IQB : Assignment 1
Writeup

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Q1) **Global Alignment**

a) **Dynamic Programming Matrix**

```
DP Matrix
[ 0. -1. -2. -3. -4. -5. -6. -7.]
[-1. -1. -2. -3. -1. -2. -3. -4.]
[-2.  1.  1.  0. -1. -2.  0. -1.]
[-3.  0.  0.  3.  2.  1.  0. -1.]
[-4. -1. -1.  2.  5.  4.  3.  2.]
[-5. -2. -2.  1.  4.  7.  6.  5.]
[-6. -3. -3.  0.  3.  6.  6.  8.]
[-7. -4. -4. -1.  2.  5.  5.  7.]
[-8. -5. -2. -2.  1.  4.  7.  6.]
[-9. -6. -3. -3.  0.  3.  6.  9.]
```

b) Yes there is more than 1 possibility of aligning the given sequences.

c) Their Output Formats are as follows

```
('Count =', 1)
ATCAGAGTA
TTC__AGTA
('Score =', 9)

('Count =', 2)
ATCAGAGTA
TTCA__GTA
('Score =', 9)

('Count =', 3)
ATCAGAGTA
TTCAG__TA
('Score =', 9)
```

Q2) **Local Alignment**

a) **Dynamic Programming Matrix**

```
DP Matrix
[ 0.  0.  0.  0.  0.  0.  0.  0.]
[ 0.  0.  0.  0.  2.  1.  0.  2.]
[ 0.  2.  2.  1.  1.  1.  3.  2.]
[ 0.  1.  1.  4.  3.  2.  2.  2.]
[ 0.  0.  0.  3.  6.  5.  4.  4.]
[ 0.  0.  0.  2.  5.  8.  7.  6.]
[ 0.  0.  0.  1.  4.  7.  7.  9.]
[ 0.  0.  0.  0.  3.  6.  6.  8.]
[ 0.  2.  2.  1.  2.  5.  8.  7.]
[  0.   1.   1.   1.   3.   4.   7.  10.]
```

b) Local Alignments

```
('Count =', 1)
TCAGAGTA
TC__AGTA
('Score =', 10)

('Count =', 2)
TCAGAGTA
TCA__GTA
('Score =', 10)

('Count =', 3)
TCAGAGTA
TCAG__TA
('Score =', 10)
```

Q3)

LOCAL ALIGNMENT

- At the time of filling up of the entire Matrix, the negative values were replaced with 0.
- The 0th Column as well as the 0th Row contained only zeros. Whereas in Global Alignment, the 0th Column and the 0th Row, except for the GAP element at DP_Matrix[0][0] , the rest of the values were with respect to addition along with the Gap_Penalty
- Backtracking was performed with respect to the coordinates of the max Value. In the case of Global alignment, we performed Backtracking with respect extreme bottom right index.

Ans 4.)

GLOBAL ALIGNMENT:-

```
('Count =', 1)
ATCAGAGTA
TTC__AGTA
('Score =', 7)

('Count =', 2)
ATCAGAGTA
TTCA__GTA
('Score =', 7)

('Count =', 3)
ATCAGAGTA
TTCAG__TA
('Score =', 7)
```

```
DP Matrix
[ 0. -1. -2. -3. -4. -5. -6. -7.]
[-2. -1. -2. -3. -1. -3. -5. -4.]
[-4.  0.  1. -1. -3. -2. -1. -3.]
[-6. -2. -1.  3.  1. -1. -3. -2.]
[-8. -4. -3.  1.  5.  3.  1. -1.]
[-10.  -6.  -5.  -1.   3.   7.   5.   3.]
[-12.  -8.  -7.  -3.   1.   5.   6.   7.]
[-14. -10.  -9.  -5.  -1.   3.   4.   5.]
[-16. -12.  -8.  -7.  -3.   1.   5.   3.]
[-18. -14. -10.  -9.  -5.  -1.   3.   7.]
('Max Score = ', 7)
```

- Gap_penalty increased, hence the matrix has changed
- Max Score has decreased from 9 to 7.

LOCAL ALIGNMENT :-

```
('Count =', 1)
TCAGAGTA
TC__AGTA
('Score =', 8)

('Count =', 2)
TCAGAGTA
TCA__GTA
('Score =', 8)

('Count =', 3)
TCAGAGTA
TCAG__TA
('Score =', 8)
```

```
DP Matrix
[ 0.  0.  0.  0.  0.  0.  0.  0.]
[ 0.  0.  0.  0.  2.  0.  0.  2.]
[ 0.  2.  2.  0.  0.  1.  2.  0.]
[ 0.  0.  1.  4.  2.  0.  0.  1.]
[ 0.  0.  0.  2.  6.  4.  2.  2.]
[ 0.  0.  0.  0.  4.  8.  6.  4.]
[ 0.  0.  0.  0.  2.  6.  7.  8.]
[ 0.  0.  0.  0.  0.  4.  5.  6.]
[ 0.  2.  2.  0.  0.  2.  6.  4.]
[ 0.  0.  1.  1.  2.  0.  4.  8.]
('Max Score = ', 8)
```

- We can observe a change with respect to the DP Matrix.
- Max Score decreased from 10 to 8