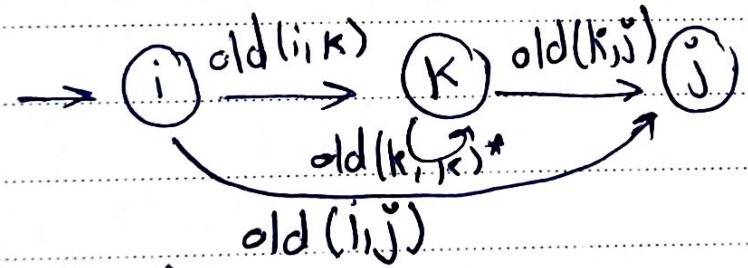
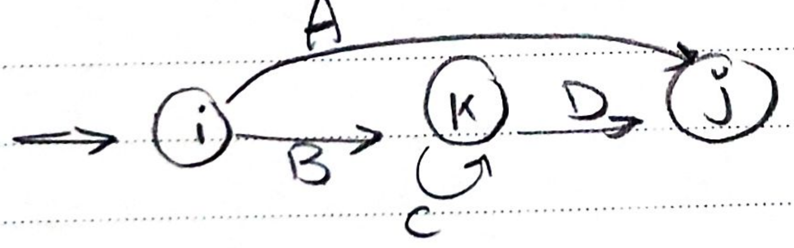
Theory sec (4) - General

→ Convert NFA to Regular Expression:

1. Connect anew start state (s) to the start states, and connect each final to the FA to anew final state (f).
2. if needed, Combine all multiple edges between same 2 node into one edge with label sum of the labels.
3. eliminate each state K of the fA by Constructing anew edge (i, j)

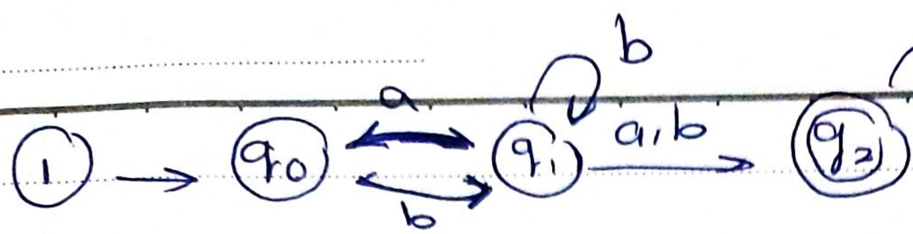
$$new(i,j) = old(i,j) + old(i,K)\,old(K,K)^*\,old(K,j)$$



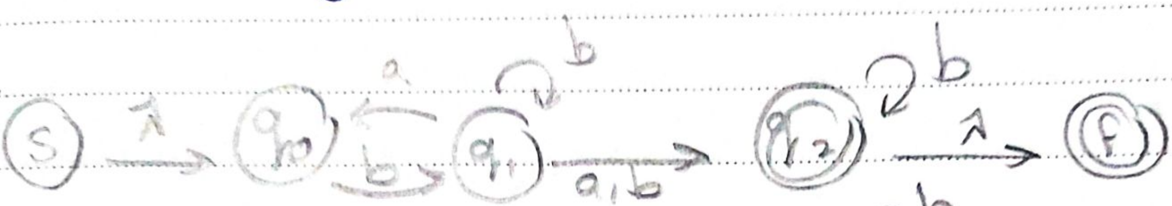


$$\Rightarrow new(i,j) = old(i,j) + old(i,K)\,old(K,K)^*\,old(K,j)$$
$$= A + BC^*D$$

1



1 -



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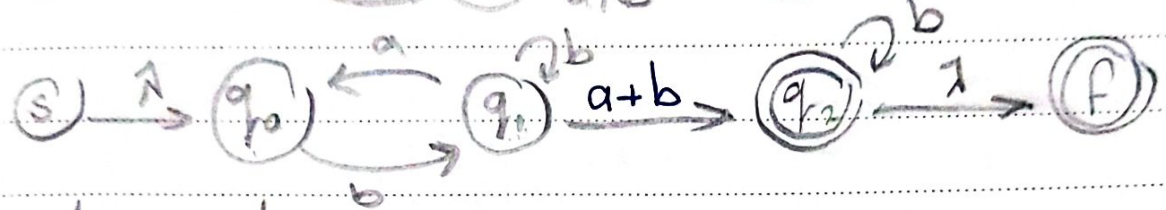
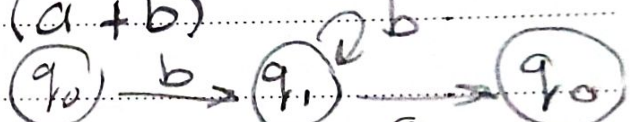


