Assignment 1
COMPSCI 2SD3
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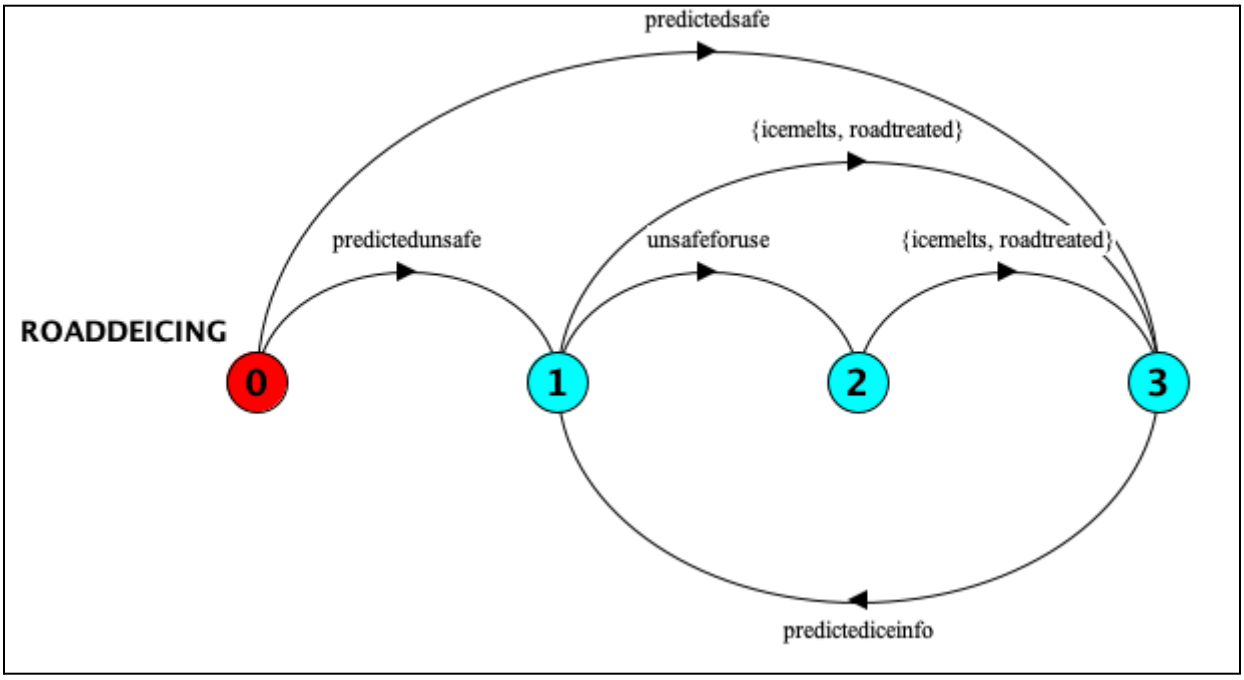
1.

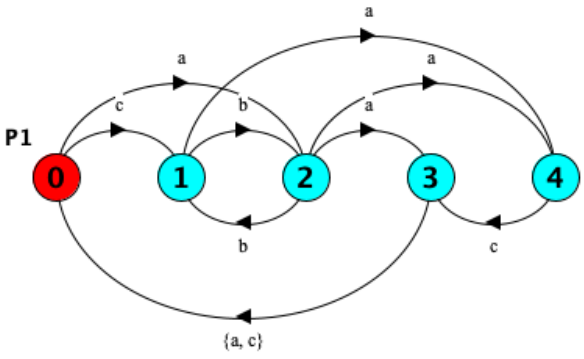
```
ROADDEICING = (predictedsafe -> PREDICTEDSAFE | predictedunsafe ->
PREDICTEDUNSAFE),
PREDICTEDUNSAFE = (icemelts -> PREDICTEDSAFE | roadtreated -> PREDICTEDSAFE |
unsafeforuse -> CLOSED),
PREDICTEDSAFE = ( predictediceinfo -> PREDICTEDUNSAFE),
CLOSED = (icemelts -> PREDICTEDSAFE | roadtreated -> PREDICTEDSAFE ).
```

