CENG 465

Introduction to Bioinformatics

HOMEWORK 1

Student Information

Full Name: Andaç Berkay Seval

ID: 2235521

Problem 1

Match score can be deduced easily, since only a match score can increase the total score (There is a single match score which is positive and single gap and mismatch penalties which are negative). If we look the table, we can see that first matching scores are incremented by 7. Thus, **match score is 7**.

For gap penalty, if we look the next right cells of matching cells, we can see that there is a decrement of 4. For example, let's look at table[1,5]. There is G-G matching, and the score is 7. However, in the next cell, we see a G-E intersection, and score is decremented by 4. This must be from gap penalty. Thus, **gap penalty is -4**.

For mismatch penalty, if there is no matching and score is coming from upper left cell (since (upper left value + mismatch penalty) > (max(left cell value, upper cell value) + gap penalty)), we can find mismatch penalty. For example, score of cell table[2,6] = 1. If we consider gap penalty, it should be 0 since upper cell and left cell scores are 3, so 3 – 4 = -1. However, since it is local alignment, there is no negative scores, thus minimum score is 0. However, table[2,6] is 1 since 7 + mismatch penalty = 1 > 0. Thus, **mismatch penalty is -6**.

	-	**M**	**I**	**M**	**A**	**G**	**E**	**D**	**I**	**L**
-	0	0	0	0	0	0	0	0	0	0
G	0	0	0	0	0	7	3	0	0	0
A	0	0	**0**	0	7	3	1	0	0	0
M	0	7	3	**7**	3	1	0	0	0	0
A	0	3	1	3	**14**	**10**	6	2	0	0
E	0	0	0	0	10	8	**17**	13	9	5
D	0	0	0	0	6	4	13	**24**	20	16
K	0	0	0	0	2	0	9	20	18	14

Table: Traceback of cells

We need to find the maximum value on table, which is 24, because it is local alignment. **24 is the local alignment score**. Then, we need to do traceback.

Best local alignment:

M A G E D

| | | | |

M A -- E D

7 +7 - 4 +7+7 = 24 (4 matches and 1 gap). Thus, it is the same with the table.

Match score is 7.

Gap penalty is -4.

Mismatch penalty is -6.

Local alignment score is 24.

Problem 2

	-	**M**	**C**	**G**	**M**	**G**	**C**	**M**	**E**	**L**
-	**0**	**-4**	**-8**	-12	-16	-20	-24	-28	-32	-36
G	-4	-3	-7	**-2**	-6	-10	-14	-18	-22	-26
M	-8	1	-3	-6	**3**	**-1**	-5	-9	-13	-17
C	-12	-3	10	6	2	0	**8**	4	0	-4
M	-16	-7	6	7	11	7	4	**13**	9	5
E	-20	-11	2	4	7	9	5	9	**18**	14
D	-24	-15	-2	1	3	6	6	5	**14**	14
L	-28	-19	-6	-3	3	2	5	8	10	**18**

M C G M G C M E -- L

| | | | | | | | | |

-- -- G M -- C M E D L

-4 -4 +6 +5 -4 +9+5 +5 -4+4 = 18. (Same with the table)