In-class Exercise 6
(PAR 10)

- Use Simulated Annealing to find the minimum cover for the same constraint matrix
  - Assume a linear cooling schedule where the start temperature is initialized to 100 and decrease by 25 after each iteration
  - Assume the random numbers generated in each iteration are r0 = 0.520, r1 = 0.287, r2 = 0.150, r3 = 0.552
  - You may choose the random neighbor selected in each iteration of the algorithm

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

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- How do we apply to the minimum cover problem?

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

1. Choose an initial solution, set an initial temperature
2. Is temperature T > 0? Yes
3. Make a random change to S

   What can we change?
   - Adding another prime implicant to our cover
   - Removing a prime implicant from the current cover ✓ **Remove P2**

4. Determine cost difference

   C = cost of S – cost of S'
   C = 5 – 4 = **1**

   We should also consider if this solution is correct. (Yes)

   a) Is the solution better? Yes.

      Keep new solution

6. Decrease Temperature

   T = T - 25 = 75

S = ~~P1 P2 P4 P5 P6~~

T = ~~100~~ 75

S' = P1, P4, P5, P6

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2. Is temperature T > 0? Yes

3. Make a random change to S

   What can we change?
   - Adding another prime implicant to our cover ✓ **Add P3**
   - Removing a prime implicant from the current cover

4. Determine cost difference

   C = cost of S – cost of S'
   C = 4 – 5 = **-1**

   We should also consider if this solution is correct. (Yes)

   a) Is the solution better? No.

   b) Should we randomly accept it anyways?

      r = 0.287 (random number), m = $1/e^{|-1/75|}$ = 0.987
      0.287 < 0.987? Yes. Keep new solution

7. Decrease Temperature

   T = T - 25 = 50

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

S = ~~**P1 P4 P5 P6**~~

T = ~~75~~ **50**

S' = P1, P3, P4, P5, P6

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1. Is temperature T > 0? Yes

2. Make a random change to S

   What can we change?
   - Adding another prime implicant to our cover
   - Removing a prime implicant from the current cover ✓ **Remove P6**

3. Determine cost difference

   C = cost of S – cost of S'
   C = 5 – 4 = **1**

   We should also consider if this solution is correct. (NO!)

5. Decrease Temperature

   T = T - 25 = 25

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

S = P1 P3 P4 P5 P6

T = ~~50~~ **25**

~~S' = P1, P3, P4, P5~~

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1. Is temperature T > 0? Yes

2. Make a random change to S

   What can we change?
   - Adding another prime implicant to our cover
   - Removing a prime implicant from the current cover ✓ **Remove P5**

3. Determine cost difference

   C = cost of S – cost of S'
   C = 4 – 3 = **1**

   We should also consider if this solution is correct. (Yes)

   a) Is the solution better? Yes.

      Keep new solution

5. Decrease Temperature

   T = T - 25 = 0

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

S = P1 ~~P3 P4 P5~~ P6

T = ~~25~~ 0

S' = P1, P3, P4, P6

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1. Is temperature T > 0? No

Done!
Solution : P1, P3, P4, P6

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

S = P1 P3 P4 P6

T = 0

- Is this solution optimal?
  - No
- Ideally, this algorithm would run longer so we can explore more of the solution space and possible find a better solution