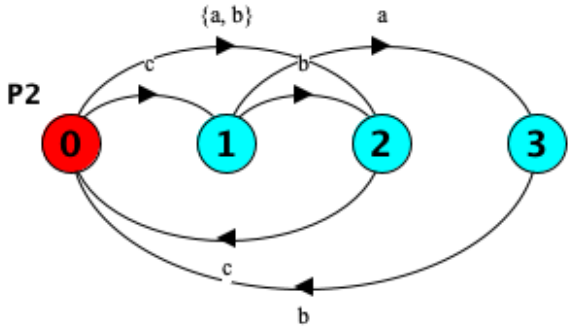
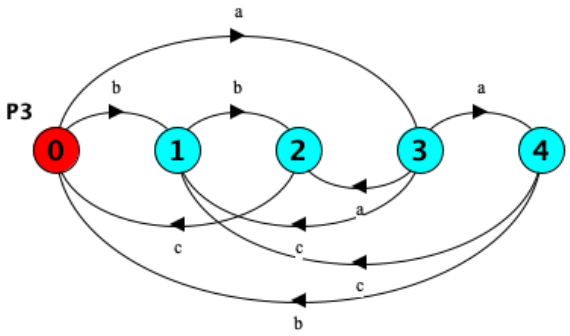
LTSA:



2.

```
P1 = A,
A = (a -> B | c -> C),
B = (a -> D | a -> E | b -> C) ,
C = (a -> D | b -> B),
D = (c -> E) ,
E = (a -> A | c -> A) .
```

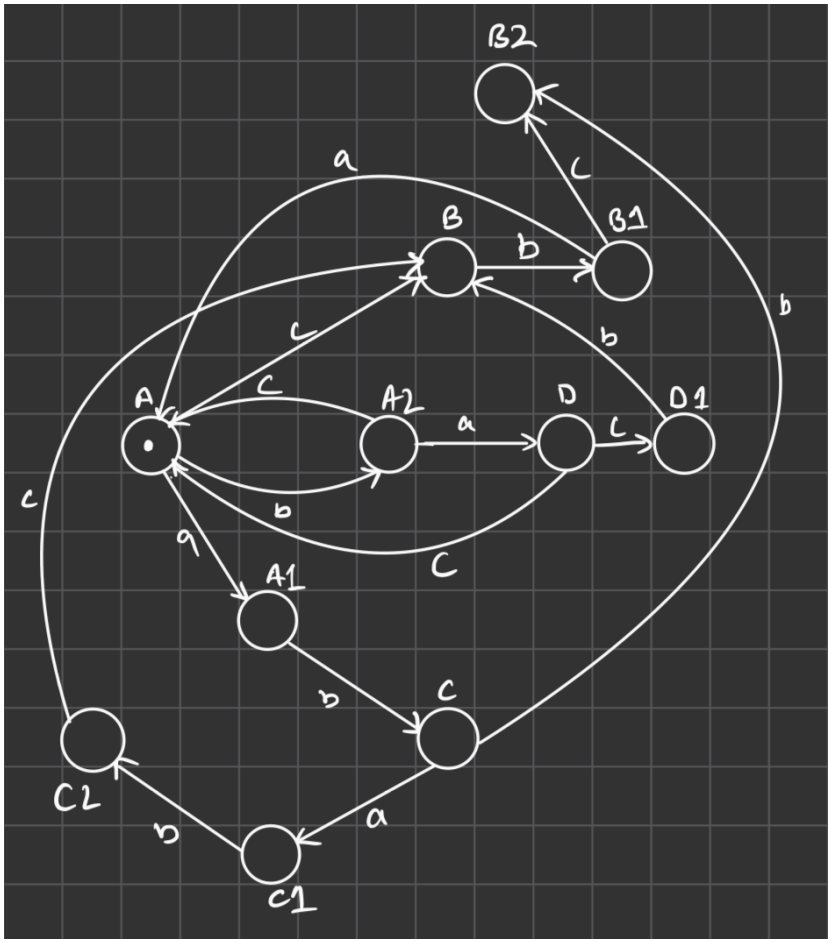


P2 = A, A = (a -> C | b -> C | c -> B) , B = (a -> D | b -> C), C = (c -> A) , D = (b -> A).	
P3 = A, A = (a -> B | b -> D) , B = (a -> C | a -> E | c -> D), C = (b -> A | c -> D) , D = (b -> E), E = (c -> A).	

