0-1 Knapsack.

Given a capacity c and the value and weight of n items in arrays V and W, find a subset of the n items whose total weight is less than or equal to the capacity and whose total value is maximal.

V	20	15	90	100
W	1	2	4	5
	0	1	2	3

$c = 7$

set	weight	value	
$\{2, 3\}$	9	190	*exceeds capacity*
$\{1, 3\}$	7	115	*not optimal*
$\{0, 1, 2\}$	7	125	*optimal*

$$B[i][j] = \begin{cases} 0 & \text{if } j = 0 \text{ and } W[0] > i \\ V[0] & \text{if } j = 0 \text{ and } W[0] \leq i \\ B[i][j-1] & \text{if } W[j] > i \\ \max \left\{ \begin{array}{l} V[j] + B\big[i - W[j]\big]\big[j-1\big], \\ B\big[i\big]\big[j-1\big] \end{array} \right\} & \text{otherwise} \end{cases}$$

3	20/S	20/S	20/S	90/S	110/S	120/T	125/S
2	20/S	20/S	20/S	90/T	110/T	110/T	125/T
1	20/S	20/S	35/T	35/T	35/T	35/T	35/T
0	20/T	20/T	20/T	20/T	20/T	20/T	20/T
	1	2	3	4	5	6	7

Longest common subsequance.

Given two sequences, find the longest subsequence that they have in common.

D A T A S T R U C T U R E S
A L G O R I T M S

A A A A A B not A A A A A B
A B A A A A A B A A A A

A A A A A B A A A A not A A A A A B A A A A
A B A A A A A B A A A A

$$L[i][j] = \begin{cases} 0 & \text{if } i = 0 \text{ or } j = 0 \\ 1 + L[i-1][j-1] & \text{if } i \neq 0 \text{ and } j \neq 0 \text{ and } a[i] = b[j] \\ \max\{L[i][j-1], \\ \qquad L[i-1][j]\} & \text{otherwise} \end{cases}$$

T	0	0	1	2	2	3	4	4	4	4	5
E	0	0	1	2	2	3	4	4	4	4	4
H	0	0	1	2	2	3	3	3	3	3	3
C	0	0	1	2	2	2	2	2	2	2	2
T	0	0	1	1	1	1	1	1	1	1	2
A	0	0	1	1	1	1	1	1	1	1	1
R	0	0	0	0	0	0	0	0	0	0	0
	B	L	A	C	K	H	E	I	G	H	T

$$M[i][j] = \begin{cases} 0 & \text{if } i = j \\ \min_{i \leq k < j} \{ M[i][k] + & \\ \qquad D[i] \times D[k+1] \times D[j+1] + & \text{otherwise} \\ \qquad M[k+1][j] \} & \end{cases}$$