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B Tech 3RD Year

DAA Tutorial 6

Ans 1:

a) The longest subsequence is: MNORM

b) The longest subsequence is: BCDCD

c) The longest subsequence is: 0110

a) For this, let us see the o/p how it is calculated.

Ans 2: Here, N = length of P = 5
M = length of Q = 4

Then,

$$L[N][M] = 1 + L[N-1][M-1] /\!/ 1 = N = M \ \& \ P[N] = Q[M]$$
$$\Rightarrow L[N-1][M-1] = 1 + L[N-2][M-2]$$
$$\Rightarrow L[N-2][M-2] = 1 + L[N-3][M-3]$$
$$\Rightarrow L[N-3][M-3] = MAX(L[N-4][M-3], L[N-3][M-4])$$

Now, let us find,
$$L[N-4][M-3] = 1$$
$$L[N-3][M-4] = 0$$

Hence, now backtracking
$$L[N-3][M-3] = 1$$
$$L[N-2][M-2] = 2$$
$$L[N-1][M-1] = 3$$
$$L[N][M] = 4.$$

For the question B,

P, ABCD BCDCDD

Q = B CDCD

Forming the DP table,

	1	2	3	4	5	6	7	8	9	10
1	0	1	1	1	1	1	1	1	1	1
2	0	1	2	2	2	2	2	2	2	2
3	0	1	2	3	3	3	3	3	3	3
4	0	1	2	3	3	4	4	4	4	4
5	0	1	2	3	3	4	5	5	5	5

Hence, Ans is 5, that is BCDCD.

For question C,

P = 100101101101

Q = 0110

Forming the DP table,

	1	2	3	4	5	6	7	8	9	10	11	12
1	0	1	1	1	1	1	1	1	1	1	1	1
2	0	1	1	2	2	2	2	2	2	2	2	2
3	0	1	1	2	2	3	3	3	3	3	3	3
4	0	1	1	2	2	3	3	4	4	4	4	4

Hence, Ans is 4, that is 0110.

Ans 2.

a) Given, the matrix chain,

$$X = P_{5\times4} \; Q_{4\times6} \; R_{6\times2} \; T_{2\times7}.$$

It can be represented as a 1D array as:-

$$A = [5 \quad 4 \quad 6 \quad 2 \quad 7]$$

Now, to get minimum number of multiplications, let us solve it using recursion.

MATRIXMUL (A, I, J):-
  If I=J Return 0.
  MIN ← MAX_VAL
  FOR K=I to K=J-1,
     MIN = MINIMUM(MIN, MATRIXMUL (I, K) + MATRIXMUL (K)
                + P[I-1] * P[K] * P[J])

  RETURN MIN.

Using the above algorithm,
Let us denote DP[J][J] = Minimum multiplications for Matrix I to Matrix J.

I \ J	1	2	3	4	5
1	0	120	88	158	
2	-	0	48	104	
3	-	-	0	84.	
4	-	-	-	0	
5	-	-	-	-	

Hence, the answer is 158 multiplications in the order :- (P (QR)) T.

For this question, we follow a similar approach.
Given,
$$X = P_{6\times5}, Q_{5\times7}, R_{7\times3}, T_{3\times8}$$
$$A = [6 \quad 5 \quad 7 \quad 3 \quad 8]$$

Constructing the DP table,

	1	2	3	4
1	0	210	195	339
2	-	0	105	225
3	-	-	0	168
4	-	-	-	0

Hence, the answer is 339 multiplications in the order :- $(P\,(QR))T$

2) For this question, we follow a similar approach.
Given,
$$X = A_{5\times3} B_{3\times6} C_{6\times7} D_{7\times3} E_{3\times5}$$
$$A = [5 \quad 3 \quad 6 \quad 7 \quad 3 \quad 5]$$

Constructing the DP Table,

	1	2	3	4	5
1	0	90	231	225	300
2	-	0	126	189	225
3	-	-	0	126	216
4	-	-	-	0	105
5	-	-	-	-	0

Hence, the answer is 300 multiplications in the order :-
$$((A(B(CD)))E)$$