3.

A = (a -> A1 | b -> A2 | c -> B), A1 = (b -> C), A2 = (a -> D | c -> A), B = (b -> B1), B1= (a -> A | c -> B2), B2 = (b -> C | a -> D), C = (a -> C1), C1 = (b -> C2), C2 = (c -> B), D = (c -> A | c -> D1), D1 = (b -> B).

LTS:



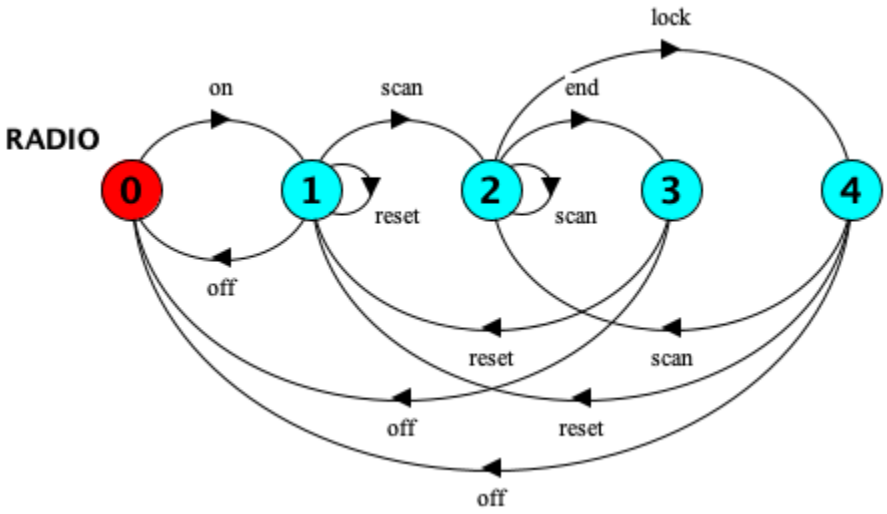
4.

```
range LEVEL = 0..11
SENSOR = SENSOR[5],
SENSOR[i:LEVEL] =
            (level[w: LEVEL] -> SENSOR[w]
            |when(i < 2) lowDanger -> SENSOR[i]
            |when(i >= 2 &&  i <= 3) low -> SENSOR[i]
            |when(i >= 8 && i <= 9) high -> SENSOR[i]
            |when(i > 9) highDanger -> SENSOR[i]
            |when(i >= 4 && i <= 7) normal -> SENSOR[i]
            ).
```

5.

```
RADIO = Off,
Off = (on -> TopFreq),
```

TopFreq = (scan -> Scanning | reset -> TopFreq | off -> Off),
Scanning = (lock -> Locked | end -> BottomFreq | scan -> Scanning),
Locked = (scan -> Scanning | reset -> TopFreq | off -> Off),
BottomFreq = (reset -> TopFreq | off -> Off).

