UNIVERSIDAD DEL VALLE DE GUATEMALA

CC2019 – Teoría de la computación

Sección 30

Laboratorio 2

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GUATEMALA, 26 de julio de 2025

Ejercicio No. 1 (25%) – Convierta las siguientes expresiones regulares en autómatas finitos deterministas (para ello deberá primero convertir las expresiones regulares a AFN y luego convertir a AFD). Muestre todo su procedimiento, i.e., AFN construido con Thompson, tabla de transición, conversión a AFD. Para el inciso g, interprete \ como un escape de carácter, i.e., \(significa que su regex reconoce el caracter (.

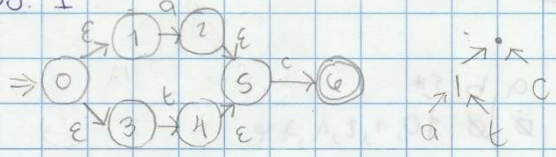
a) $(a|t)c$
b) $(a|b)*$
c) $(a*|b*)*$
d) $((\varepsilon|a)|b*)*$
e) $(a|b)*abb(a|b)*$
f) $0?(1?)?0*$
g) $if\backslash([ae]+\backslash)\backslash\{[ei]+\backslash\}(\backslash n(else\backslash\{[jl]+\backslash\}))?$
h) $[ae03]+@[ae03]+.(com|net|org)(.(gt|cr|co))?$

María José Girón Isidro, 23559

Laboratorio No. 2

Ejercicio No. 1

a) (a|t)c



AFN → AFD

$\Sigma = \{a, t, c\}$

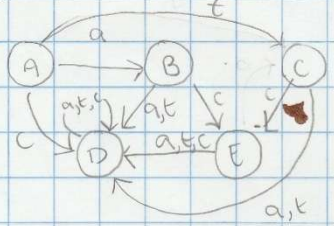
$S = \{0, 1, 2, \ldots, 6\}$

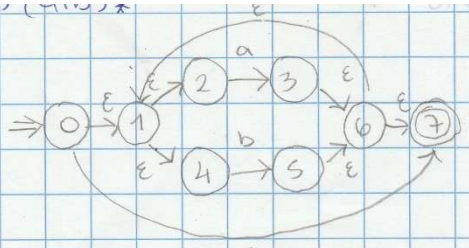
$S_0 = 0$

$F = \{6\}$

	a	t	c	ε*
⇒ 0	∅	∅	∅	{0,1,3}
1	2	∅	∅	{1}
2	∅	∅	∅	{2,5}
3	∅	4	∅	{3}
4	∅	∅	∅	{4,5}
5	∅	∅	6	{5}
(6)	∅	∅	∅	{6}

Estados del AFN	aε*	tε*	cε*
⇒ {0,1,3} = A	{2,5} = B	{4,5} = C	{5} = D
{2,5} = B	{6} = D	{5} = D	{6} = E
{4,5} = C	{5} = D	{5} = D	{6} = E
{5} = D	{5} = D	{5} = D	{6} = D
{6} = E	{5} = D	{5} = D	{5} = D





