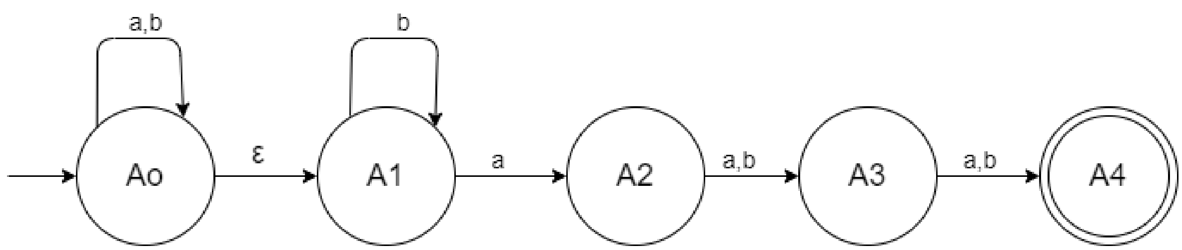
Practice Sheet

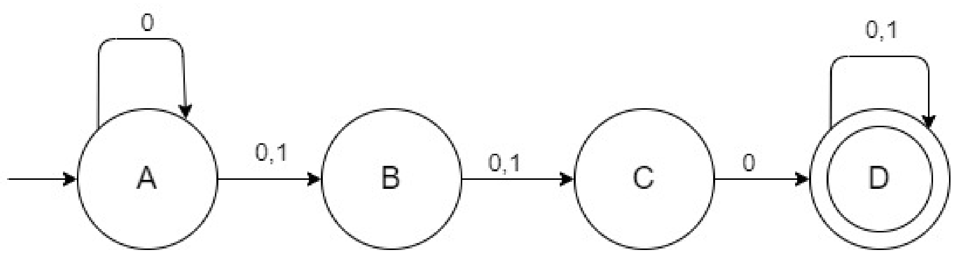
NFA to DFA & DFA Minimization

[1-5] Convert the following NFA/ε-NFA to its corresponding DFA.

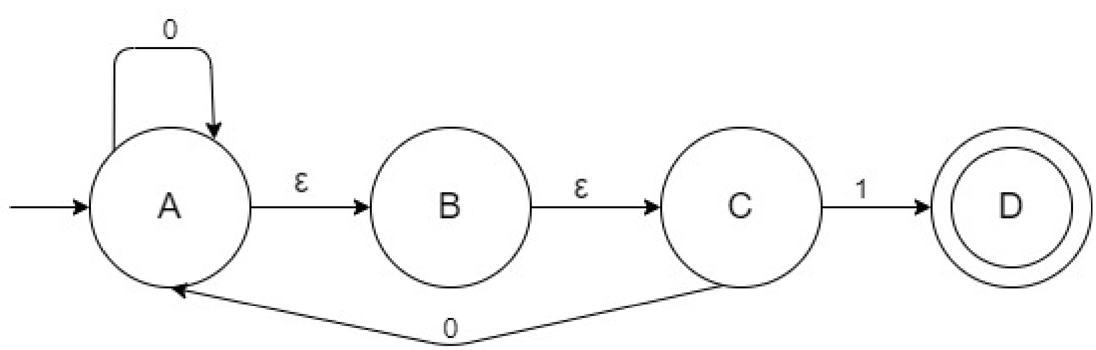
1.



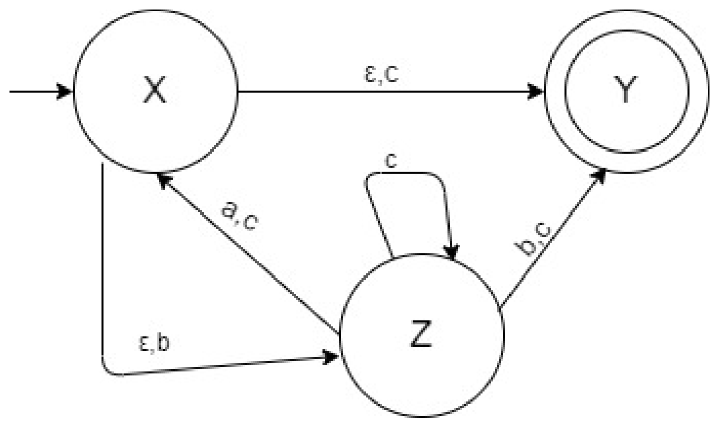
2.



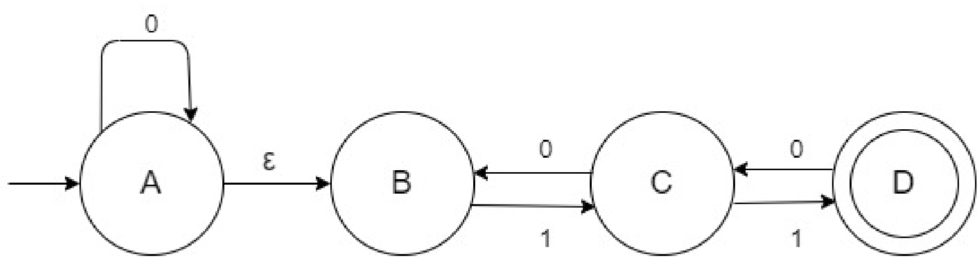
3.



4.

