① Let m: match score
d: mismatch penalty
g: gap penalty ; where $m > 0$ and $g, d < 0$

And $F(i,j)$ is the element in the i^{th} row and j^{th} column of the matrix.

Let $X(i,j) = \begin{cases} F(i-1, j-1) + m & \text{if } F(0,i) = F(j,0) \\ F(i-1, j-1) + d & \text{if } F(0,i) \neq F(j,0) \end{cases}$

and $F(i,j) = \max\{ X(i,j), F(i-1,j) + g, F(i,j-1) - g \}$.

Consider $F(3,6) = 3$.

$F(3,6) = \max\{ F(2,5) + d, F(2,6) + g, F(3,5) + g \}$

If it is $F(2,5) + d$, which is a mismatch, the following must be true: $0 + d = 3$ where $d \in \mathbb{Z}^-$. Since this is not possible, consider a gap penalty: $F(2,6) + g$ or $F(3,5) + g$. So it is either $7 + g = 3$ or $7 - g = 3$. $\rightarrow$ $\boxed{g = -4}$. That is, gap penalty $= -4$.

Now, consider $F(6,6) = \max\{ 14 + d, 10 + g, 10 + g \} = 8$.

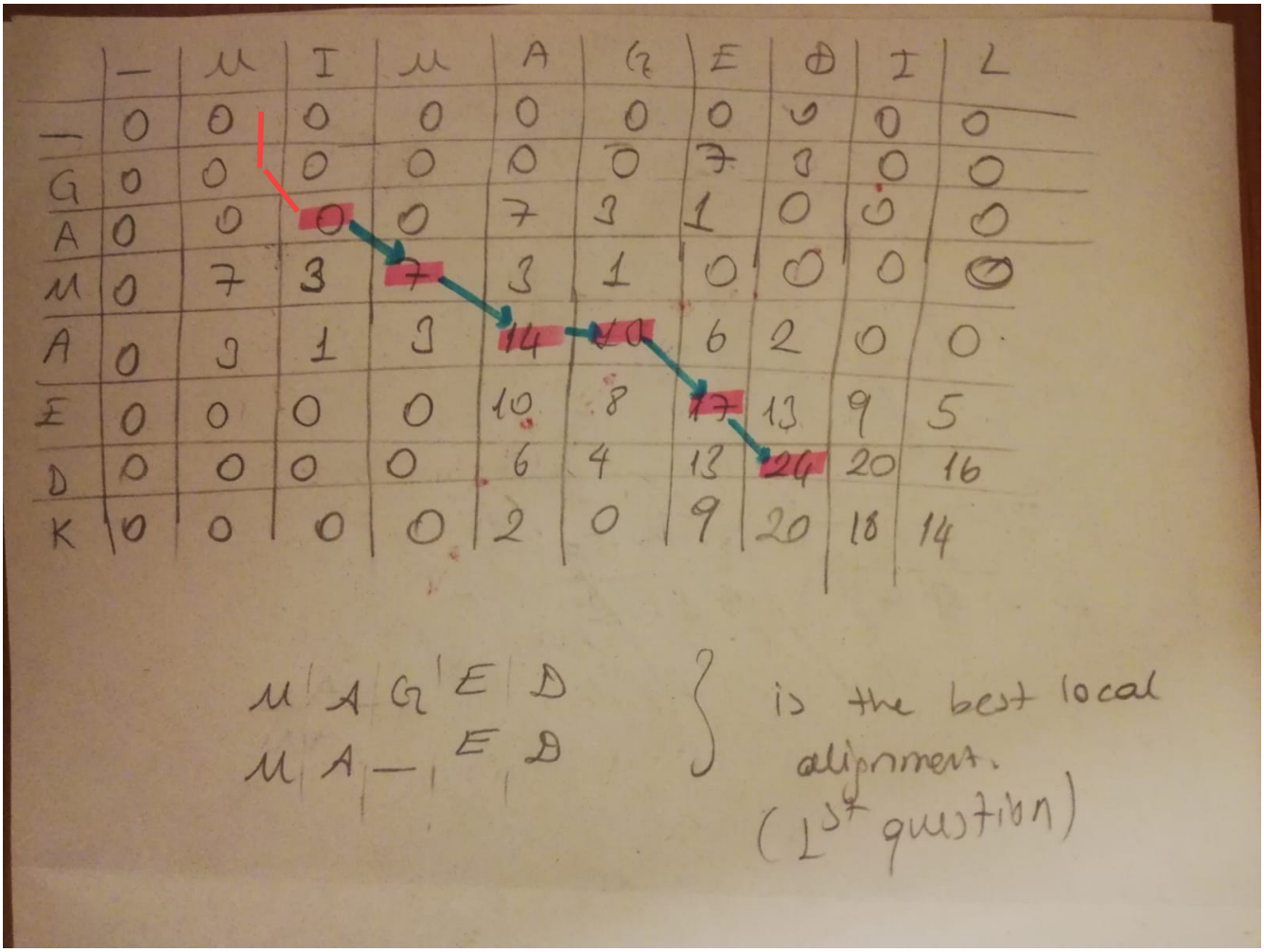
Knowing $g = -4$, $10 + g = -6 \neq 8$. Then $14 + d = 8$ / $\boxed{d = -6}$

So mismatch penalty is -6.

Now, consider $F(2,6) = \max\{ 0 + m, 0 + g, 0 + g \} = 7$.

Knowing $g = -4$, $0 - 4 \neq 7$. So $0 + m = 7$. $\rightarrow$ $\boxed{m = 7}$

Matching score $= 7$.



	–	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	0	7	3	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	16	14

M A G E D
M A – E D

} is the best local alignment.
(1st question)

(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	10	4	0	-4
M	-16	-7	6	7	11	7	4	15	9	5
E	-21	-11	2	4	7	9	5	9	20	16
D	-24	-15	-2	1	3	6	6	5	16	16
L	-28	-19	-6	-3	3	2	5	8	10	20

C	G	M	—	C	M	L	E	L	} best alignment of the sequences.
G	G	M	M	C	M	L	—	L	