ALGO ASSIGNMENT 03

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QUESTION 1-5 (Bilal Ahmed)

QUESTION 6-10 (Ahmed Ahsan)

QUESTION 01

≠ Longest Common Sequence:

X: { B, B, C, A, B, A }

Y: { A, B, C, B, D, A, D }

$$c[i,j] = \begin{cases} c[i-1,j-1]+1 & \text{if } i,j>0 \text{ \& } x_i = y_j \\ \max(c[i,j-1], c[i-1,j]) & \text{if } i,j>0 \text{ \& } x_i \neq y_j \end{cases}$$

	y_j	A	B	C	B	D	A	D
x_i	0	0	0	0	0	0	0	0
B	0	0	1	1	1	1	1	1
B	0	0	1	1	2	2	2	2
C	0	0	1	2	2	2	2	2
A	0	1	1	2	2	2	3	3
B	0	1	2	2	3	3	3	3
A	0	1	2	2	3	3	4	4

Longest common subsequence of "BBCABA" & "ABCBDAD" has length 4.

QUESTION 02

X: {B, I, L, A, L} ; Y: {A, H, M, E, D}

Shortest Common Supersequence.

	xi	B	I	L	A	L
yj	0	0	0	0	0	0
A	0	0	0	0	1	0
H	0	0	0	0	0	0
M	0	0	0	0	0	0
E	0	0	0	0	0	0
D	0	0	0	0	0	0

LCS = 1

Thus shortest common supersequence will be.

= len (x) + len (Y) - len (LCS)

= 5 + 5 - 1

Shortest common Supersequence = 9

QUESTION 03

Largest increasing subsequence:

Array: {5, 1, 10, 2, 1, 2, 20}

t = take ; nt = not take

Not take condition:

len = 0 + f(ind+1, prev_ind)

take case:

len = max (len, f (ind+1, ind)+1)

1) len = 0

5, 1, 10, 2, 1, 2, 20

t

len = 1

2) len = 1

5, 1, 10, 2, 1, 2, 20

t nt

len = 1

3) len = 1

5, 1, 10, 2, 1, 2, 20

t nt

len = 2

4) len = 2

5, 1, 10, 2, 1, 2, 20
t t nt

5) len = 2

5, 1, 10, 2, 1, 2, 20
t t nt

len = 2

6) len = 2

5, 1, 10, 2, 1, 2, 20
t t nt

len = 2

7) len = 2

5, 1, 10, 2, 1, 2, 20
t t t

len = 3

8) len = 3

ind = n, array complete

Answer length of the longest increasing subsequence is 3.

QUESTION 04

S_1 = "PLASMA"
S_2 = "ALTRUISM"

character match:
$f(i-1, j-1)$

character not match:
$1 + \min(f(i-1, j), f(i, j-1), f(i-1, j-1))$

Base case:
if (i < 0) return j+1
if (j < 0) return i+1

Using dynamic programming

1) PLASMA (Removing A)
ALTRUISM

2) 0 1 2 3 4
PLASM (Adding u btw index 2 & 3
ALTRUISM
PLAUSM

3) 0 1 2 3 4 5
PLAUSM Adding I Bfw index 3 & 4
ALTRUISM

PLAUISM
ALTRUISM

04) Replacing P with A

ALAUISM
ALTRUISM

05) Replacing A with T

0, 1 2 3 4 5 6
ALTUISM
ALTRUISM

06) Adding R Bfw ind 2 & 3

ALTRUISM
ALTRUISM

Thus it will take minimum 3 steps to change PLASMA to ATRUISM

	"	P	L	A	S	M	A
"	0	1	2	3	4	5	6
A	1	1	2	2	3	4	5
L	2	2	1	2	3	4	5
T	3	3	2	2	3	4	5
R	4	4	3	3	3	4	5
U	5	5	4	4	4	4	5
I	6	6	5	5	5	5	5
S	7	7	6	6	5	6	6
M	8	8	7	7	6	5	6

Table for Edit-Distance problem

QUESTION NO 05

Matrix chain multiplication

$p_0 = 2,\ p_1 = 25,\ p_2 = 3,\ p_3 = 16,\ p_4 = 1,\ p_5 = 5$

	0	1	2	3	4	5
0	0	150	246	101	111	
1		0	1200	51	126	
2			0	48	63	
3				0	80	
4					0	
5						

Matrix m

$m[1,2] = m[1,1] + m[2,2] + p_0 \cdot p_1 \cdot p_2 = 150$

$m[2,3] = m[2,2] + m[3,3] + p_1 \cdot p_2 \cdot p_3 = 1200$

$m[3,4] = m[3,3] + m[4,4] + p_2 \cdot p_3 \cdot p_4 = 48$

$m[4,5] = m[4,4] + m[5,5] + p_3 \cdot p_4 \cdot p_5 = 80$

~~$m[1,3] = m[1,1] + m[2,3] + p_0 \cdot p_1 \cdot p_3 = 1350$~~

~~$m[1,3] = m[1,2] + m[3,3] + p_0 \cdot p_2 \cdot p_3$~~

$m[1,3] = m[1,1] + m[2,3] + p_0 \cdot p_1 \cdot p_3 = 2000$

$m[1,3] = m[1,2] + m[3,3] + p_0 \cdot p_2 \cdot p_3 = 246$

$K = 2$ for $m[1,3]$

$m[2,4] = m[2,2] + m[3,4] + p_1 \cdot p_2 \cdot p_4 = 51$

$m[2,4] = m[2,3] + m[4,4] + p_1 p_3 p_4 = 1216$

$K = 2$ for $m[2,4]$

$m[3,5] = m[3,3] + m[4,5] + p_2 \cdot p_3 p_5 = 320$

$m[3,5] = m[3,4] + m[5,5] + p_2 p_4 p_5 = 63$

$K = 4$ for $m[3,5]$

$m[1,4] = m[1,1] + m[2,4] + p_0 \cdot p_1 \cdot p_4 = 101$

$= m[1,2] + m[3,4] + p_0 p_2 p_4 = 204$

$= m[1,3] + m[4,4] + p_0 p_3 p_4 = 278$

$K = 1$ for $m[1,4]$

$m[2,5] = m[2,2] + m[3,5] + p_1 p_2 p_5 = 436$

$= m[2,3] + m[4,5] + p_1 p_3 p_5 = 3280$

$= m[2,4] + m[5,5] + p_1 p_4 p_5 = 176$

$K = 4$ for $m[2,5]$

$m[1,5] = m[1,1] + m[2,5] + p_0 p_1 p_5 = 426$

$= m[1,2] + m[3,5] + p_0 p_2 p_5 = 243$

$= m[1,3] + m[4,5] + p_0 p_3 p_5 = 486$

$= m[1,4] + m[5,5] + p_0 p_4 p_5 = 111$

$K = 4$ for $m[1,5]$

Matrix s

0	1	2	1	4
	0	2	2	4
		0	3	4
			0	4
				0

Parenthesis

$((A_1)(A_2\ A_3\ A_4))(A_5)$