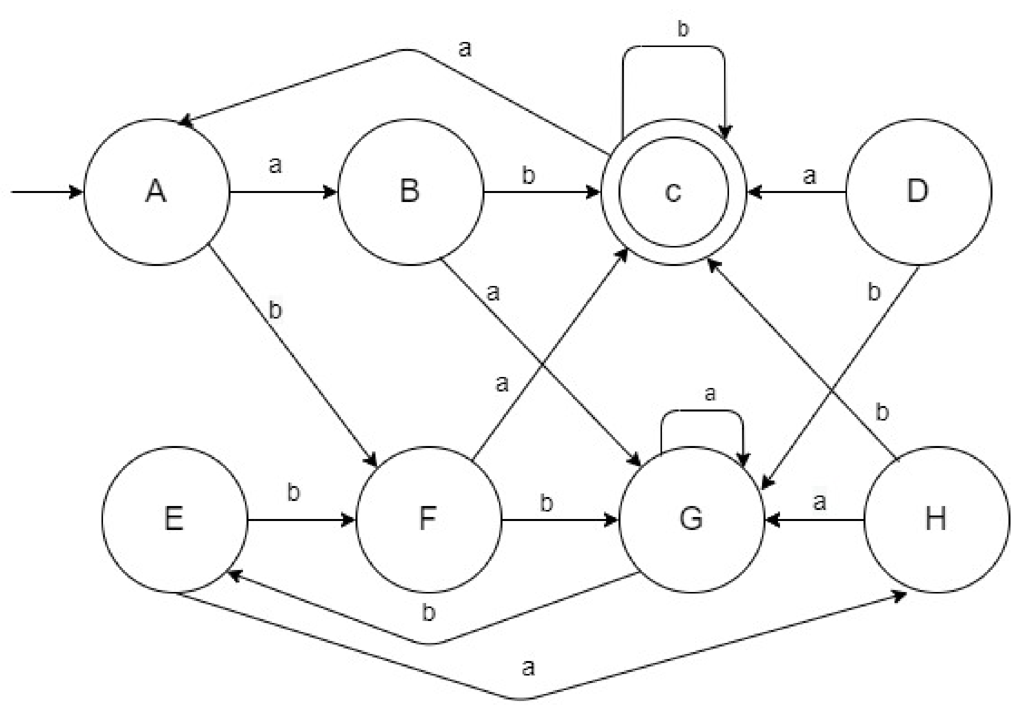


5.

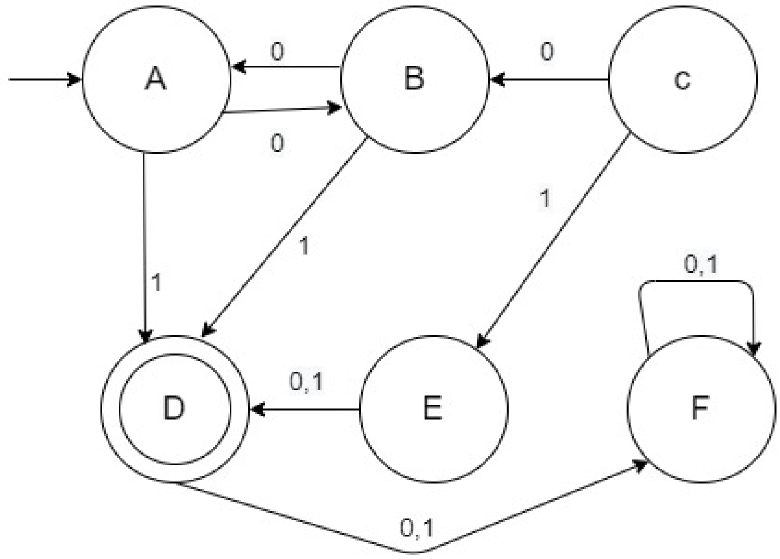


[6-10] Minimize the following DFAs using Hopcroft's Algorithm:

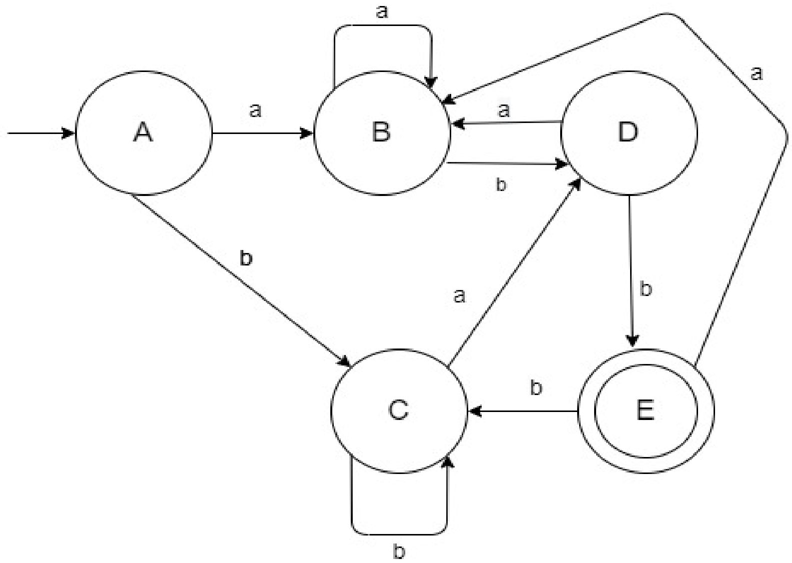
6.



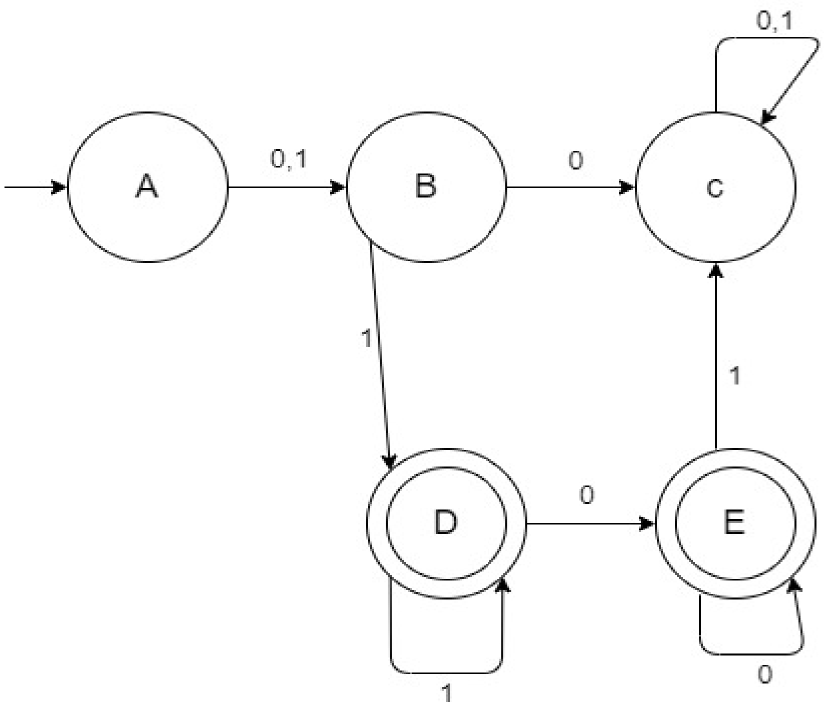
7.



