4 Exercise solutions – Local alignment

1. Local alignment with DP

The DP algorithm can be used to identify optimal local alignments. Assume the scoring scheme as match: 1, mismatch: -1, and gap penalty: 1.

(a) Complete the DP table to find the optimal local alignment.

	d		J	A	V	N	N	
q	_		1	2	3	4	5	
		0	0	0	0	0	0	
J	1	0	1	0	0	0	0	
A	2	0	0	2	1	0	0	
V	3	0	0	1	3	2	1	
A	4	0	0	1	2	2	1	
A	5	0	0	1	1	1	1	

q: 1 JAV 3 d: 1 JAV 3

(b) Backtrack from $H_{9,6}$ and write down the local alignment.

	d		F	U	N	J	A	V	N	N	O	Т
q			1	2	3	4	5	6	7	8	9	10
	•	0	0	0	0	0	0	0	0	0	0	0
F	1	0	1	0	0	0	0	0	0	0	0	0
U	2	0	0	2	1	0	0	0	0	0	0	0
N	3	0	0	1	3	2	1	0	1	1	0	0
Τ	4	0	0	0	2	2	1	0	0	0	0	1
Ο	5	0	0	0	1	1	1	0	0	0	1	0
N	6	0	0	0	1	0	0	0	1	1	0	0
J	7	0	0	0	0	2	1	0	0	0	0	0
A	8	0	0	0	0	1	3	2	1	0	0	0
\vee	9	0	0	0	0	0	2	4	3	2	1	0
A	10	0	0	0	0	0	1	3	3	2	1	0

Solution:

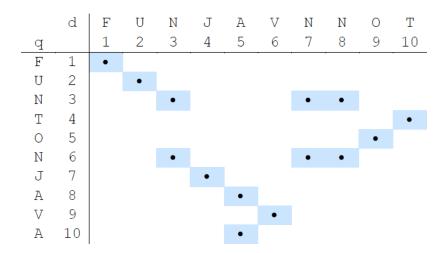
q: 6 NJAV 9

d: 3 NJAV 6

2. Dot matrix

A dot matrix is one of the simplest methods to identify local alignments.

(a) Fill the table with dots.



(b) Identify all segment pairs with at least 3 contiguous dots along diagonals.

Solution:

q: 1 FUN 3 q: 6 NJAV 9 d: 1 FUN 3 d: 3 NJAV 6

(c) Identify all segment pairs with at least 3 contiguous dots along aniti-diagonals.

Solution:

q: 4 TON 6 d: 8 NOT 10