SCP - Set Covering Probs, 68e, 4/18,

	S_j^1					S_j^2				S_j^3	S_j^4				S_j^5			S_j^6		
	6	1	3	8	2	6	1	3	8	4	5	8	7	2	6	5	7	1	7	2
1	1	1	1	1	1															
2	1	1	1	1	0	1	1	1	1											
3	0	0	0	0	0	0	0	0	0	1										
4	0	0	0	1	1	0	0	0	1	0	1	1	1	1						
5	1	0	0	0	0	1	0	0	0	0	1	0	1	0	1	1	1			
6	0	1	0	0	1	0	1	0	0	0	0	0	1	1	0	0	1	1	1	1
	2	4	5	5	7	2	4	5	5	8	3	5	6	7	2	3	6	4	6	7

Reduction: 5 | 1 covers all of 2

TABLEAU associated w/algorithm
Selected candidates

Now go back to bottom p. 41

L - Set of Sets

1		
2	E1	
3		
4	E6	
5	E9	E11
6		
7	E12	
8		
9	E13	
10	E2	
11		
12	E7	
13	E3	E10
14		
15	E8	
16	E5	
17	E4	
18		
19		

COST Z_i

PARTIAL SOLNS FOR DOMINANCE TESTS

HARD CONSTRAINTS: We want...
SOFT : Country wants

Per SCP p. 40, Step 3

$V_1 = (6,1,3,8,2)$
$V_2 = (6,1,3,8)$
$V_2 \subseteq V_1$ - so far, so good
$p=2, q=1 \therefore V_1$ can be del'd

$E1 = (1,2,5)$
$E2 = (1,2,3,5)$
$E3 = (1,2,3,4,5)$
$E4 = (1,2,3,4,5,6)$
$E5 = (1,2,3,4,5,6)$
$E6 = (1,2,6)$
$E7 = (1,2,3,6)$
$E8 = (1,2,3,4,5,6)$