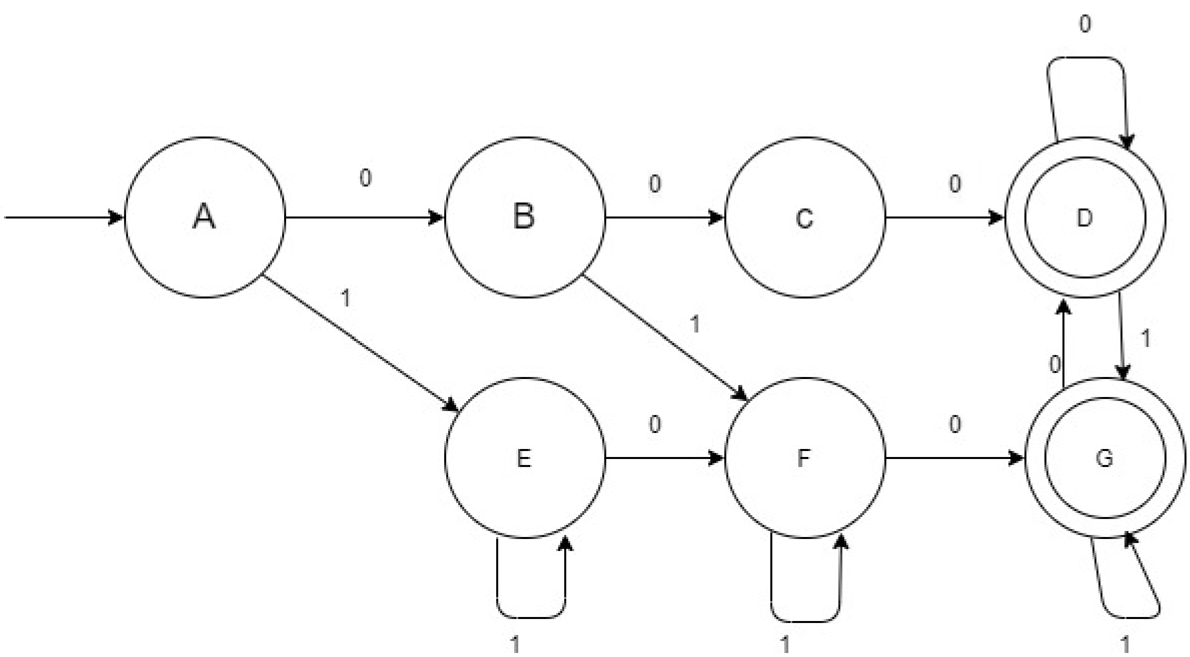
8.



9.

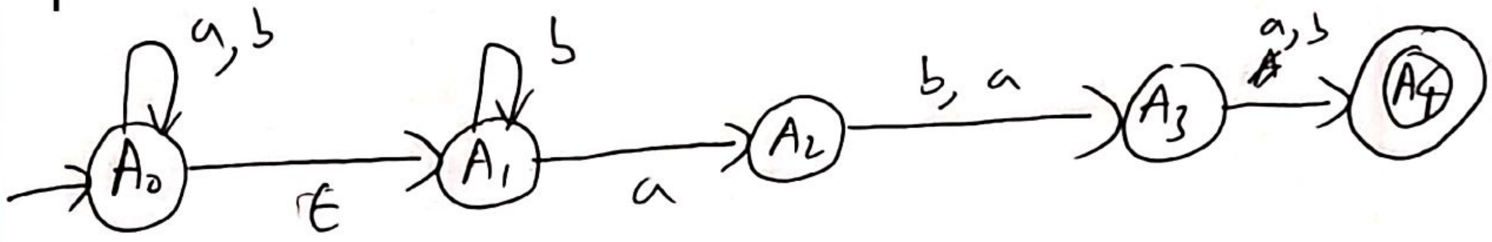


10.