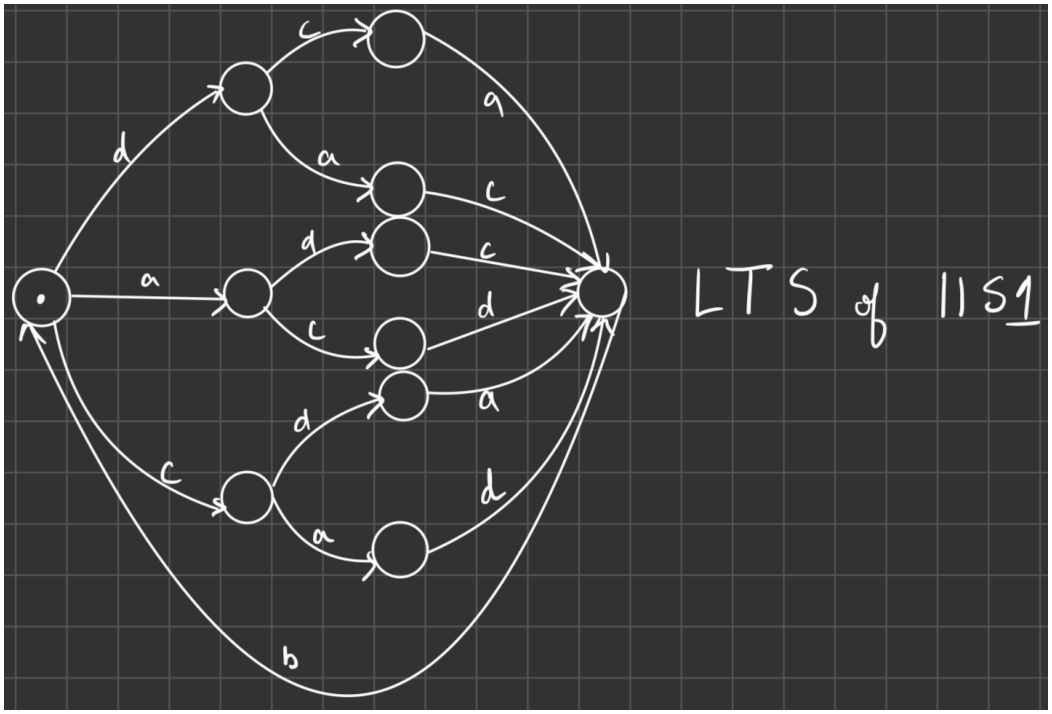


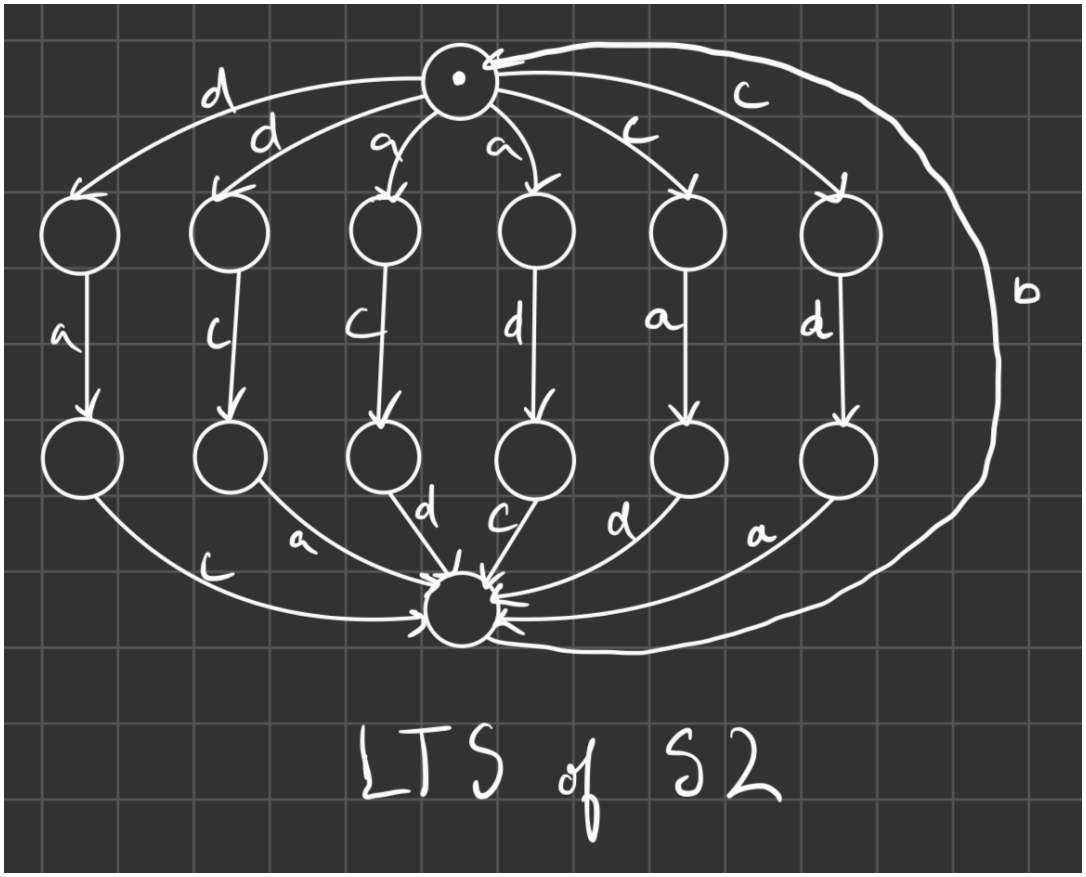
6.

a) S2 begins with some actions but reaches action ‘b’ where action ‘b’ loops it back to the initial state.