Σ

Σ = {a, b}

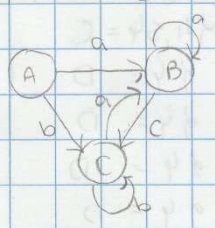
Q = {0, 1, 2, 3, ..., 8}

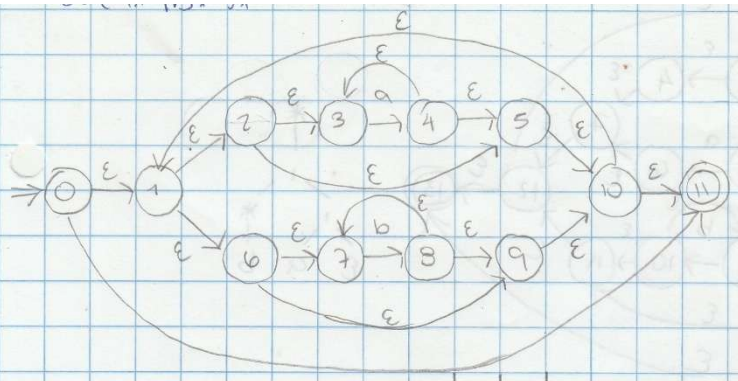
q_0 = 0

F = {7}

	a	b	ε*
0	∅	∅	{0, 1, 2, 4, 7}
1	∅	∅	{1, 2, 4}
2	3	∅	{2}
3	∅	∅	{1, 2, 3, 4, 6, 7}
4	∅	5	{4}
5	∅	∅	{5, 6, 1, 2, 4, 7} → {1, 2, 4, 5, 6, 7}
6	∅	∅	{6, 1, 2, 4, 7} → {1, 2, 4, 6, 7}
7	∅	∅	{7}

Estados (AFN)	aε*	bε*
→ {0, 1, 2, 4, 7} = A	{1, 2, 3, 4, 6, 7} = B	{1, 2, 4, 5, 6, 7} = C
{1, 2, 3, 4, 6, 7} = B	{1, 2, 3, 4, 6, 7} = B	{1, 2, 4, 5, 6, 7} = C
{1, 2, 4, 5, 6, 7} = C	B	C





$\Sigma = \{a, b\}$

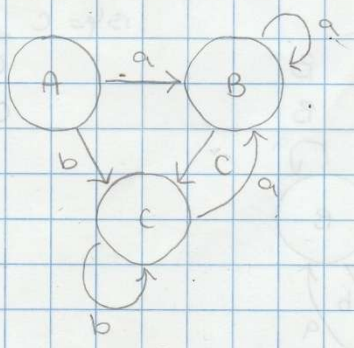
$S = \{0, 1, 2, 3, \ldots, 11\}$

$S_0 = 0$

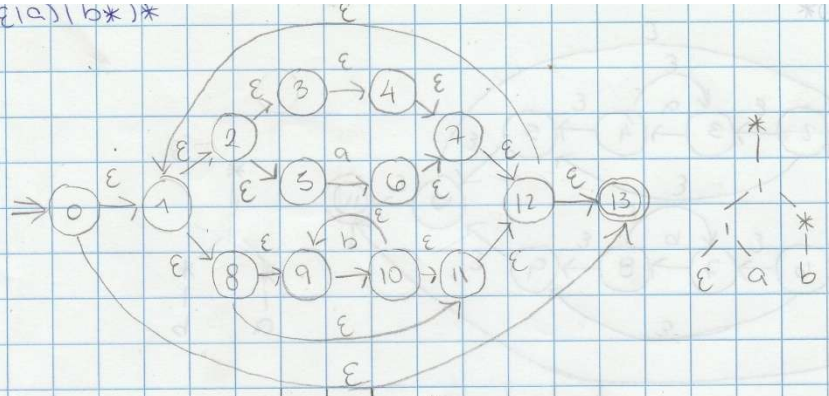
$F = 11$

	a	b	ε*
0	∅	∅	{0, 1, 2, 6, 3, 5, 10, 7, 9, 11}
1	∅	∅	{1, 2, 3, 5, 10, 11, 6, 7, 9}
2	∅	∅	{2, 3, 5, 10, 11, 1, 6, 7, 9}
3	4	∅	{3}
4	∅	∅	{4, 3, 5, 10, 1, 11, 6, 7, 9, 2}
5	∅	∅	{10, 11, 1, 2, 3, 5, 6, 7, 9}
6	∅	∅	{6, 7, 9, 10, 11, 1, 2, 3, 5, 6, 7, 9}
7	∅	8	{7}
8	∅	∅	{8, 9, 10, 1, 2, 3, 5, 11, 6, 7}
9	∅	∅	{9, 10, 11, 1, 2, 3, 5, 6, 7}
10	∅	∅	{10, 11, 1, 2, 3, 5, 6, 7, 9}
11	∅	∅	{11}