3 - eliminate (q_1)

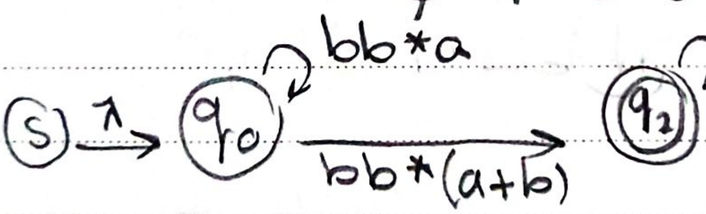
$new(q_0, q_2) = old(q_0, q_2) + old(q_0, q_1)\, old(q_1, q_1)^*\, old(q_1, q_2)$

$= \phi + b \cdot b^*(a+b)$



$new(q_0, q_0) = old(q_0, q_0) + old(q_0, q_1)\, old(q_1, q_1)^*\, old(q_1, q_0)$

$= \phi + bb^*a$



$\Rightarrow RE = (bb^*a)^*\, bb^*(a+b)\, b^*$

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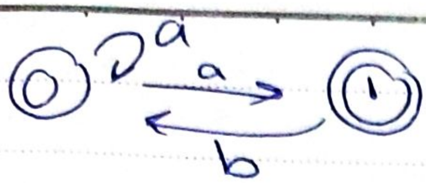
2 

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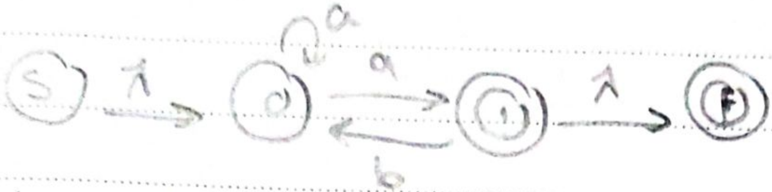


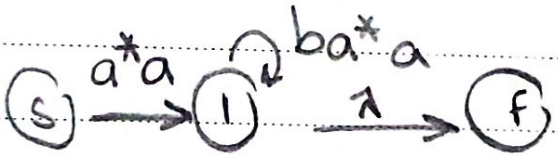
2 - eliminate (0)

$new(S,1) = old(S,1) + old(S,0)\, old(0,0)^*\, old(0,1)$

$= \phi + \lambda\, a^* a = a^* a$

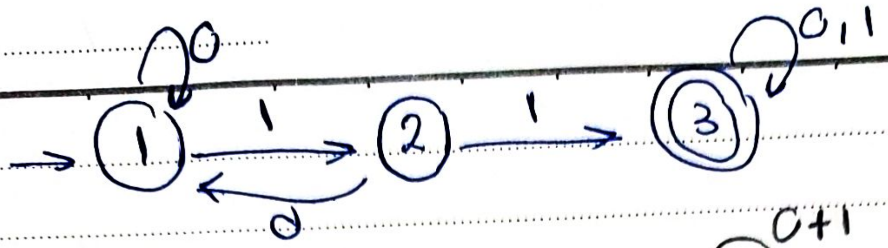
$new(1,1) = old(1,1) + old(1,0)\, old(0,0)^*\, old(0,1)$

$= \phi + b a^* a$



$RE = (a^* a) \cdot (b a^* a)^*$

(3)



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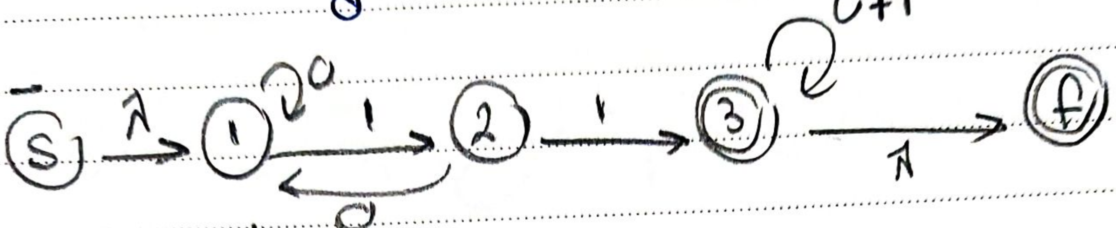