$E9 = (1,2)$
$E10 = (1,2,3)$
$E11 = (1,2,4)$
$E12 = (1,4,6)$
$E13 = (1,2,4,5,6)$

SCP Search

Set Covering Prob - p. 54

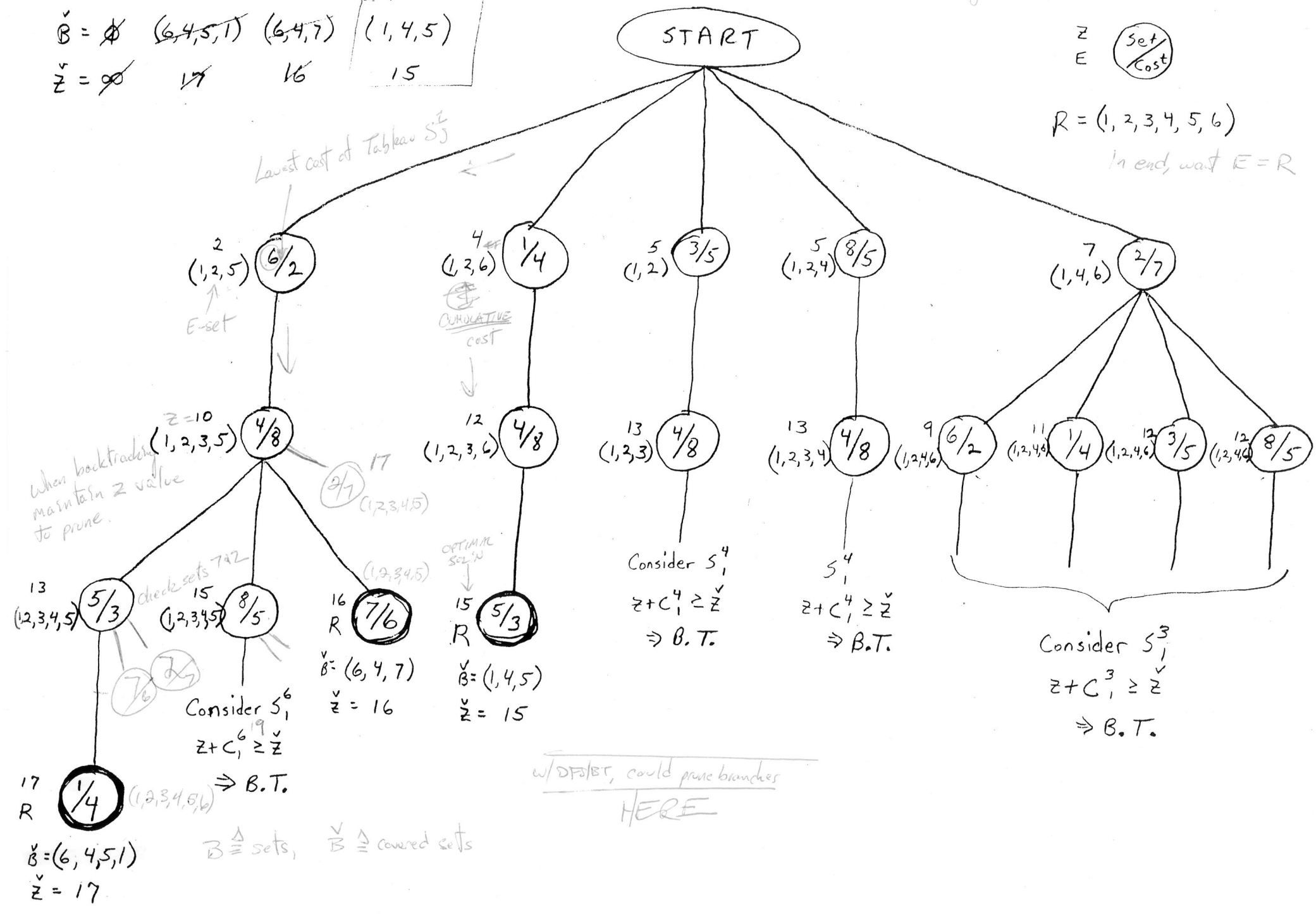
Search Space = $O(2^n)$

Optimal Soln space = $O(?) \cdot 2^m$

686, 4/"

$\check{B} = \cancel{\emptyset}$ ~~(6,4,5,1)~~ (6,4,7) | (1,4,5)

$\check{z} = \cancel{\infty}$ ~~17~~ 16 | 15



SCP Search WITH Dominance Test

Use for → smaller size graphs

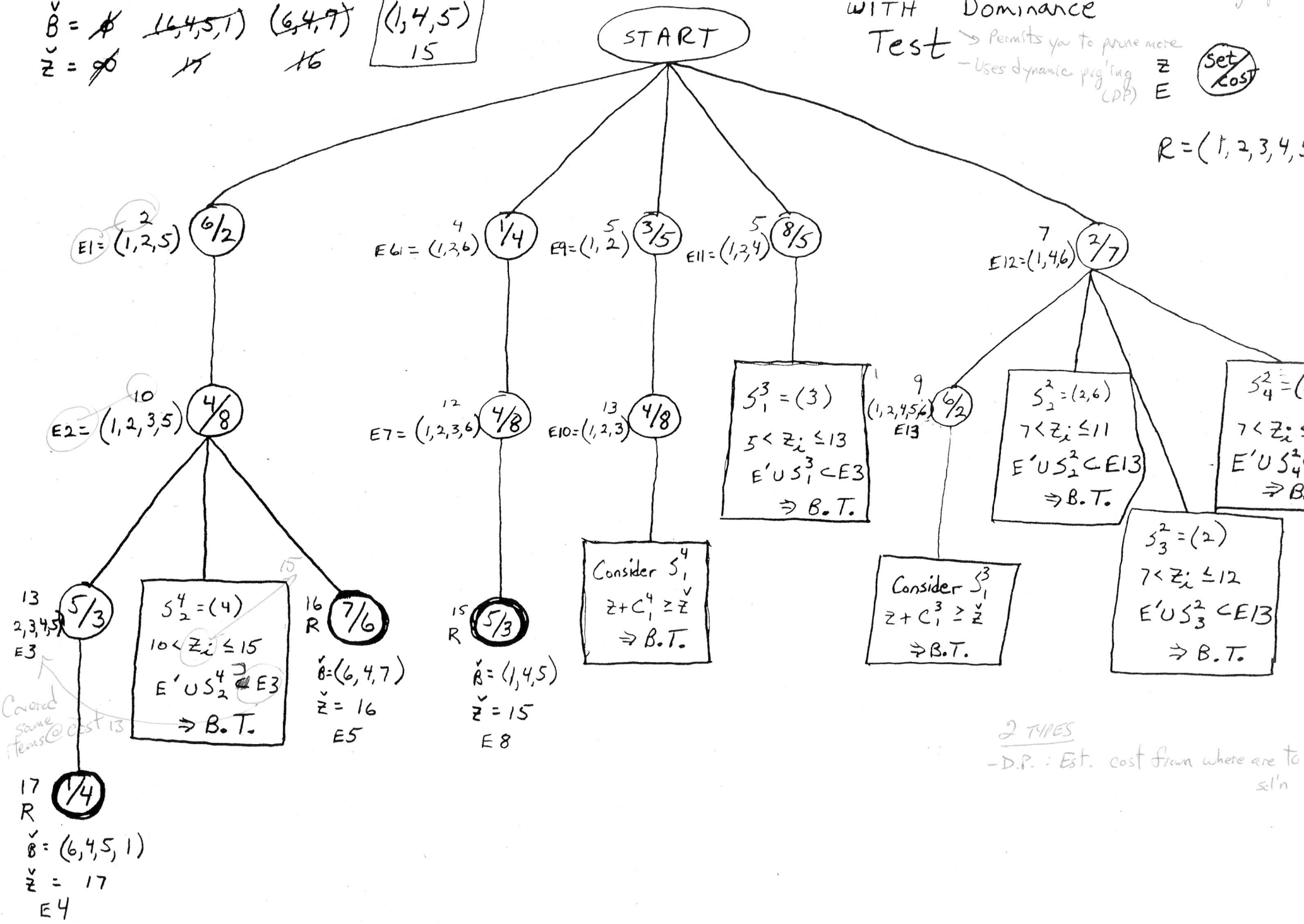
→ Permits you to prune more
– Uses dynamic prog'ing (DP)