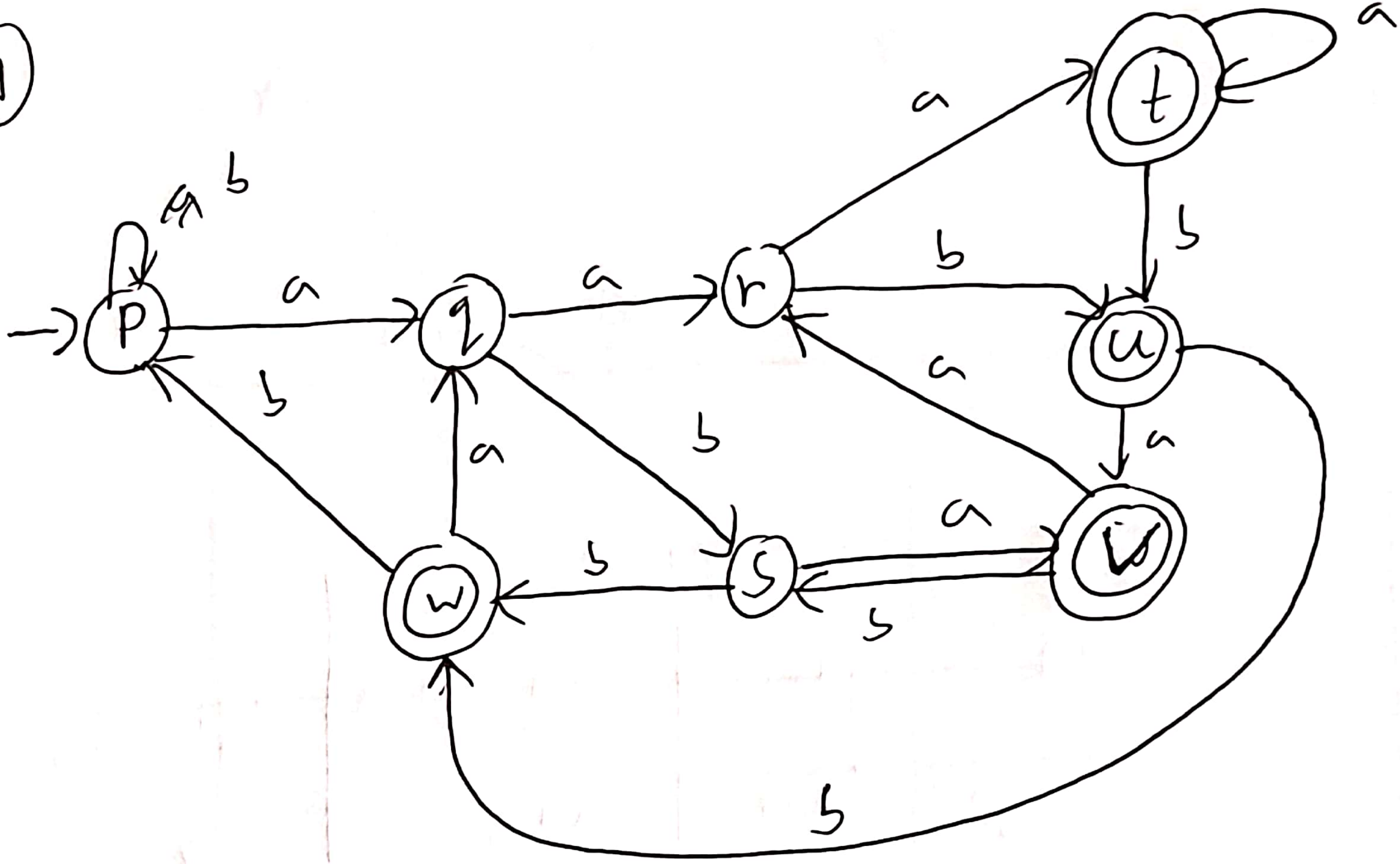
NFA / ε-NFA → DFA

1

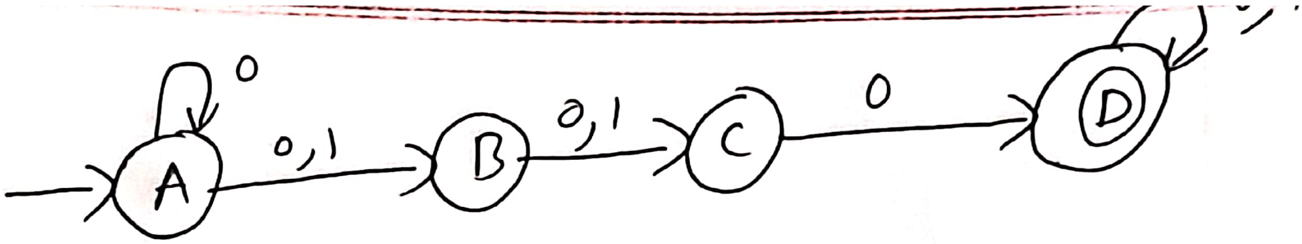


	a	b
$A_0, A_1 = p$	$A_0, A_1, A_2 = q$	$A_0, A_1 = p$
$A_0, A_1, A_2 = q$	$A_0, A_1, A_2, A_3 = r$	$A_0, A_1, A_3 = s$
$A_0, A_1, A_2, A_3 = r$	$A_0, A_1, A_2, A_3, A_4 = t$	$A_0, A_1, A_3, A_4 = u$
$A_0, A_1, A_3 = s$	$A_0, A_1, A_2, A_4 = v$	$A_0, A_1, A_4 = w$
$A_0, A_1, A_2, A_3, A_4 = t$	$A_0, A_1, A_2, A_3, A_4 = t$	$A_0, A_1, A_3, A_4 = u$
$A_0, A_1, A_3, A_4 = u$	$A_0, A_1, A_2, A_4 = (v)$	$A_0, A_1, A_4 = (w)$
$A_0, A_1, A_2, A_4 = v$	$A_0, A_1, A_2, A_3 = (r)$	A_0, A_1, A_3 (s)
$A_0, A_1, A_4 = w$	$A_0, A_1, A_2 = q$	$A_0, A_1 = p$

