

### BLG 231 Homework 3

$X_3X_4$ $X_1X_2$	00	01	11	10
00	1	1		1
01	1	$\Phi$	1	
11		1		$\Phi$
10	$\Phi$			1

1)  $\bar{X}_1\bar{X}_3, \bar{X}_2\bar{X}_4, \bar{X}_1X_2X_4, X_2\bar{X}_3X_4, X_1X_3\bar{X}_4$

2)

	0	1	2	4	7	10	13	Cost
$\bar{X}_1\bar{X}_3$	X	X		X				6
$\bar{X}_2\bar{X}_4$	X		X			X		6
$\bar{X}_1X_2X_4$					X			7
$X_2\bar{X}_3X_4$							X	7
$X_1X_3\bar{X}_4$						X		7

First we can remove the row with  $X_1X_3\bar{X}_4$  because it covers only 10 and has higher cost than  $\bar{X}_2\bar{X}_4$  which also cover 10 and other points. 1, 2, 4, 7, and 13 are distinguished points so we have to select the prime implicants that cover those points, when we select them 0 and 10 are also automatically covered.

3)  $F = \bar{X}_1\bar{X}_3 + \bar{X}_2\bar{X}_4 + \bar{X}_1X_2X_4 + X_2\bar{X}_3X_4$  (Cost: 26)

4)

	X <sub>1</sub>	X <sub>2</sub>	X <sub>3</sub>	X <sub>4</sub>			X <sub>1</sub>	X <sub>2</sub>	X <sub>3</sub>	X <sub>4</sub>	
0	0	0	0	0	✓	0,1	0	0	0	—	✓
1	0	0	0	1	✓	0,2	0	0	—	0	✓
2	0	0	1	0	✓	0,4	0	—	0	0	✓
4	0	1	0	0	✓	0,8	—	0	0	0	✓
8	1	0	0	0	✓	1,5	0	—	0	1	✓
5	0	1	0	1	✓	2,10	—	0	1	0	✓
10	1	0	1	0	✓	4,5	0	1	0	—	✓
7	0	1	1	1	✓	8,10	1	0	—	0	✓
13	1	1	0	1	✓	5,7	0	1	—	1	
14	1	1	1	0	✓	5,13	—	1	0	1	
						10,14	1	—	1	0	

	X <sub>1</sub>	X <sub>2</sub>	X <sub>3</sub>	X <sub>4</sub>
0,1,4,5	0	—	0	—
0,2,8,10	—	0	—	0

**Prime implicants:**  $\overline{X}_1\overline{X}_3$ ,  $\overline{X}_2\overline{X}_4$ ,  $\overline{X}_1X_2X_4$ ,  $X_2\overline{X}_3X_4$ ,  $X_1X_3\overline{X}_4$

5)

a. Drawing rectangles with more units is better because that means we can form prime implicants with fewer variables and that means less cost.

b. We take don't care values as 1 when finding prime implicants because we want to form prime implicants with fewer variables as possible and we take them as 0 when forming the prime implicant chart because we don't have to cover don't care values to find out the expression.

c.

	00	01	11	10
00	1	1		
01	1	1		
11	1			1
10		Φ	Φ	