateness; that is a schedule  $\sigma$  which minimizes  $\max_{i=1}^n \lambda_i(\sigma)$ .

### Part I: First Algorithm

Guess the  $\min_{\sigma} \max_{i=1}^n \lambda_i(\sigma)$  to be  $\Lambda$ . We will iterate over all possible values of  $\Lambda$ ; how many values of  $\Lambda$  are possible? For a particular  $\Lambda$ , compute the latest time  $t_i$  at which any job  $i$  can be started. Design an algorithm to check if there exists any schedule  $\sigma$  where every job  $i$  can be started not later than  $t_i$ .

### Part II: Greedy Algorithm

Design a  $\mathcal{O}(n \log n)$  time greedy algorithm for the problem.

Submit a single `.c` or `.cpp` file. Your code should get compiled properly by `gcc` or `g++` compiler.

## Sample Output

```
palash@palash-ThinkPad-X1-Yoga-3rd:~$ ./a.out
Write the number of jobs: 10
Write the length of the jobs: 19 23 67 43 19 55 100 32 78 65
Write the deadlin of the jobs: 200 200 130 90 100 150 300 500 182 205
Optimal schedule by late guessing algorithm is: 4, 5, 3, 6, 9, 2, 1,
10, 7, 8,
Maximum lateness is 169
Optimal schedule by greedy algorithm is: 4, 5, 3, 6, 9, 2, 1, 10, 7, 8,
Maximum lateness is 169
palash@palash-ThinkPad-X1-Yoga-3rd:~$
```

## Policy on Plagiarism

**Academic integrity is expected from all the students. Ideally, you should work on the assignment/exam consulting only the material we share with you. You are required to properly mention/cite anything else you look at. Any student submitting plagiarised code will be penalised heavily. Repeated violators of our policy will be deregistered from the course. Read [this](#) to know what is plagiarism.**