1

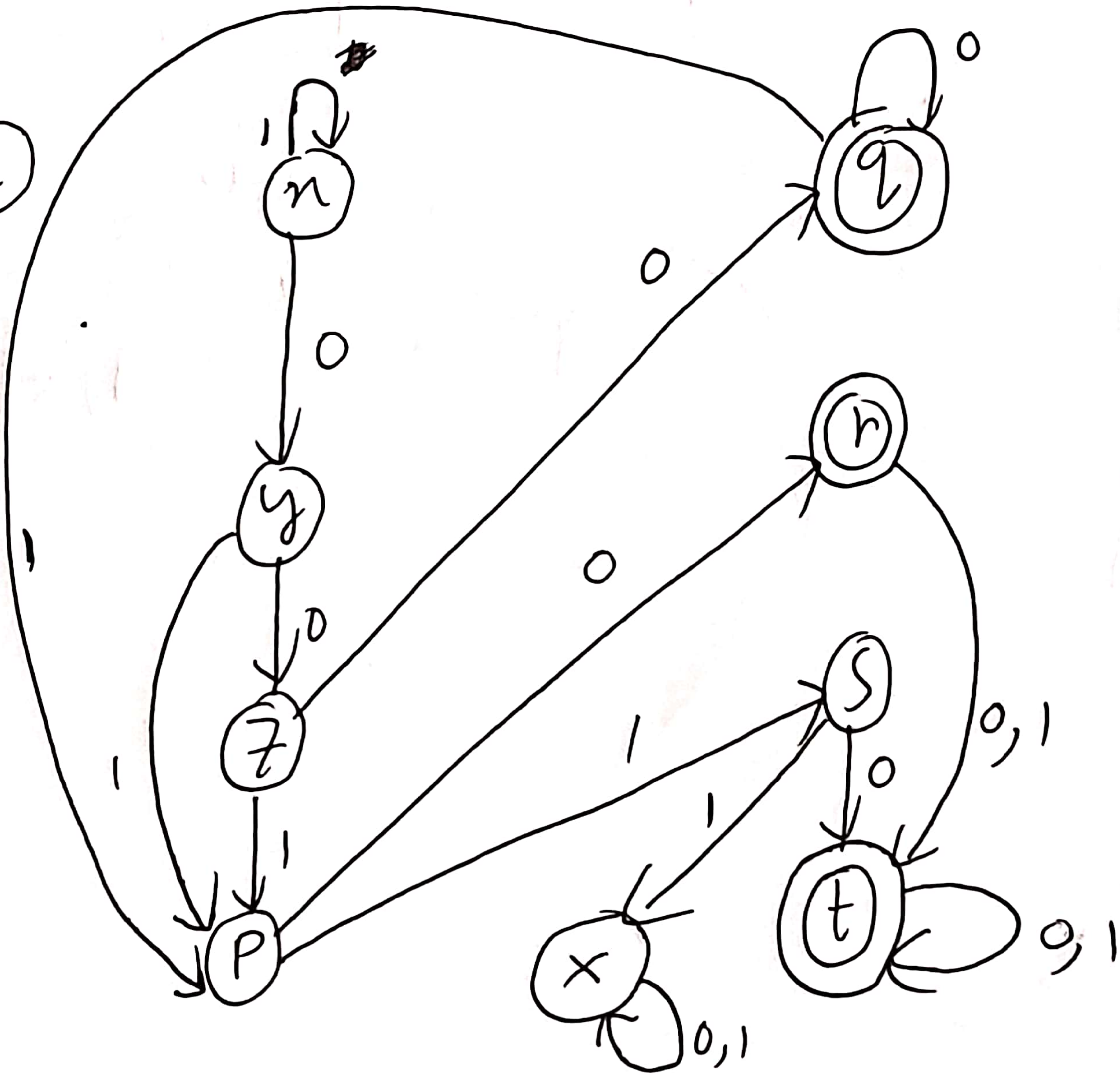


2

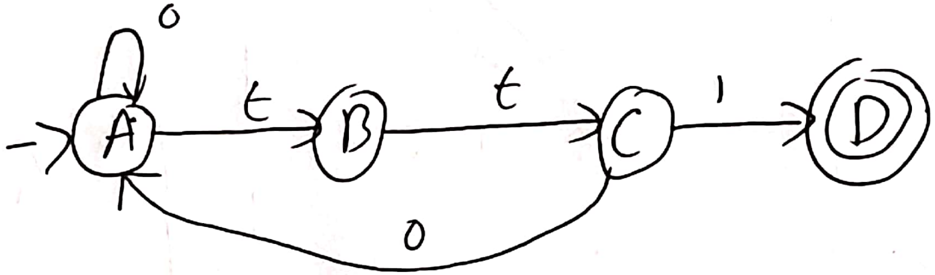


	0	1
A (x)	AB (y)	A (x)
A, B (y)	ABC (z)	BC (p)
A, BC (z)	ABCD (q)	BC (p)
B C (p)	CD (r)	C (s)
ABCD (q)	ABCD (q)	BC (p)
CD (r)	D (t)	D (t)
C (s)	D (t)	
D (t)	D (t)	D (t)