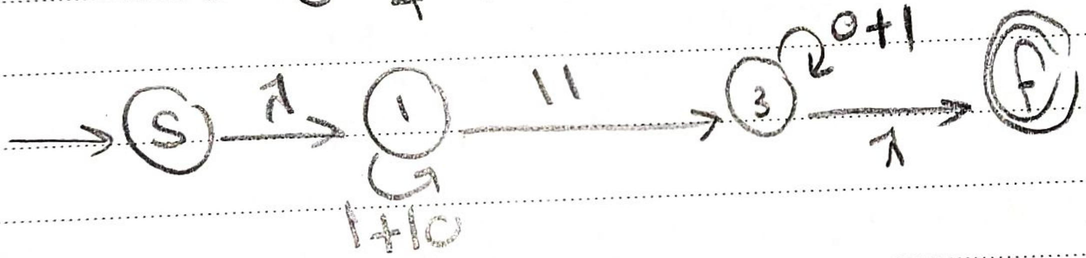
2_ Eliminate 2:

$N(1,3) = o(1,3) + o(1,2)\, o(2,2)^*\, o(2,3)$

$= \phi + 1\, \lambda\, 1 = 11$

$N(1,1) = o(1,1) + o(1,2)\, o(2,2)^*\, o(2,1)$

$= 0 + 1\, \lambda\, 0 = 1 + 10$



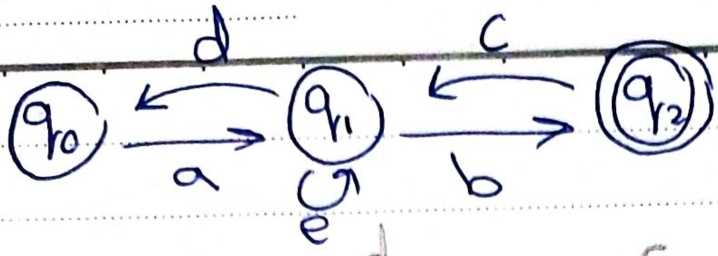
Eliminate 1:

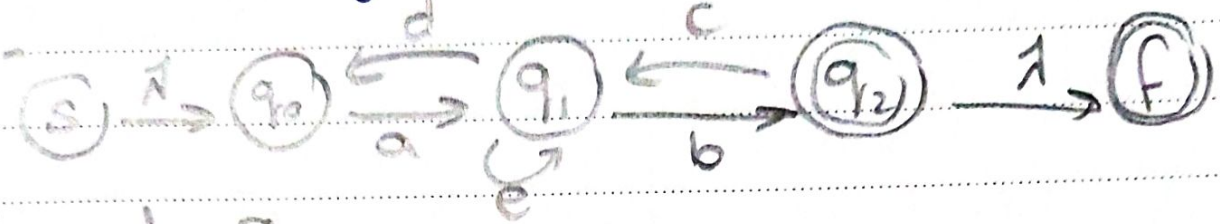
$N(S,3) = o(S,3) + o(S,1)\, o(1,1)^*\, o(1,3)$

$= \phi + \lambda\, (1+10)^*\, 11$

$RE = (1+10)^*\, 11\, (0+1)^*$

4





Eliminate q_1:

$N(q_0, q_2) = o(q_0, q_2) + o(q_0, q_1)\, o(q_1, q_1)^*\, o(q_1, q_2)$

$= \phi + a\, e^* b = ae^*b$

$N(q_0, q_0) = o(q_0, q_0) + o(q_0, q_1)\, o(q_1, q_1)^*\, o(q_1, q_0)$

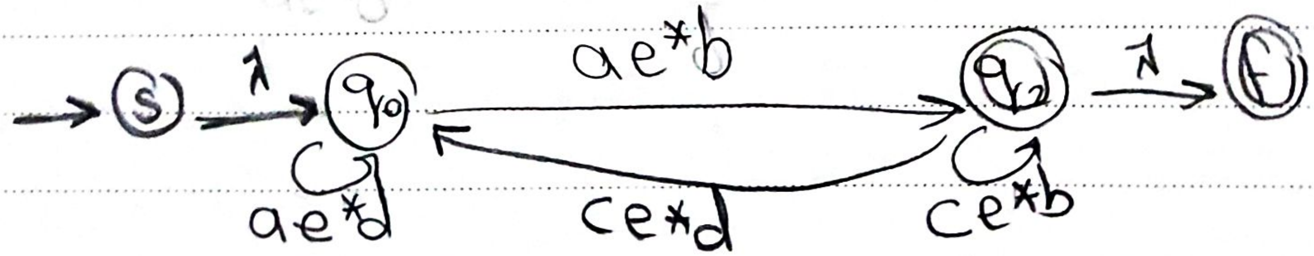
$= \phi + a\, e^* d = ae^*d$

$N(q_2, q_2) = o(q_2, q_2) + o(q_2, q_1)\, o(q_1, q_1)^*\, o(q_1, q_2)$

$= \phi + c\, e^* b = ce^*b$

$N(q_2, q_0) = o(q_2, q_0) + o(q_2, q_1)\, o(q_1, q_1)^*\, o(q_1, q_0)$

$= \phi + c\, e^* d = ce^*d$



Eliminate q_0:

$N(S, q_2) = o(S, q_2) + o(S, q_0)\, o(q_0, q_0)^*\, o(q_0, q_2)$

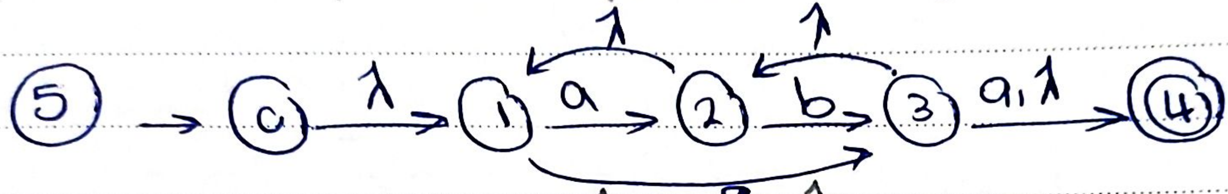
$= \phi + \lambda\, (ae^*d)^*\, ae^*b$.

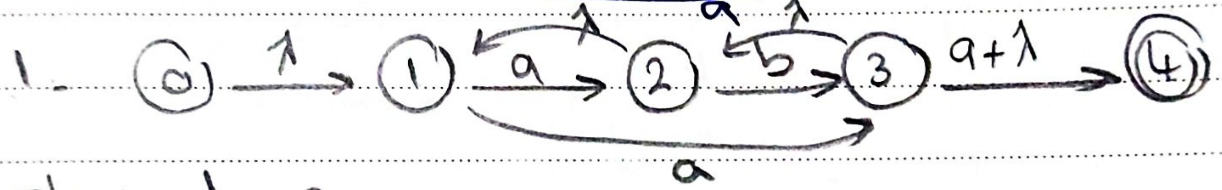
$N(q_2, q_2) = o(q_2, q_2) + o(q_2, q_0)\, o(q_0, q_0)^*\, o(q_0, q_2)$

$= ce^*b + ce^*d \cdot ae^*d \cdot ae^*b$

$ce^*b + ce^*d \,.\, (ae^*d)^* \,.\, (ae^*b)$

$RE = (ae^*d)^* a e^*b \,.\, (ce^*b + ce^*d \,.\, (ae^*d)^* \,.\, (ae^*b))^*$





Eliminate 2 :

