HW-6

(1) There are n different items.
For optimal solution, we either choose the item or we don't.
Let there be a subproblem with k items, and w capacity.

$$OPT(k, w) = \max \begin{cases} OPT(k-1, w), & \text{← not selected} \\ OPT(k, w-w_k) + v_k & \text{→ selected, hence add value} \end{cases}$$

$\Theta(Wk)$

Initial condition: $OPT(0, 0) = 0$

(2) Let there be a substring from ith element to jth element.
Here, $0 \leq i \leq j$

$$\therefore OPT(j) = \max_{\text{where } S_{i+1,j} \text{ is a valid word.}} OPT(i)$$

Time complexity: $\Theta(n^2)$

(3) We select the balloon to burst at the end. Let that balloon be i. So first we burst all balloons on its left side, then its right side.
$(l \leq i \leq r)$

$$\therefore OPT(l, r) = \max \begin{cases} OPT(l, i-1) + OPT(i+1, r) \\ + n[i] \times num[l-1] \times num[r+1] \end{cases}$$

$O(n^3)$

(4) We have to maximize to quality.
Let there be a substring denoted by S_{ij} for $S_i S_{i+1} S_{i+2} \cdots S_j$
Here, $0 < i < j$

$OPT(j) = \max (OPT(i) + quality(S_{i+1,j})$

$\theta(n^2) \rightarrow$ complexity.

(5) Let there be k words in first line from a set of n words; in opt. soln.
Let OPT(i) be sum of squares of slacks for the optimal solut^n with words w_{k+1} to w_n.
Now suppose there are p words at present in first line.

$$OPT(i) = \begin{cases} 0 & \text{if } p \geq n-(i-1) \\ \min_{1 \leq k \leq p} \{(S(i,k))^2 + OPT(i+k)\} & \text{if } p < n-(i-1) \end{cases}$$

Complexity $\rightarrow$ pseudo-polynomial.

(6) Let there be at least x A-votes in dist. 1 and y A-votes in dist. 2
M[j, p, x, y] = true.
Look for entry M[j, p-1, x-2, y].
Each dist. gets mn/2 votes total.
$O(n^2 m^2)$