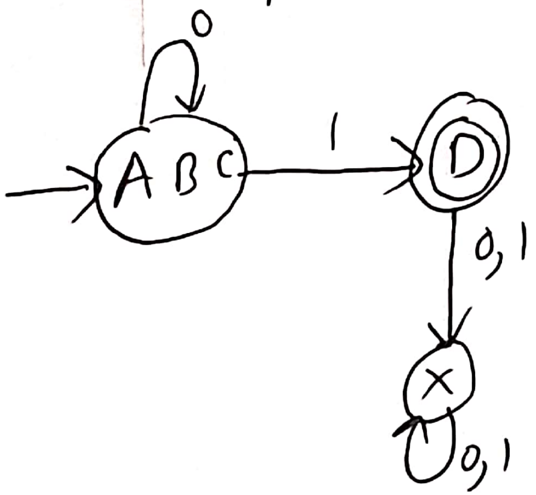
2



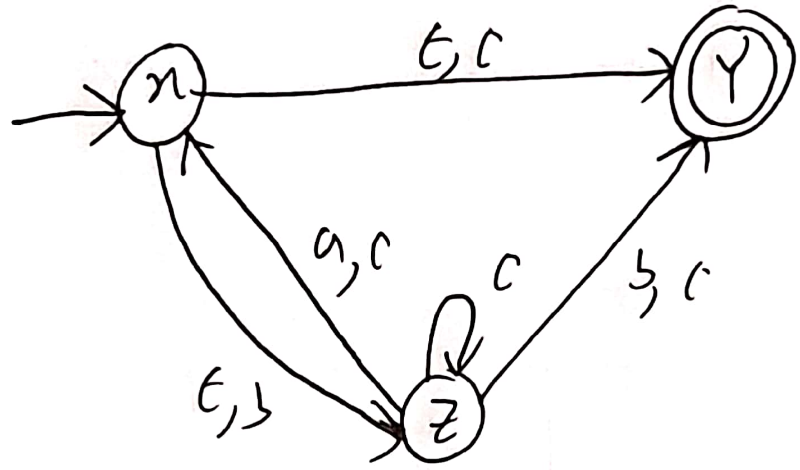
3



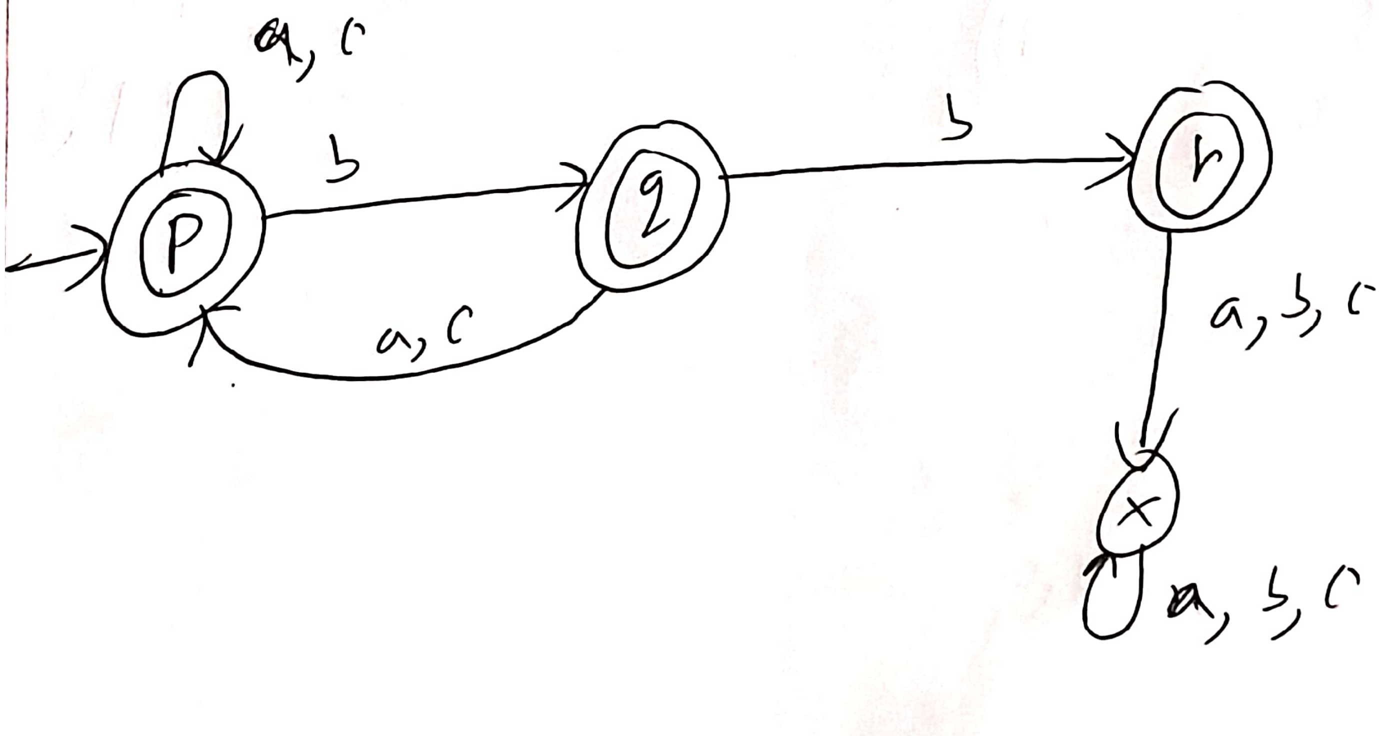
	0	1
ABC	ABC	D
D		



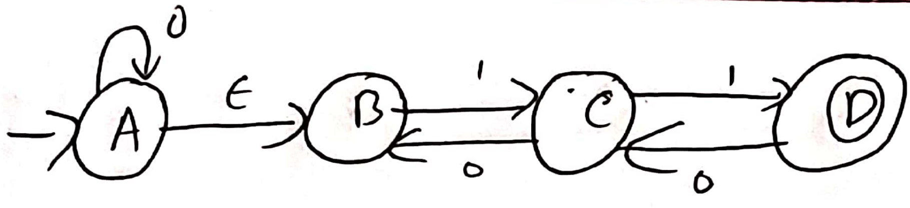
4)



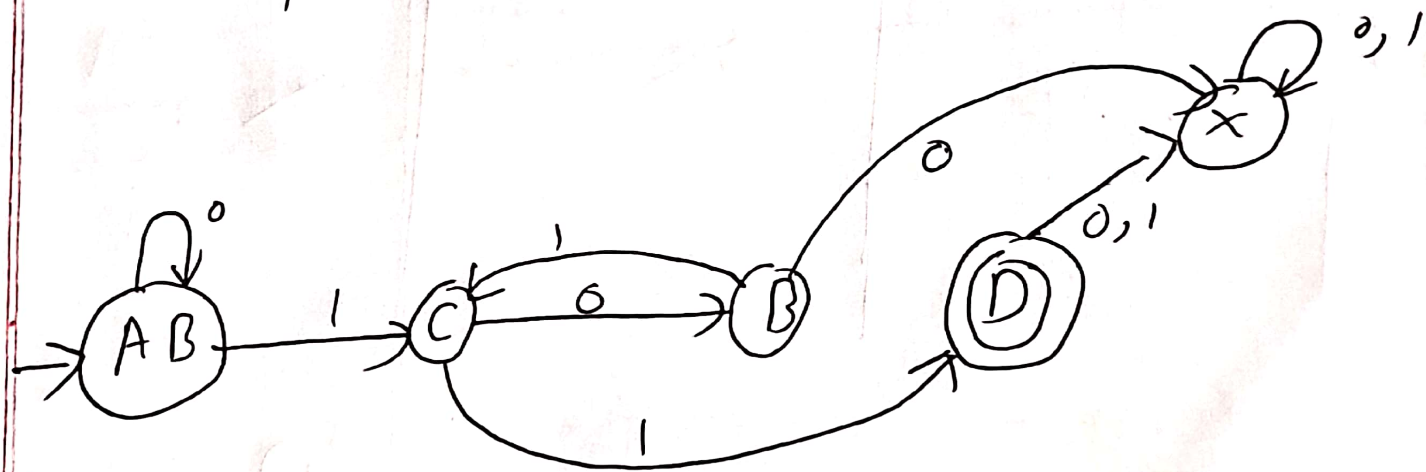
	a	b	c
xyz (P)	xyz (P)	Yz (q)	xyz (P)
Yz (q)	xYz (P)	Y(r)	xYz (P)
Y (r)			