Estados (AFN)	aε*	bε*
⇒ {0, 1, 2, 3, 5, 6, 7, 9, 10, 11} = A	{1, 2, 3, 4, 5, 6, 7, 9, 10, 11} = B	{1, 2, 3, 5, 6, 7, 8, 9, 10, 11} = C
B	B	C
C	B	C



d) ((ε|a)|b*)*



Σ = {a, b}

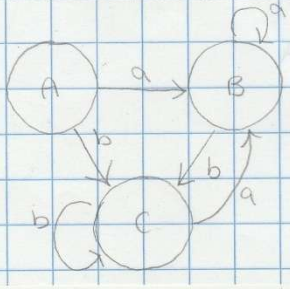
Q = {0, 1, 2, 3 ... 13}

q_0 = 0

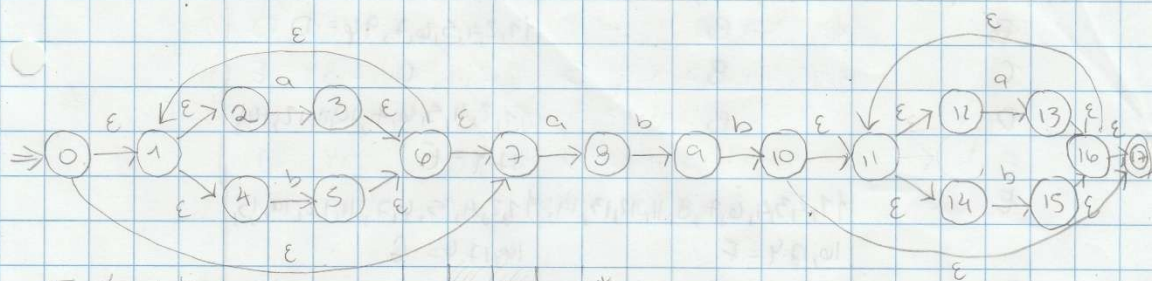
F = {13}

	a	b	ε*
0	∅	∅	{0, 1, 2, 3, 4, 5, 7, 8, 9, 11, 12, 13}
1	∅	∅	{1, 2, 3, 4, 5, 7, 8, 9, 11, 12, 13}
2	∅	∅	{1, 2, 3, 4, 5, 7, 8, 9, 11, 12, 13}
3	∅	∅	{1, 2, 3, 4, 5, 7, 8, 9, 11, 12, 13}
4	∅	∅	{1, 2, 3, 4, 5, 7, 8, 9, 11, 12, 13}
5	6	∅	{13}
6	∅	∅	{1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13}
7	∅	∅	{1, 2, 3, 4, 5, 7, 8, 9, 11, 12, 13}
8	∅	∅	{1, 2, 3, 4, 5, 7, 8, 9, 11, 12, 13}
9	∅	10	{9}
10	∅	∅	{1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 12, 13}
11	∅	∅	{1, 2, 3, 4, 5, 7, 8, 9, 11, 12, 13}
12	∅	∅	{1, 2, 3, 4, 5, 7, 8, 9, 11, 12, 13}
13	∅	∅	{13}

Estados (AFND)	aε*	bε*
{0, 1, 2, 3, 4, 5, 7, 8, 9, 11, 12, 13} = A	{1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13} = B	{1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 12, 13} = C
B	B	C
C	B	C



