ECSE210L: Design and Analysis of Algorithms

Lab 9 (Week 13: 30 March- 03 April, 2020)

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Write an algorithm and implement for the following problems.

1. There are n houses for sale. The i-th house costs A_i dollars to buy. You have a budget of B dollars to spend. What is the maximum number of houses you can buy?

   You need to come up with $O(n \log n)$-time algorithm and implement the same.

2. In the above problem, assume that each A_i and B are positive integers. Further, assume that every i-th house has a rating r_i. The goal is to buy houses with in budget B and the total rating of the houses brought is the maximum. Give an $O(nB)$-time dynamic programming based algorithm for the problem.

   Sample input:

   a) $B = 26$, $n = 5$

House	A	B	C	D	E
cost	12	7	11	8	9
rating	24	13	23	15	16

   b) $B = 50$, $n = 7$

House	A	B	C	D	E	F	G
cost	31	10	20	19	4	3	6
rating	70	20	39	37	7	5	10

3. (**Bonus point**) There are N stacks of plates in a dinning room and each stack contains K plates. Further, each plate has a positive beauty value, describing how beautiful it looks. Mr. X would like to take exactly P plates to use for dinner tonight. If he would like to take a plate in a stack, he must also take all of the plates above it in that stack as well.

   Help Mr. X to pick the P plates that would maximize the total sum of beauty values. Your algorithm must take $O(NPK)$-time.