5



	0	1
AB	AB	C
C	B	D
B	..	C
D		



(b) $\pi_1 = (A, B, D, E, F, G, H) \quad (C)$

$\qquad\qquad G_1 \qquad\qquad\qquad\quad G_2$

for a transition

$A \to G_1$ $\quad E \to G_1$

$B \to G_1$ $\quad F \to G_2$

$C \to G_1$ $\quad G \to G_1$

$D \to G_2$ $\quad H \to G_1$

for b transition

$A \to G_1$ $\quad E \to G_1$

$B \to G_2$ $\quad F \to G_1$

$C \to G_2$ $\quad G \to G_1$

$D \to G_1$ $\quad H \to G_2$

$\pi_2 = (A, E, G) \quad (B, H) \quad (D, F) \quad (C)$

$\qquad G_1 \qquad\quad G_2 \qquad\quad G_3 \qquad G_4$

For a transition

$A \to G_2$ $\quad E \to G_2$

$B \to G_1$ $\quad F \to G_4$

$C \to G_1$ $\quad G \to G_2$

$D \to G_4$ $\quad H \to G_1$

For b transition

$A \to G_3$ $\quad E \to G_3$

$B \to G_4$ $\quad F \to G_1$

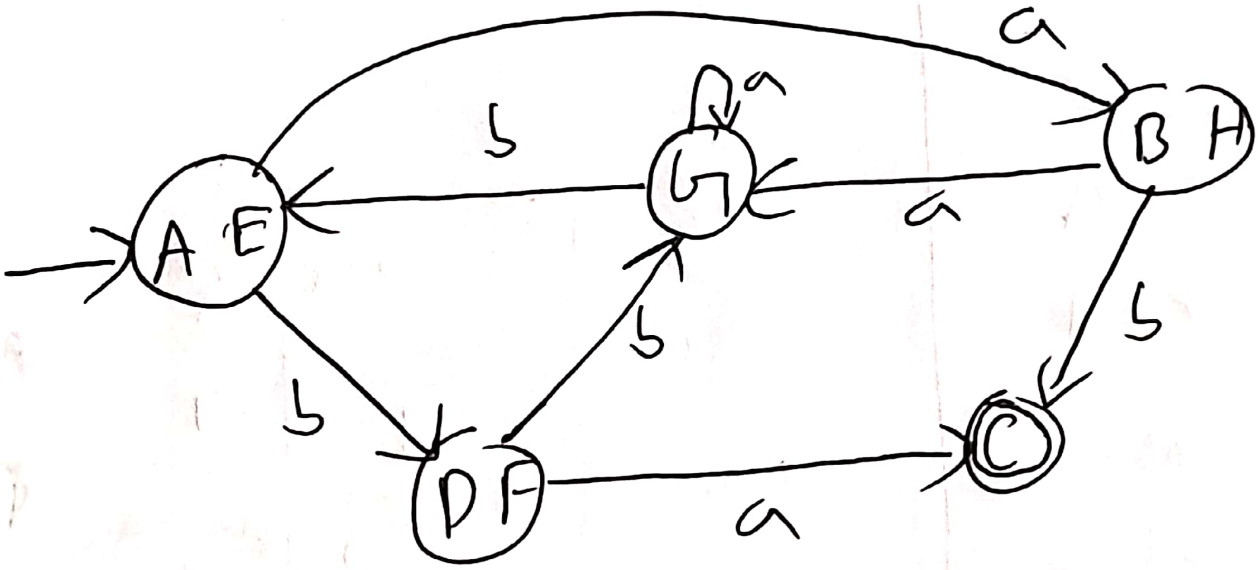
$C \to G_4$ $\quad G \to G_1$

$D \to G_2$ $\quad H \to G_4$

$\pi_3 \quad (A, E) \quad (G) \quad (B, H) \quad (D, F) \quad (C)$

~~tho~~

no more partition possible.



7

$\pi_1 = (A, B, C, E, F) \quad (D)$

$G_1 \quad G_2$

for 0

A -> G_1

B -> G_1

C -> G_1

~~D~~ -> G_1

E -> G_2

F -> G_1

for ~~#~~ 1

A -> G_2

B -> G_2

C -> G_1

D -> G_1

E -> G_2

F -> G_1

$\pi_2 = (A, B) \quad (C, F) \quad (E) \quad (D)$

$G_1 \quad G_2 \quad G_3 \quad G_4$

For 0

C -> G_1

F -> G_2

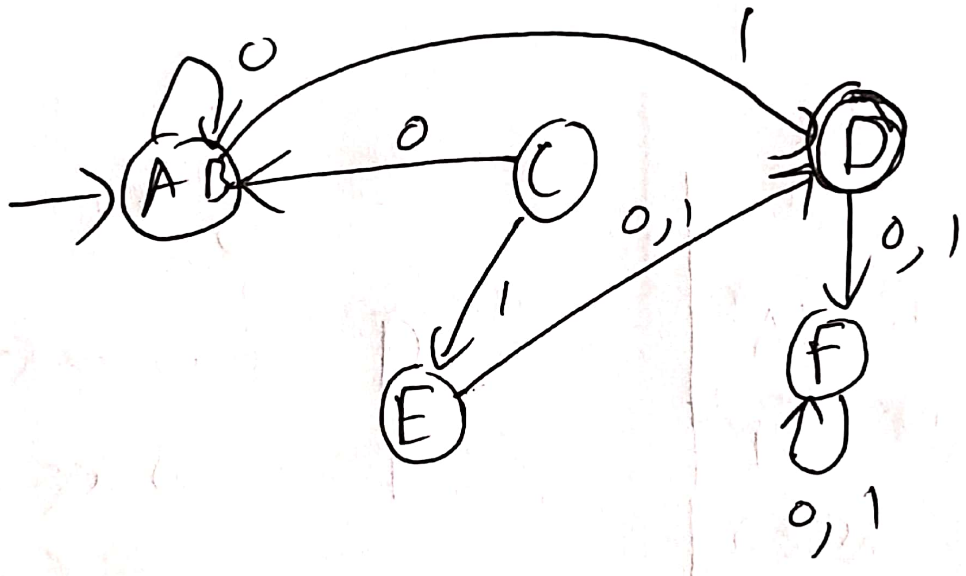
For 1

C -> G_3

F -> G_2

rest (A, B) (E) ~~A~~(D) not shown as they remain same

$P_3 = (A,B)\ (C)\ (D)\ .\ (E)\ (F)$



8.