c) $(a|b)^*abb(a|b)^*$



$\Sigma = \{a, b\}$

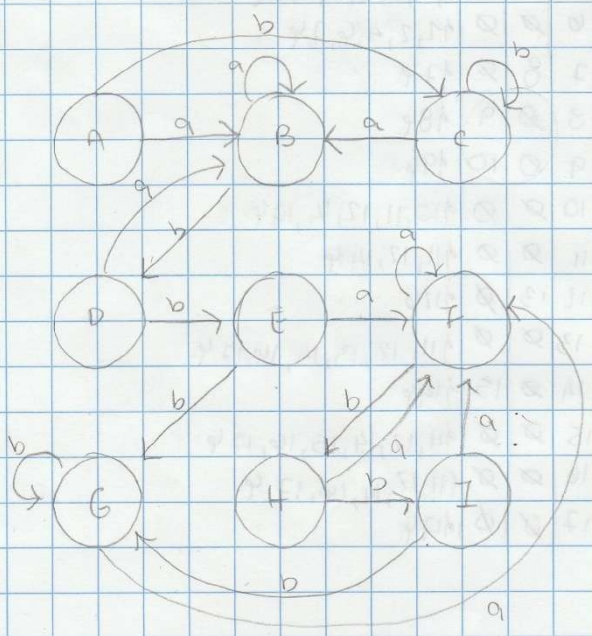
$S = \{0, 1, 2, 3, \ldots, 17\}$

$S_0 = 0$

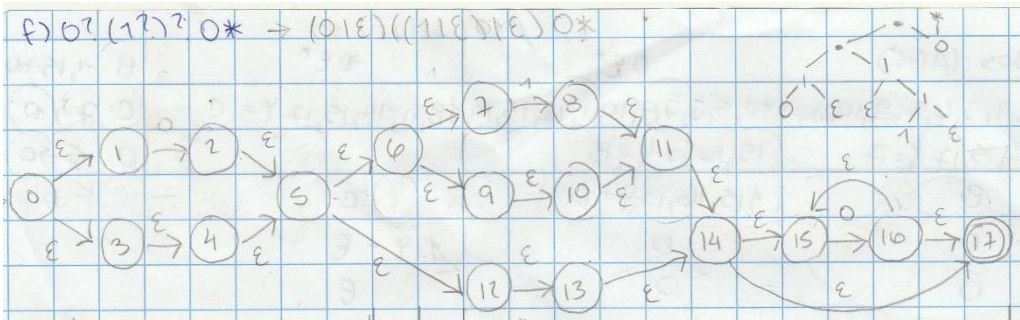
$F = \{17\}$

	a	b	ε*
0	∅	∅	{0,1,2,4,7}
1	∅	∅	{1,2,4}
2	3	∅	{2}
3	∅	∅	{1,2,3,4,6,7}
4	∅	5	{4}
5	∅	∅	{1,2,4,5,6,7}
6	∅	∅	{1,2,4,6,7}
7	8	∅	{7}
8	∅	9	{8}
9	∅	10	{9}
10	∅	∅	{10,11,12,14,17}
11	∅	∅	{11,12,14}
12	13	∅	{12}
13	∅	∅	{11,12,13,14,16,17}
14	∅	15	{14}
15	∅	∅	{11,12,14,15,16,17}
16	∅	∅	{11,12,14,16,17}
17	∅	∅	{17}

Estado (AFN)	aE*	bE*	
{0,1,2,4,7} = A	{1,2,3,4,6,7,8} = B	{1,2,4,5,6,7} = C	
B	B	{1,2,4,5,6,7,9} = D	
C	B	C	
D	B	{1,2,4,5,6,7,10,11,12,14,17} = E	
E	{1,2,3,4,6,7,8,11,12,13,14,16,17} = F	{1,2,4,5,6,7,11,12,14,15,16,17} = G	
F	F	{1,2,4,5,6,7,9,11,12,14,15,16,17} = H	F: 2,12 → 9 G: 4,14 H: 4,9,14 I: 4,9,14 (b)
G	F	G	
H	F	{1,2,4,5,6,7,10,11,12,14,15,16,17} = I	
I	F	G	



