

**COP 3503 Recitation Worksheet - Dynamic Programming Solutions**

1) Find the length of the longest common subsequence between “GACATATAGGA” and “AGCATTACGAG” utilizing the dynamic programming algorithm shown in class. In order to get full credit, you have to fill in the matrix provided below.

	G	A	C	A	T	A	T	A	G	G	A
A	0	1	1	1	1	1	1	1	1	1	1
G	1	1	1	1	1	1	1	1	2	2	2
C	1	1	2	2	2	2	2	2	2	2	2
A	1	2	2	3	3	3	3	3	3	3	3
T	1	2	2	3	4	4	4	4	4	4	4
T	1	2	2	3	4	4	5	5	5	5	5
A	1	2	2	3	4	5	5	6	6	6	6
C	1	2	3	3	4	5	5	6	6	6	6
G	1	2	3	3	4	5	5	6	7	7	7
A	1	2	3	4	4	5	5	6	7	7	8
G	1	2	3	4	4	5	5	6	7	8	8

2) Utilize the dynamic programming algorithm shown in class to solve the 0-1 knapsack problem to determine the most valuable knapsack of weight 13 utilizing the items below:

Item	Weight	Value
A	5	107
B	3	60
C	6	140
D	2	35
E	8	180
F	4	93

Include	1	2	3	4	5	6	7	8	9	10	11	12	13
A	0	0	0	0	107	107	107	107	107	107	107	107	107
B	0	0	60	60	107	107	107	167	167	167	167	167	167
C	0	0	60	60	107	140	140	167	200	200	247	247	247
D	0	35	60	60	107	140	142	175	200	202	247	247	282
E	0	35	60	60	107	140	142	180	200	215	247	247	247
F	0	35	60	93	107	140	153	180	200	233	247	273	293

3) Determine the number of ways to make change for 11 cents using 2 cent, 3 cent, 4 cent and 7 cent coins. In order to get full credit, please complete the chart below using the algorithm shown in class.

Num Cents	1	2	3	4	5	6	7	8	9	10	11
Max Coin											
2	<b>0</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>0</b>
3	<b>0</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>
4	<b>0</b>	<b>1</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>3</b>	<b>2</b>	<b>4</b>	<b>3</b>	<b>5</b>	<b>4</b>
7	<b>0</b>	<b>1</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>3</b>	<b>3</b>	<b>4</b>	<b>4</b>	<b>6</b>	<b>6</b>

4) Determine the fewest number of coins to make change for 11 cents using 2 cent, 3 cent, 4 cent and 7 cent coins. In order to get full credit, please complete the chart below using the algorithm shown in class.

Num Cents	1	2	3	4	5	6	7	8	9	10	11
Max Coin											
2	--	<b>1</b>	--	<b>2</b>	--	<b>3</b>	--	<b>4</b>	--	<b>5</b>	--
3	--	<b>1</b>	<b>1</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>4</b>	<b>4</b>
4	--	<b>1</b>	<b>1</b>	<b>1</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>3</b>
7	--	<b>1</b>	<b>1</b>	<b>1</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>

5) (Note: Leave this for one week later. I left it on the sheet so that you all still had the practice problem.) Determine the fewest number of multiplications to calculate the product ABCDE, for matrices A, B, C, D, E with the following dimensions:

Matrix	Dimensions
A	2x6
B	6x1
C	1x3
D	3x5
E	5x2

In order to get full credit you must fill out the chart below appropriately, as shown in class. Please include your calculations below the chart.

	A	B	C	D	E
A	0	<b>12</b>	<b>18</b>	<b>37</b>	<b>41</b>
B	X	0	<b>18</b>	<b>45</b>	<b>37</b>
C	X	X	0	<b>15</b>	<b>25</b>
D	X	X	X	0	<b>30</b>
E	X	X	X	X	0

**(AB)C:  $12 + 2 \times 1 \times 3 = 18$**

**A(BC):  $18 + 2 \times 6 \times 3 = 54$**

**(ABC)D:  $18 + 2 \times 3 \times 5 = 48$**

**(AB)(CD):  $12 + 15 + 2 \times 1 \times 5 = 37$**

**A(BCD):  $45 + 2 \times 6 \times 5 = 105$**

$$\mathbf{(BC)D: 18 + 6x3x5 = 108}$$

$$\mathbf{B(CD): 15 + 6x1x5 = 45}$$

$$\mathbf{(CD)E: 15 + 1x5x2 = 25}$$

$$\mathbf{C(DE): 30 + 1x3x2 = 36}$$

$$\mathbf{(BCD)E: 45 + 6x5x2 = 105}$$

$$\mathbf{(BC)(DE): 18 + 30 + 6x3x2 = 84}$$

$$\mathbf{B(CDE): 25 + 6x1x2 = 37}$$

$$\mathbf{(ABCD)E: 37 + 2x5x2 = 57}$$

$$\mathbf{(ABC)(DE): 18+30+2x3x2 = 60}$$

$$\mathbf{(AB)(CDE): 12 + 25 + 2x1x2 = 41}$$

$$\mathbf{A(BCDE): 37 + 2x6x2 = 61}$$