$\check{B} = \cancel{\emptyset}$ ~~(4,5,1)~~ ~~(6,4,7)~~ (1,4,5)
$\check{z} = \cancel{\infty}$ ~~17~~ ~~16~~ 15

Optimal

z / E — Set / Cost

R = (1, 2, 3, 4, 5



2 TYPES
– D.P. : Est. cost from where are to sol'n

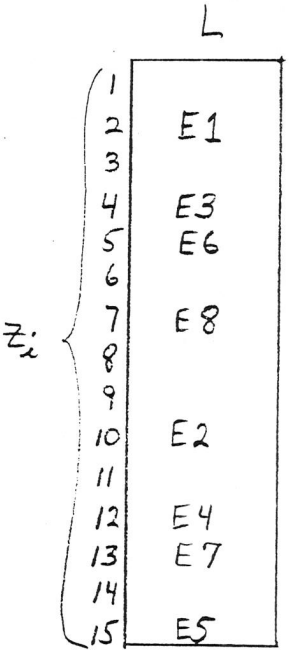
15 SCP easier than SPP

SPP

An SCP w/ "no overcovering" restriction

Table

	S_j^1					S_j^2	S_j^3	
	6	1	8	3	2	4	5	7
1	1	1	1	1	1			
2	1	1	1	1	0			
3	0	0	0	0	0	1		
4	0	0	1	0	1	0	1	1
5	1	0	0	0	0	0	1	1
6	0	1	0	0	1	0	0	1
	2	4	5	5	7	8	3	6



* Dominance test doesn't help in this problem.

because of harder constraint of not overlapping. Single branches vs. branching out.

E1 = (1, 2, 5)

E2 = (1, 2, 3, 5)

E3 = (1, 2, 6)

E4 = (1, 2, 3, 6)

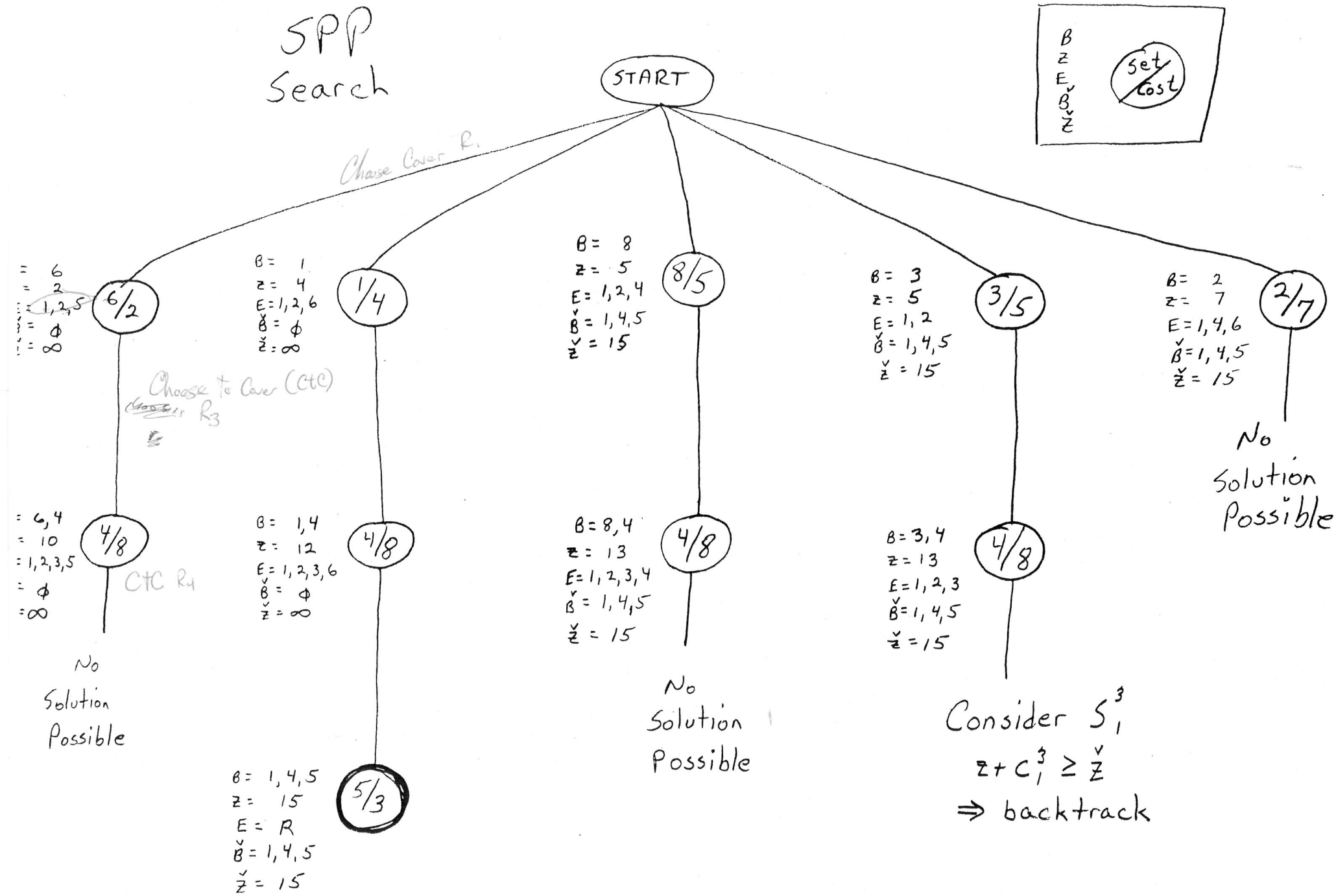
E5 = (1, 2, 3, 4, 5, 6)