$N(1,3) = o(1,3) + o(1,2)\, o(2,2)^*\, o(2,3)$

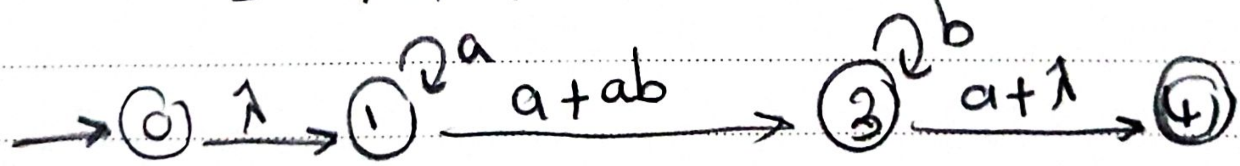
$= a + a\lambda b = a + ab$

$N(1,1) = o(1,1) + o(1,2)\, o(2,2)^*\, o(2,1)$

$= \phi + a\lambda\lambda = a$

$N(3,3) = o(3,3) + o(3,2)\, o(2,2)^*\, o(2,3)$

$= \phi + \lambda\lambda b = b$



$RE = a^*(a+ab)\, b^*\, (a+\lambda)$

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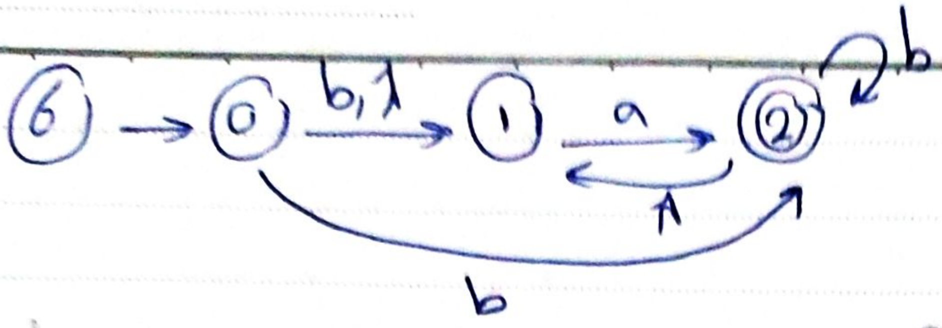

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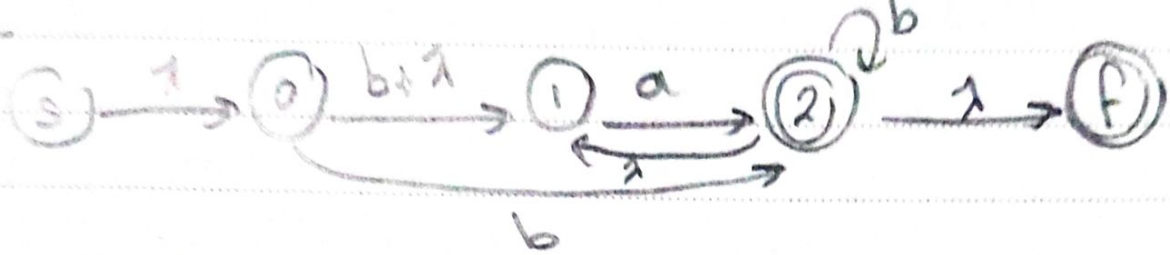


Eliminate 1:

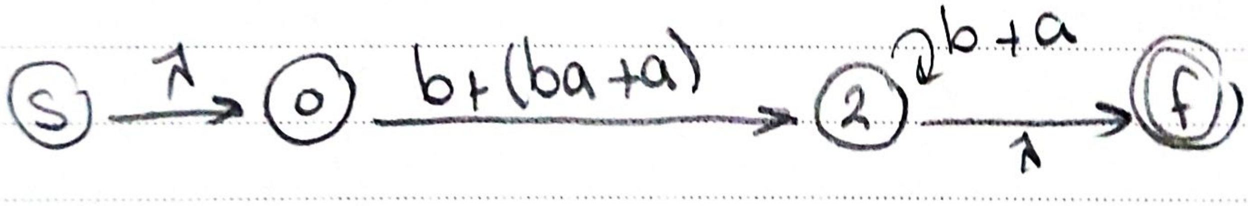
$N(0,2) = o(0,2) + o(0,1)\, o(1,1)^* \, o(1,2)$

$= b + (b+\lambda)\, \lambda\, a = b + (b+\lambda)a$

$= b + (ba + a)$

$N(2,2) = o(2,2) + o(2,1)\, o(1,1)^* \, o(1,2)$

$= b + \lambda\, \phi^* a = b + a$



$RE = (b + (ba + a))\,(b+a)^*$

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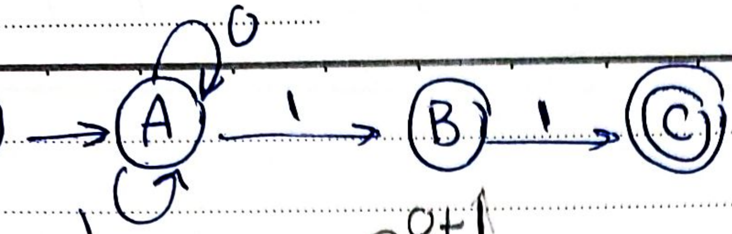

