

# Lab 10 – OJ

## Dynamic Programming (p1)

CS208 Algorithm Design and Analysis  
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# Q1: Game

Lanran likes shopping! There are  $n$  items in the shop, where each one has beauty value of  $w_i$  and a cost of  $c_i$  coins. Lanran has  $m$  coins, and he wants to get the largest sum of beauty on items he can buy. Note that, Lanran can buy at most one per item.

# Q1: Game

Sample input:

3	6
5	3
3	2

Sample output:

8

items	$W_i$	$C_i$
1	5	3
2	3	2
3	3	4



items	$sum(C_i)$	$sum(W_i)$
1	3	5
2	2	3
3	4	3
1+2	$3+2 \leq 6$	$5+3 = 8$
2+3	$3+3 \leq 6$	$2+4 = 6$
1+3	$3+4 > 6$	--
1+2+3	$3+2+4 > 6$	--



## Q2: Shopping

- Bob is very angry because Alice broke his wonderful TV, so he will battle with Alice in a game to avenge.
- The game is a very simple one. Initially, they are given a non-empty string  $s$ , consisting of lowercase letters. The length of  $s$  is an even integer number. Each player also has his/her own empty string. In one move, a player takes **either the first or the last letter** of the string  $s$ , removes it from  $s$  and **appends** it to their own string (put it at the end of the string).
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- The game ends when  $s$  is empty. And then Alice and Bob will compare their strings, whoever owns a lexicographically smaller string will be the winner.
- Bob is very confident so he will let **Alice move first**. Also, they will take their moves optimally.
- Your task is to tell who is the winner or if it is a draw.

# Q2: Shopping

Sample input:

3 # of test cases

ilikealgorithm the non-empty string  $s$  with even number of letters

gggggggggggggggg

ooooooooooooooooohhhhhhhhhhhhhhhh

ilikealgorithm ➡ Alice moves first, if Alice gets letter *i* first, she will win

gggggggggggggggg ➡ All letters are identical, which will be a draw

ooooooooooooooooohhhhhhhhhhhhhhhh

➡ If Alice gets letter *h* first, she will win

**Sample output:**

Alice  
Draw  
Alice