$\pi_1 = (A, B, C, D) \quad (E)$

$\qquad\qquad G_1 \qquad\qquad G_2$

For a

$A \to G_1$ $\quad$ $D \to G_1$

$B \to G_1$ $\quad$ $E \to G_1$

$C \to G_1$

For b

$A \to G_1$ $\quad$ $D \to \cancel{E}\, G_2$

$B \to G_1$ $\quad$ $E \to G_1$

$C \to G_1$

$\pi_2 = (A, B, C) \quad (D) \quad (E)$

$\qquad\qquad G_1 \qquad\quad G_2 \quad G_3$

For a

$A \to G_1$ $\quad$ $D \to$

$B \to G_1$ $\quad$ $E \to$

$C \to G_2$

For b

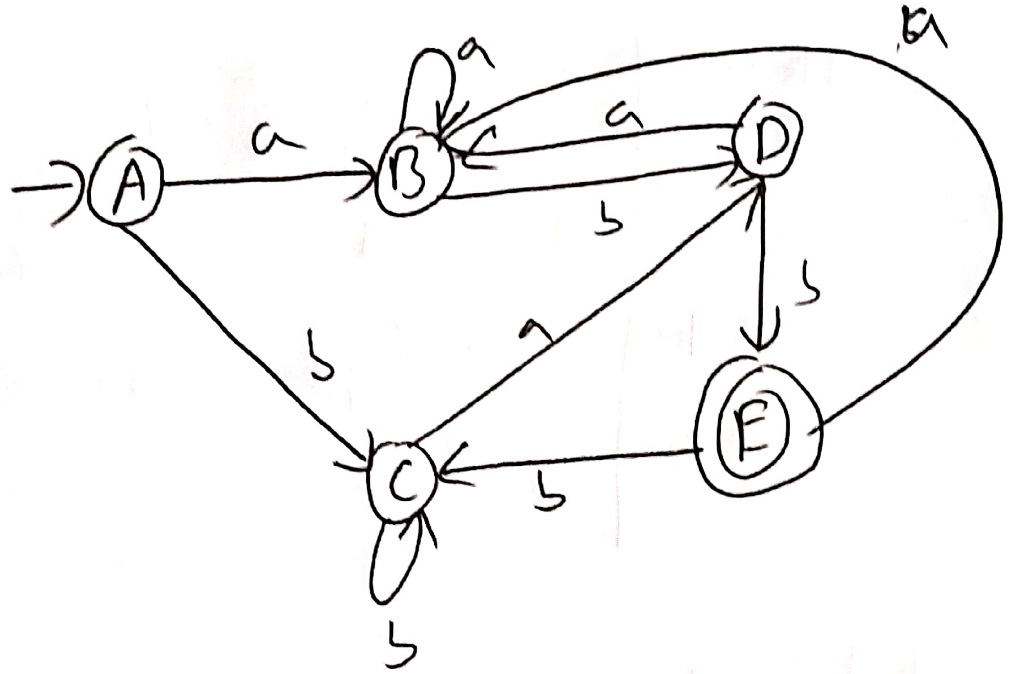
$A \to G_1$ $\quad$ $D \to$

$B \to G_2$ $\quad$ $E \to$

$C \to G_1$

D, E not shown as ~~remain~~ already different same.

λ_3 : (A) (B) (C) (D) (E)



9. $\pi_1 = (A, B, C) \quad (D, E)$

$\quad\quad G_1 \quad\quad G_2$

For, 0

$A \to G_1$ $\quad D \to G_2$

$B \to G_1$ $\quad E \to G_2$

$C \to G_1$

For 1

$A \to G_1$ $\quad D \to G_2$

$B \to G_2$ $\quad E \to G_1$

$C \to G_1$

$\pi_2 =$ ~~(A) E~~ $(A, C) \quad (B) \quad (D) \quad (E)$

$\quad\quad G_1 \quad G_2 \quad G_3 \quad G_4$

For 0

$A \to G_2$

$C \to G_1$

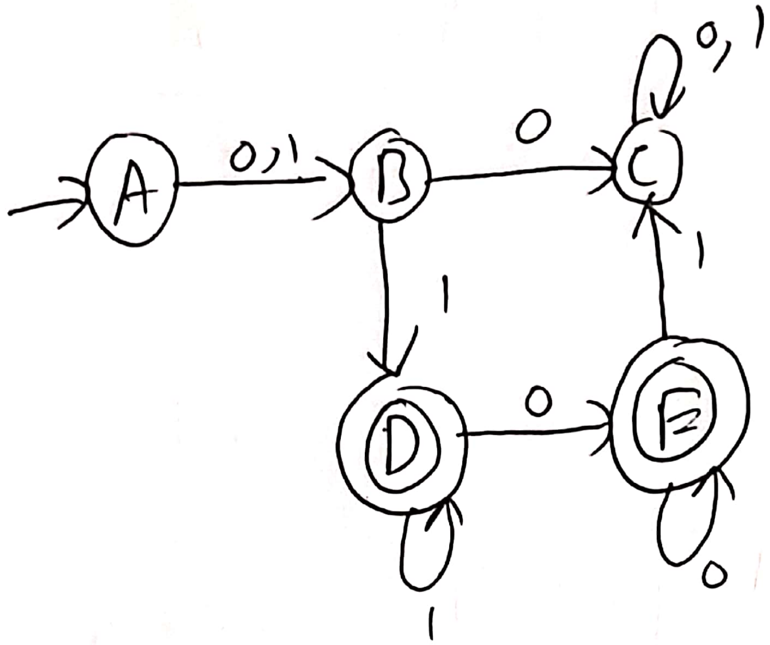
For, 1

$A \to G_2$

$C \to G_1$

no more partitions

$\pi_3 = (A) (B) \ (C) \ (D) \ (E)$


A
0,1
B
0
C
0,1
1
1
D
0
E
1
0

10

$\pi_1 = (\underbrace{A, B, C, E, F}_{G_1}) \quad (\underbrace{D, G}_{G_2})$

For 0

$A \to G_1$

$B \to G_1$

$C \to G_2$

$D \to G_2$

$E \to G_1$

$F \to G_2$

$G \to G_2$

For 1

$A \to G_1$

$B \to G_1$

C

$D \to G_2$

$E \to G_1$

$F \to G_1$

$G \to G_2$

$\pi_2 = (\underbrace{A, B, E}_{G_1}) \quad (\underbrace{C}_{G_2}) \quad (\underbrace{D, G}_{G_3}) \quad (\underbrace{F}_{G_4})$

For 0,

$A \to G_1$

$B \to G_2$

$E \to G_4$

For, 1

$A \to G_1$

$B \to G_4$

$E \to G_1$

rest not shown as they don't change.

$\pi_3 = (A)\ (B)\ (C)\ \cancel{(D)}\ (D,G)\ (E)\ (F)$