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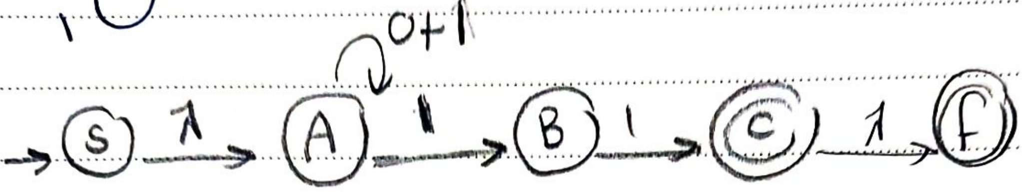
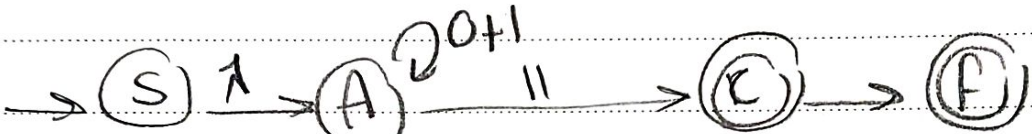


Eliminate B:

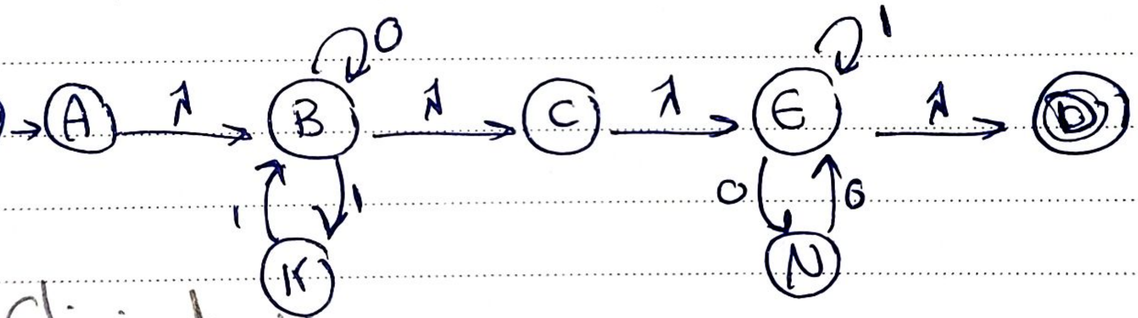
$N(A,C) = O(A,C) + O(A,B)\,O(B,B)^*\,O(B,C)$

$= \phi + 1\,\phi^*\,1 = 11$



$RE = (0+1)^*\,11$

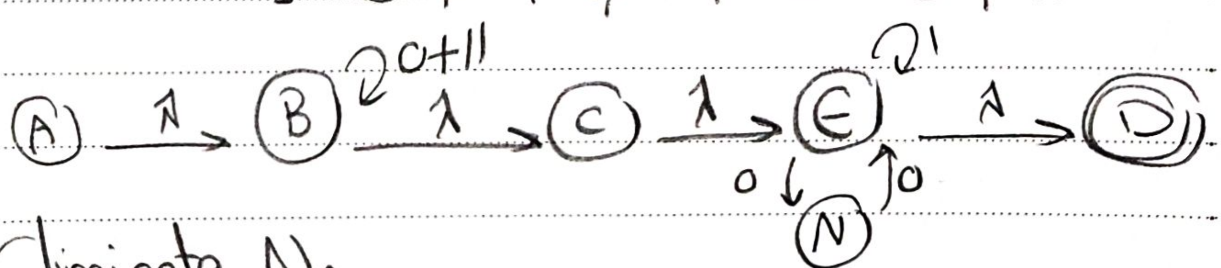
8



_ Eliminate K:

$N(B,B) = O(B,B) + O(B,K)\,O(K,K)^*\,O(K,B)$

$= 0 + 1\,\phi^*\,1 = 0+11$



Eliminate N:

$N(\epsilon,\epsilon) = O(\epsilon,\epsilon) + O(\epsilon,N)\,O(N,N)^*\,O(N,\epsilon)$

$= 1+00$

$RE = (0+11)^*(1+00)^*$