f) $0^?(1^?)^?0^* \rightarrow (0|\varepsilon)((11|\varepsilon)0^*$



$\Sigma = \{0, 1\}$

$S = \{0, 1, 2, \ldots, 17\}$

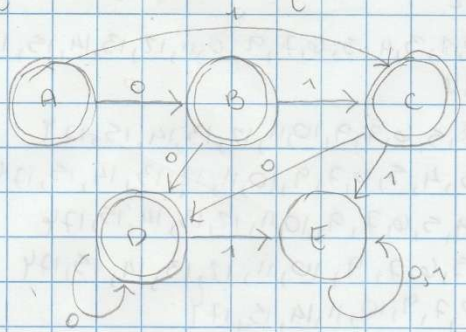
$S_0 = 0$

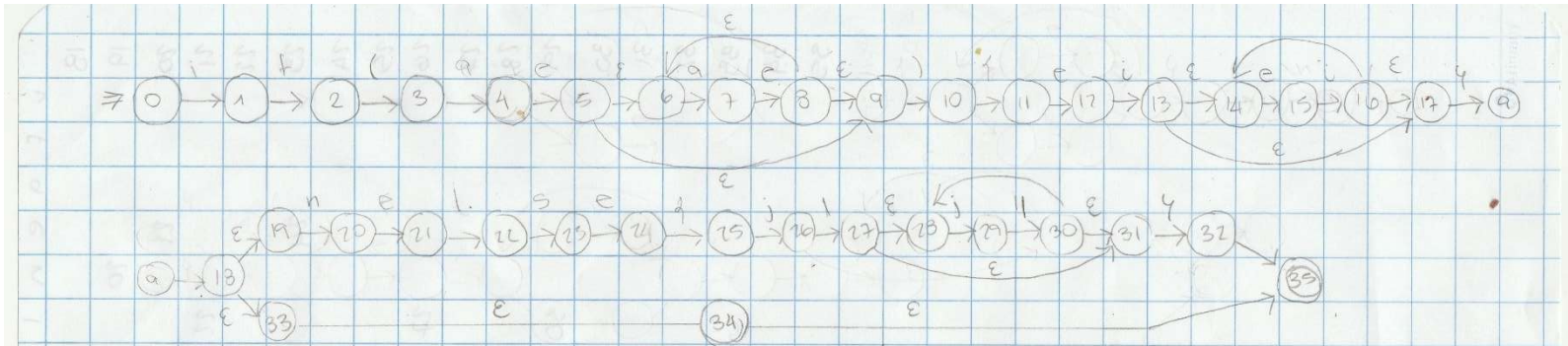
$F = \{17\}$

	0	1	ε^*
0	∅	∅	{0, 1, 3, 4, 5, 6, 7, 9, 10, 11, 12, 13, 14, 15, 17}
1	2	∅	{1, 4}
2	∅	∅	{2, 5, 6, 7, 9, 10, 11, 12, 13, 14, 15, 17}
3	∅	∅	{3, 4, 5, 6, 7, 9, 10, 11, 12, 13, 14, 15, 17}
4	∅	∅	{4, 5, 6, 7, 9, 10, 11, 12, 13, 14, 15, 17}
5	∅	∅	{5, 6, 7, 9, 10, 11, 12, 13, 14, 15, 17}
6	∅	∅	{6, 7, 9, 10, 11, 14, 15, 17}
7	∅	8	{7, 17}
8	∅	∅	{8, 11, 14, 15, 17}
9	∅	∅	{9, 10, 11, 14, 15, 17}
10	∅	∅	{10, 11, 14, 15, 17}
11	∅	∅	{11, 14, 15, 17}
12	∅	∅	{12, 13, 14, 15, 17}
13	∅	∅	{13, 14, 15, 17}
14	∅	∅	{14, 15, 17}
15	16	∅	{15}
16	∅	∅	{15, 16, 17}
17	∅	∅	{17}

Estados (AFN)	0ε*	1ε*
→ 0,1,3,4,5,6,7,9,10,11, 12,13,14,15,17 φ = A	2,5,6,7,9,10,11,12,13,14, 15,16,17 φ = B	8,11,14,15,17 φ = C
B	15,16,17 φ = D	C
C	D	φ = E
D	D	E
E	E	E

B: 1,15→0
C: 7→1
D: 15→0





	i	f	a	e	n	l	s	j	(	)	;	=	ε*
0	1												q0, q4
1		2											q1, q6
2								3					q2, q4
3			4										q3, q4
4				5									q4, q4
5													q5, 6, 9, q4
6			7										q6, q4
7				8									q7, q6
8													q6, 8, 9, q4
9										10	10		q9, q4
10											11		q10, q4
11				12									q11, q4
12	13												q12, q4
13													q13, 14, 17, q4
14				15									q14, q4
15	16												q15, q6
16													q14, 16, 17, q4
17													q17, q4