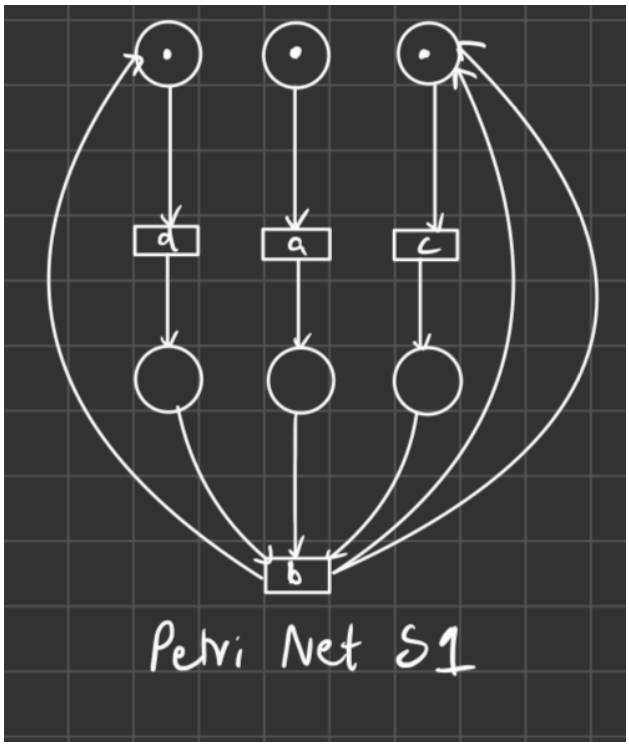
S1 is made of combination processes ‘P’, ‘Q’ and, ‘R’ which also eventually reach action ‘b’ which loops back to the initial state, similar to S2.

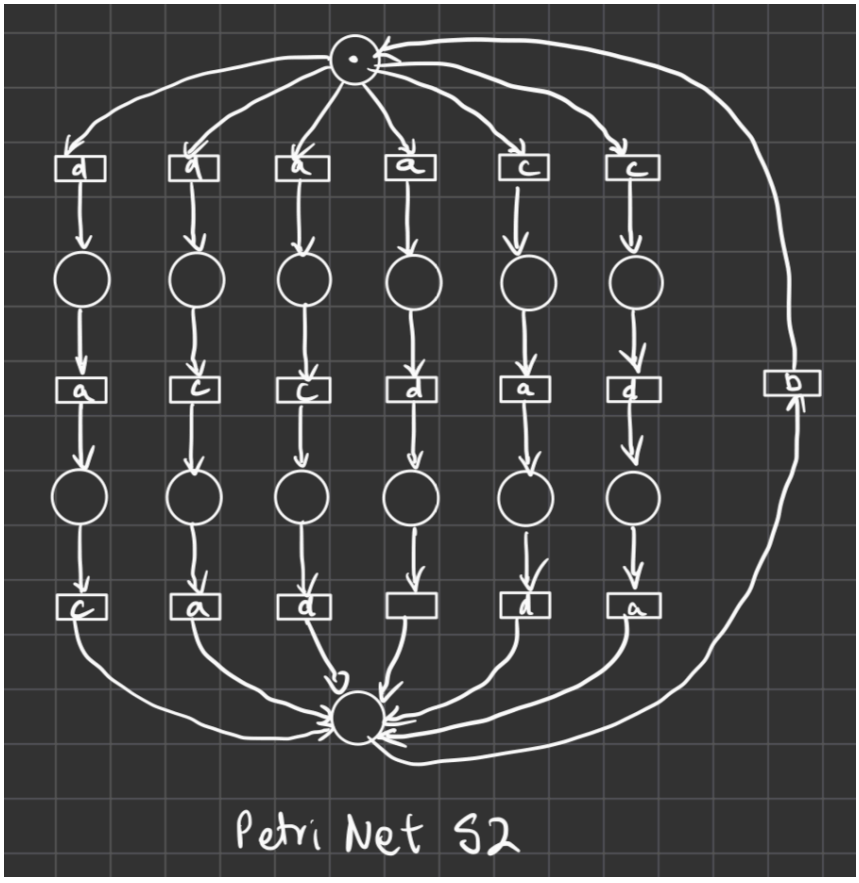
Both execute some actions but loop back to the initial state at the end, therefore, they portray similar behavior.


