INT102 Assignment 2 Submission

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1 Question 1

1.1 1)

A	G	C	T
1	2	5	3

1.2 2)

The process is shown below:

A	G	C	A	A	T	G	A	A
A	T	G	A	A				
	A	T	G	A	A			
				A	T	G	A	A

The total number of comparisons is 3 (C $\neq$ G) + 1 (T $\neq$ A) + 5 (match found) = 9.

2 Question 2

2.1 1)

The process is shown below, assuming that each iteration goes through the edges in the order from e_1 to e_6.

iteration	a	b	c	d	e
before	(a, 0)	(-, ∞)	(-, ∞)	(-, ∞)	(-, ∞)
1 finish	(a, 0)	(a, 4)	(a, 5)	(-, ∞)	(-, ∞)
2 until e_3	(a, 0)	(a, 4)	(a, 5)	(b, 14)	(-, ∞)
2 until e_4	(a, 0)	(a, 4)	(a, 5)	(b, 14)	(c, -2)
2 finish	(a, 0)	(e, -5)	(a, 5)	(b, 14)	(c, -2)
3 until e_3	(a, 0)	(e, -5)	(a, 5)	(b, 5)	(c, -2)
3 finish	(a, 0)	(e, -5)	(a, 5)	(b, 5)	(c, -2)
4 finish	(a, 0)	(e, -5)	(a, 5)	(b, 5)	(c, -2)
5 finish	(a, 0)	(e, -5)	(a, 5)	(b, 5)	(c, -2)

The shortest path from a to a is {(a,a)}. From a to b is {(a,c), (c,e) (e,b)}. From a to c is {(a,c)}. From a to d is {(a,c), (c,e), (e,b), (b,d)}. From a to e is {(a,c), (c,e)}.

3 Question 3

3.1 1)

The table is shown below:

	-	A	G	C	C	C	T
-	0	0	0	0	0	0	0
G	0	0↑	1↖	1←	1←	1←	1←
A	0	1↖	1↑	1↑	1↑	1↑	1↑
G	0	1↑	2↖	2←	2←	2←	2←
T	0	1↑	2↑	2↑	2↑	2↑	3↖

3.2 2)

According to the table, the longest subsequence is AGT.

4 Question 4

4.1 1)

4.1.1 a)

The table is shown below:

	-	A	G	A	C	C	T
-	0	-1	-2	-3	-4	-5	-6
G	-1	-2←↖↑	0↖	-1←	-2←	-3←	-4←
A	-2	0↖	-1←↑	1↖	0←	-1←	-2←
G	-3	-1↑	1↖	0←↑	-1←↑	-2←↑	-3←↑
T	-4	-2↑	0↑	-1←↑	-2←↖↑	-3←↖↑	-1↖

4.1.2 b)

According to the table, an optimal global alignments is:

A	G	A	C	C	_	T
_	G	A	_	_	G	T

4.2 2)

4.2.1 a)

The table is shown below:

	-	A	G	A	C	C	T
-	0	0	0	0	0	0	0
G	0	0	1↖	0←	0	0	0
A	0	1↖	0←	2↖	1←	0←	0
G	0	0↑	2↖	1←	0←↑	0	0
T	0	0	1↑	0←↑	0	0	1↖

4.2.2 b)

According to the table, an optimal local alignment is:

G	A
G	A

5 Question 5

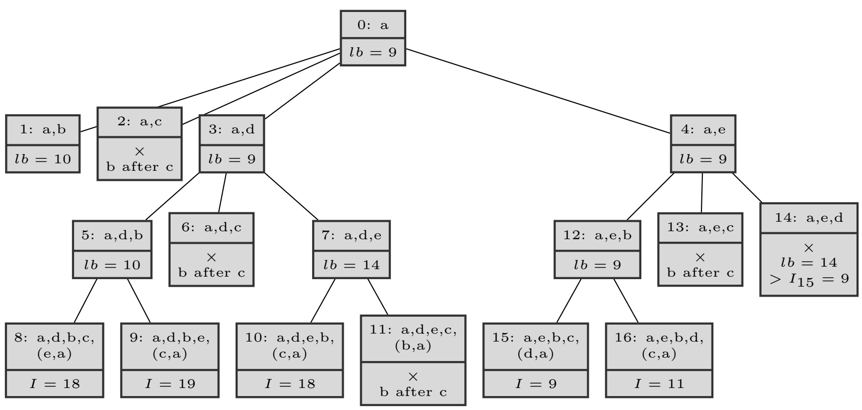
First fill in the matrix:

	a	b	c	d	e
a	0	4	5	2	1
b	4	0	4	3	1
c	5	4	0	1	8
d	2	3	1	0	6
e	1	1	8	6	0

At the beginning, the lower bound is

$$\lceil \frac{1+2}{2} + \frac{1+3}{2} + \frac{1+4}{2} + \frac{1+2}{2} + \frac{1+1}{2} \rceil = 9$$

It is sufficient to only consider tours starting from vertex a. In addition, since it is an undirected graph, a requirement is made that b must be travelled before c, under which it will still be enough to get the correct result. The calculation process is shown below:



According to the process, the optimal tour is: $a \to e \to b \to c \to d \to a$.

6 Question 6