E6 = (1, 2, 4)

E7 = (1, 2, 3, 4)

E8 = (1, 4, 6)

SPP Search


B
z
E
B̌
ž
set/cost
START
Choose Cover R1
6/2
= 6
= 2
= 1,2,5
= ϕ
= ∞
Choose to Cover (CtC) R3
4/8
= 6,4
= 10
= 1,2,3,5
= ϕ
= ∞
CtC R4
No Solution Possible
1/4
B = 1
z = 4
E = 1,2,6
B̌ = ϕ
ž = ∞
4/8
B = 1,4
z = 12
E = 1,2,3,6
B̌ = ϕ
ž = ∞
5/3
B = 1,4,5
z = 15
E = R
B̌ = 1,4,5
ž = 15
8/5
B = 8
z = 5
E = 1,2,4
B̌ = 1,4,5
ž = 15
4/8
B = 8,4
z = 13
E = 1,2,3,4
B̌ = 1,4,5
ž = 15
No Solution Possible
3/5
B = 3
z = 5
E = 1,2
B̌ = 1,4,5
ž = 15
4/8
B = 3,4
z = 13
E = 1,2,3
B̌ = 1,4,5
ž = 15
Consider S_1^3
$z + c_1^3 \geq \check{z}$
⇒ backtrack
2/7
B = 2
z = 7
E = 1,4,6
B̌ = 1,4,5
ž = 15
No Solution Possible

SPP

686, 4/21

ascending order of elements/set

element (within # of sets)

1 (5), 2 (4), 3 (1), 4 (4), 5 (3), 6 (3)

PREPROCESSING

new #		sets 1	2	3	4	5	6	7	8
1	3	0	0	0	1	0	0	0	0
2	5	0	0	0	0	1	1	1	0
3	6	1	1	0	0	0	0	1	0
4	2	1	0	1	0	0	1	0	1
5	4	0	1	0	0	1	0	1	1
6	1	1	1	1	0	0	1	0	1
		4	7	5	8	3	2	6	5

tableau

	S^1	S^2			S^3		S^4	
	4	6	5	7	1	2	3	8
1	1							
2	0	1	1	1				
3	0	0	0	1	1	1		
4	0	1	0	0	1	0	1	1
5	0	0	1	1	0	1	0	1
6	0	1	0	0	1	1	1	1
	8	2	3	6	4	7	5	5

SCP

686, 4/21

ascending order of elements/sets from SPP restructured matrix

	S^1	S^2			S^3			S^4				S^5				S^6				
	4	6	5	7	1	7	2	6	1	3	8	5	8	7	2	6	1	3	8	2
1	1																			
2	0	1	1	1																
3	0	0	0	1	1	1	1													
4	0	1	0	0	1	0	0	1	1	1	1									
5	0	0	1	1	0	1	1	0	0	0	1	1	1	1	1					
6	0	1	0	0	1	0	1	1	1	1	1	0	1	0	1	1	1	1	1	1
	8	2	3	6	4	6	7	2	4	5	5	3	5	6	7	2	4	5	5	7