LTS of IIS1


LTS of S2

b) Petri net of 21 allows simultaneity as all 3 processes can be executed at once

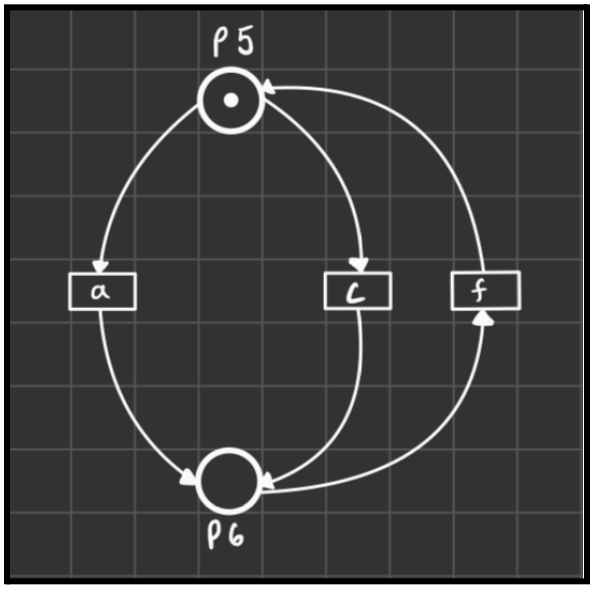


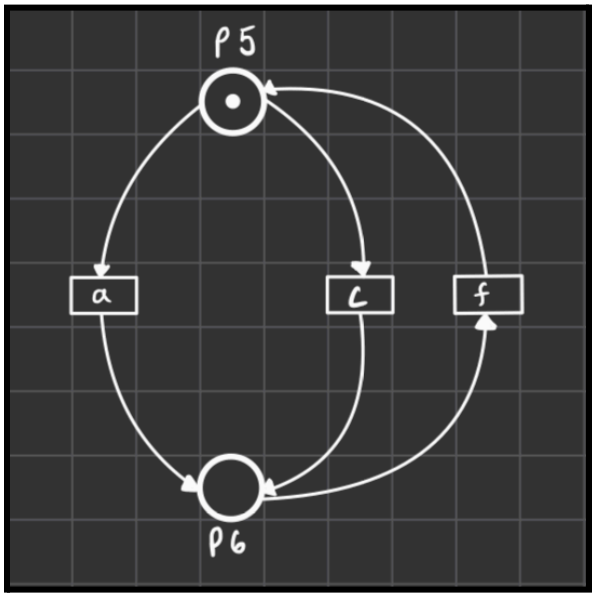


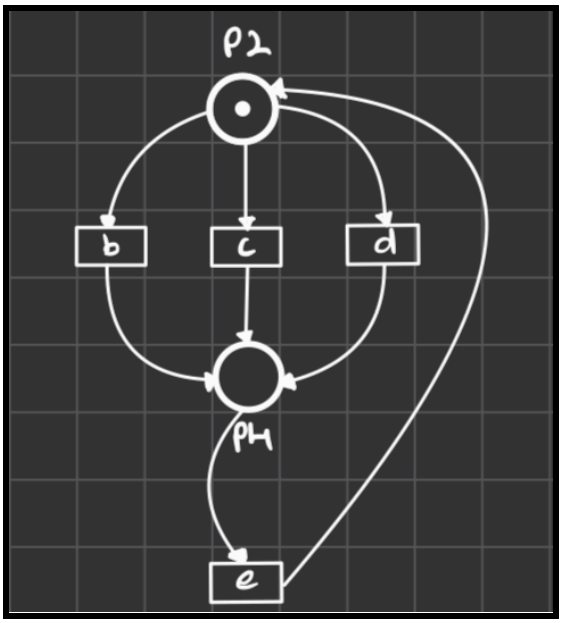
7.

