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	T
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
T	4	0	0	0	2	2	1	0	0	0	0	1
O	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
V	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.

q	d	F 1	U 2	N 3	J 4	A 5	V 6	N 7	N 8	O 9	T 10
F	1	•									
U	2		•								
N	3			•				•	•		
T	4										•
O	5									•	
N	6			•				•	•		
J	7				•						
A	8					•					
V	9						•				
A	10					•					

(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
```