

In-class Exercise 5

(PAR 9)

- Use branch-and-bound to find the minimum cover for the following constraint matrix

	P1	P2	P3	P4	P5	P6
m4	X	X				
m5	X		X			
m7			X	X		
m12		X				X
m14					X	X
m15				X	X	

ECE 474a/575a
Susan Lysecky

In-class Exercise 5

(PAR 9)

Call to BCP(F, U, {})

- Initialize best solution (F) and current cost (U) variables
- Reduce matrix
- Solution found? No.
- Calculate lower bound on subtree

$$F = \emptyset$$

$$U = 6 + 1 = 7$$

	P1	P2	P3	P4	P5	P6
m4	X	X				
m5	X		X			
m7			X	X		
m12		X				X
m14					X	X
m15				X	X	

*No reduction can be made,
matrix cyclic*

ECE 474a/575a
Susan Lysecky

In-class Exercise 5

(PAR 9)

CALL MIS QUICK

	P1	P2	P3	P4	P5	P6	
m4	X	X					w=4
m5	X		X				w=4
m7			X	X			w=4
m12		X				X	w=4
m14					X	X	w=4
m15			X	X			w=4

MIS = {m4}
Remove m4, m5, m12

	P3	P4	P5	P6	
m7	X	X			w=3
m14			X	X	w=3
m15	X	X			w=4

MIS = {m4, m7}
Remove m7, m15

	P5	P6	
m14	X	X	w=2

MIS = {m4, m7, m14}
Remove m14

Matrix empty -- done!

Return |MIS| = 3

ECE 474a/575a
Susan Lysecky

In-class Exercise 5

(PAR 9)

Call to BCP(F, U, {})

1. Initialize best solution (F) and current cost (U) variables

$$F = \Phi$$

$$U = 6 + 1 = 7$$

2. Reduce matrix

$$L = 3$$

3. Solution found? No.

P1

4. Calculate lower bound on subtree
MIS_QUICK returns {m4, m7, m14}

$$\text{Lower bound (L)} = \# \text{ prime implicants} + \text{MIS}$$

$$= 0 + 3 = 3$$

5. $L \geq U$? No.

6. $x_i = P1$

7. $S^i = \text{BCP}(F_{S^i}, U, \text{currentSoln} \cup x_i)$

	P1	P2	P3	P4	P5	P6
m4	X	X				
m5	X		X			
m7			X	X		
m12		X				X
m14					X	X
m15			X	X		

No reduction can be made,
matrix cyclic

ECE 474a/575a
Susan Lysecky

In-class Exercise 5

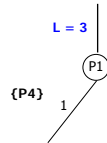
(PAR 9)

Call to BCP(F, U, {P1})

$$F = \Phi$$

$$U = 6 + 1 = 7$$

2. Reduce matrix



	P1	P2	P3	P4	P5	P6
m4	X	X				
m5	X		X			
m7		X	X			
m12		X				X
m14				X	X	
m15				X	X	

P1 included in cover

	P2	P3	P4	P5	P6
m7	X	X			
m12	X				X
m14			X	X	
m15			X	X	

No row dominance.
P6 dominates P2, P4 dominates P3

	P4	P5	P6
m7	X		
m12		X	
m14	X	X	
m15	X	X	

P4 becomes essential

ECE 474a/575a
Susan Lysecky

In-class Exercise 5

(PAR 9)

Call to BCP(F, U, {P1})

$$F = \{P1, P4, P6\}$$

$$U = 3$$

~~$$F = \Phi$$

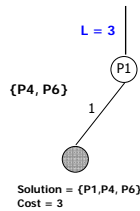
$$U = 6 + 1 = 7$$~~

2. Reduce matrix

3. Solution found? Yes

cost(currentSoln) < U ?
cost(3) < 7 ? Yes.

Update placeholders



	P4	P5	P6
m7	X		
m12			X
m14	X	X	
m15	X	X	

remove P4 (and minterms covered)

	P5	P6
m12	X	
m14	X	X

P6 becomes essential

	P5	P6
m12	X	
m14	X	X

remove P6 (and minterms covered)

matrix empty – no further simplification

ECE 474a/575a
Susan Lysecky

In-class Exercise 5

(PAR 9)

Call to BCP(F, U, {})

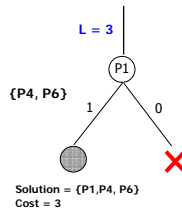
1. Initialize best solution (F) and current cost (U) variables
2. Reduce matrix
3. Solution found? No.
4. Calculate lower bound on subtree
 MIS_QUICK returns {m4, m7, m14}

 Lower bound (L) = # prime implicants + MIS
 = 0 + 3 = 3
5. $L \geq U$? No.
6. $x_i = P1$
7. $S^1 = \text{BCP}(F_{x_i}, U, \text{currentSoln} \cup x_i)$ ← Returns from here with updated F and U
8. Cost($S^1 = L$)? Yes.
 Kill S^0 subtree.

F = {P1, P4, P6}
 U = 3

	P1	P2	P3	P4	P5	P6
m4	X	X				
m5	X		X			
m7			X	X		
m12		X				X
m14					X	X
m15				X	X	

No reduction can be made,
 matrix cyclic



Done!