To make the given Petri as a composition of many FSP processes we can split them into 3 different Petri's and make FSPs of all the Petri's then combine them in the code.

Below are 3 diagrams representing how I split the given Petri into smaller ones.



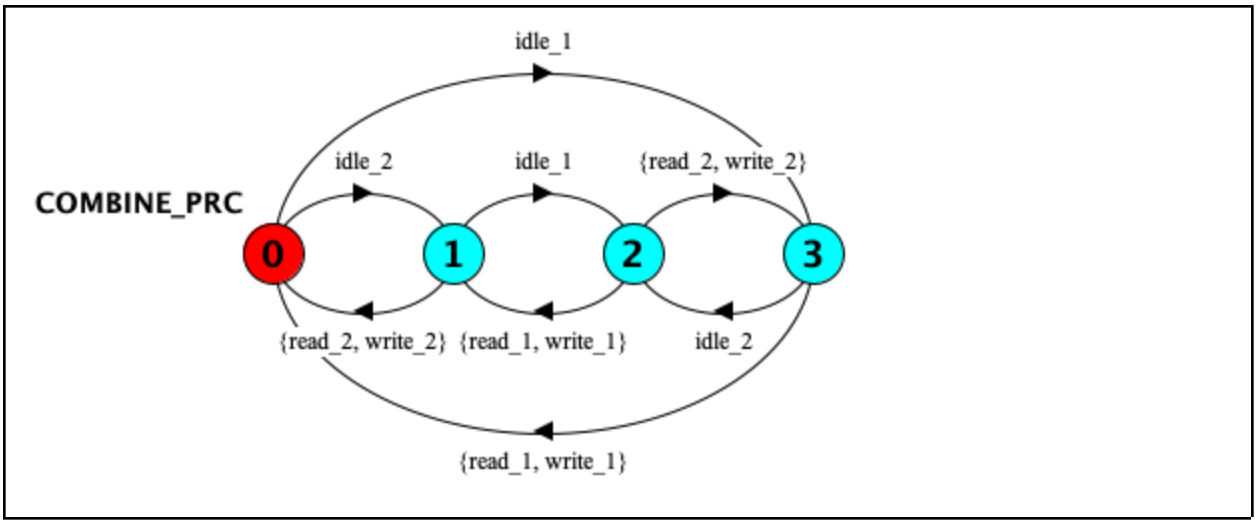




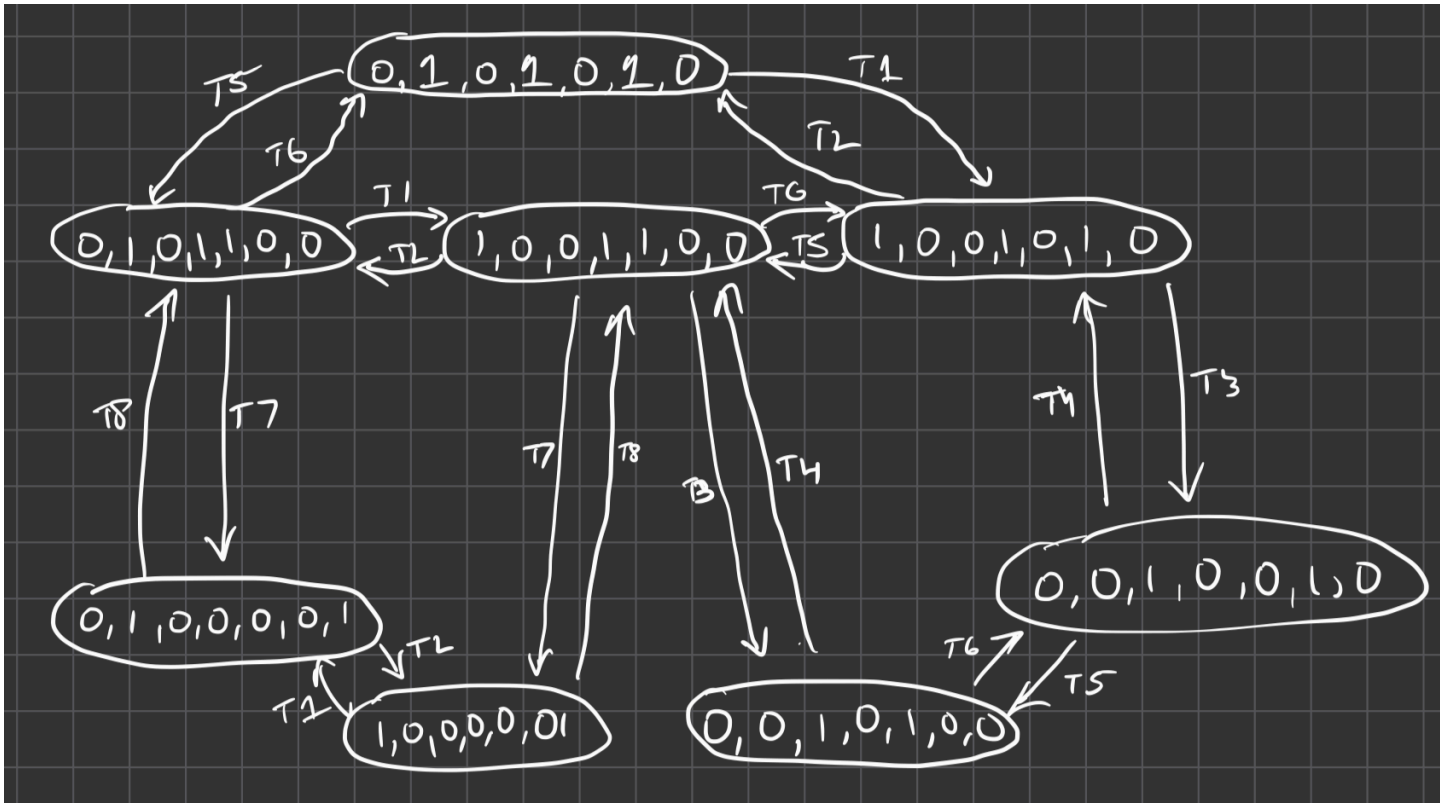

```
X = P1,
P1 = (a -> P3 | b -> P3),
P3 = (e -> P1).

Y = P2,
P2 = (b -> P4 | c -> P4 | d -> P4),
P4 = (e -> P2).

Z = P5,
P5 = (a -> P6 | c -> P6),
P6 = (f -> P5).

||NET = (X || Y || Z).
```

8.

```
CMP_1 = (idle_1 -> (read_1 -> CMP_1 | write_1 -> CMP_1)).
CMP_2 = (idle_2 -> (read_2 -> CMP_2 | write_2 -> CMP_2)).
PRINT = (write_1 -> PRINT | write_2 -> PRINT).
||COMBINE_PRC = (CMP_1||CMP_2||PRINT).
```


COMBINE_PRC
idle_1
idle_2
idle_1
{read_2, write_2}
0
1
2
3
{read_2, write_2}
{read_1, write_1}
idle_2
{read_1, write_1}

9.


T5
T1
T6
T2
T1
T6
T2
T5
T8
T7
T7
T8
T3
T4
T4
T2
T1
T6
T5

10.
a)
In both instances, p1 and s1 are bisimilar as they both permit the action 'a.'
p2 and s2 are bisimilar since they allow 'a,' 'b,' and 'c.'
Bisimilarity is also observed between p3 and s3, as they both permit 'a' and 'c.'
P4 and s4 are bisimilar because they both allow 'a' and 'b,'
p5 and s5 exhibit bisimilarity by allowing 'b' and 'c.'
p5 and s6 are bisimilar due to their common allowance of 'b' and 'c,'
p6 and s7 are bisimilar as they exclusively allow 'c.'

b)
P1 can be in either state q1 or q2
P2 is in state p2. In p2, actions 'a,' 'b,' and 'c' are permissible
in q1 only 'a' and 'c' are allowed, and in q2 only 'a' and 'b' are permitted

c)
After the 'a' trace, the labeled transition system P1 can be in either state q1 or q2, while P3 is in state s2. In s2, actions 'a,' 'b,' and 'c' are allowed

d)
Traces = Pref((ac*a $\cup$ ab*a) (c $\cup$ bc)*)