a) $\Sigma = \{i, f, a, e, n, l, s, j, (,), ;, =, q4\}$

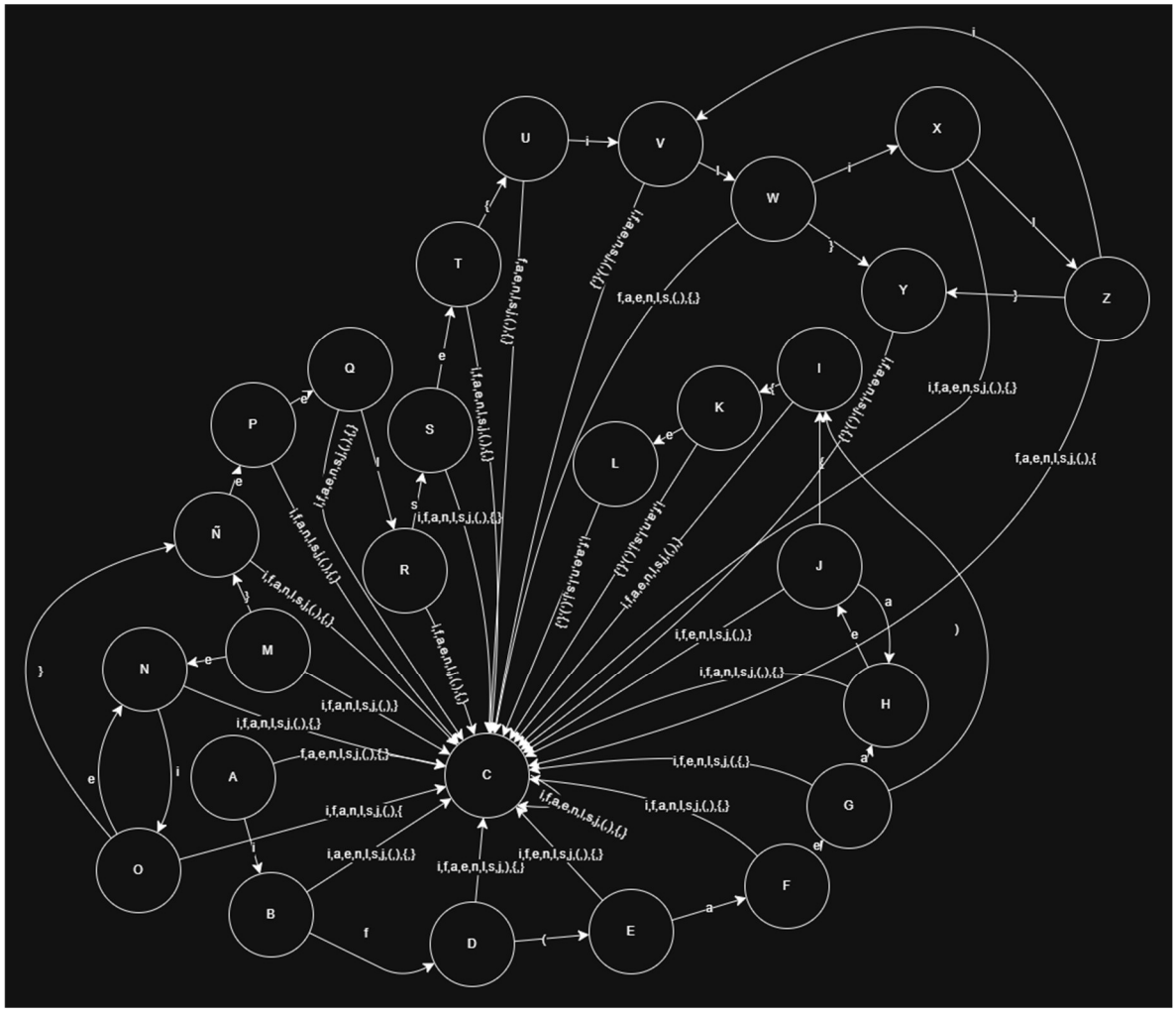
$S = \{0, 1, 2, \ldots, 34\}$

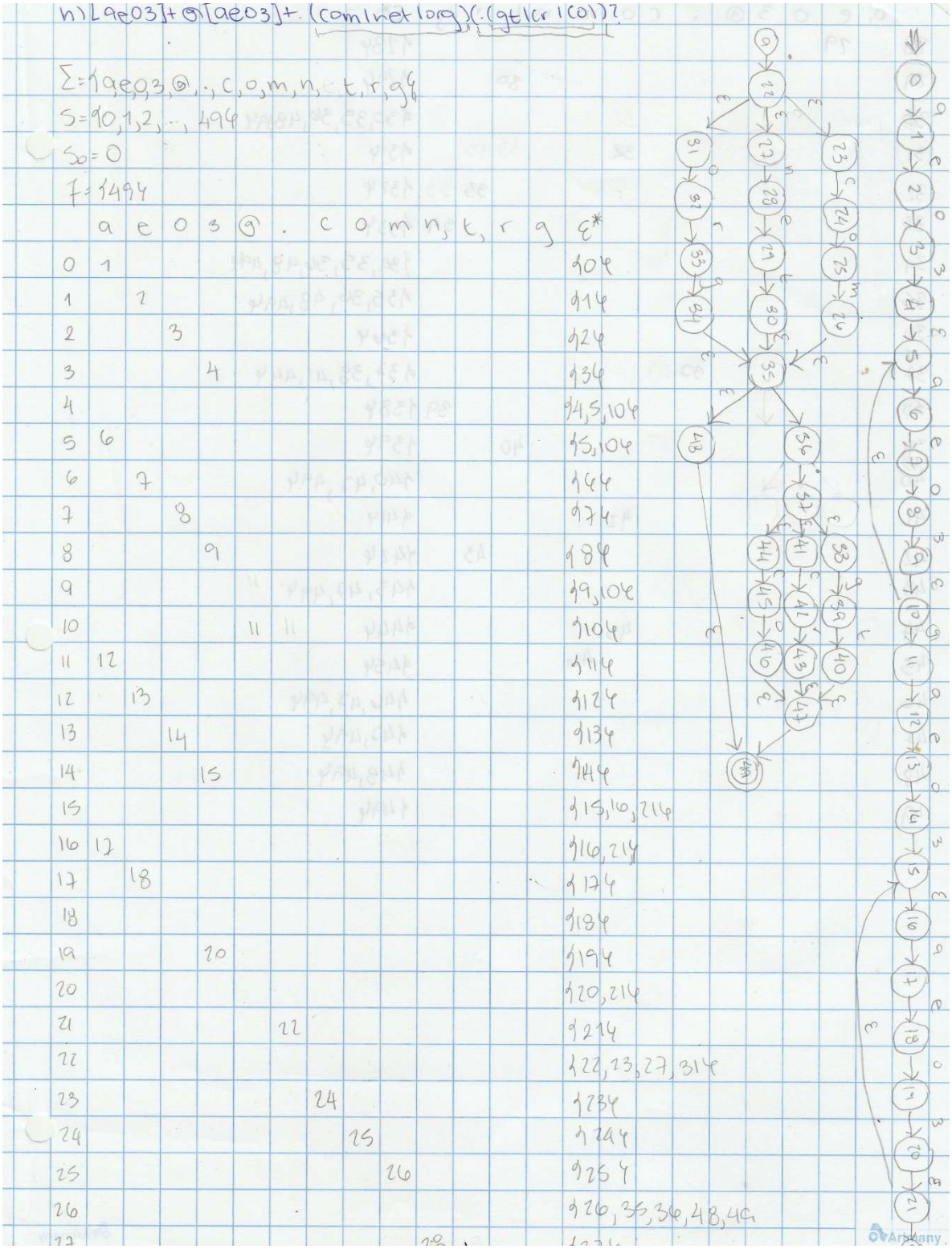
$S_0 = 0$

$F = \{34\}$

	i	f	a	e	n	l	s	j	(	)	q	4	8*
18													18, 19, 33, 34, 35
19					20								19
20				21									20
21						22							21
22							23						22
23				24									23
24											25		24
25								26					25
26						27							26
27													27, 28, 31
28								29					28
29						30							29
30													25, 30, 31
31												32	31
32													32, 35
33													33, 34, 35
34													34, 35
35													35

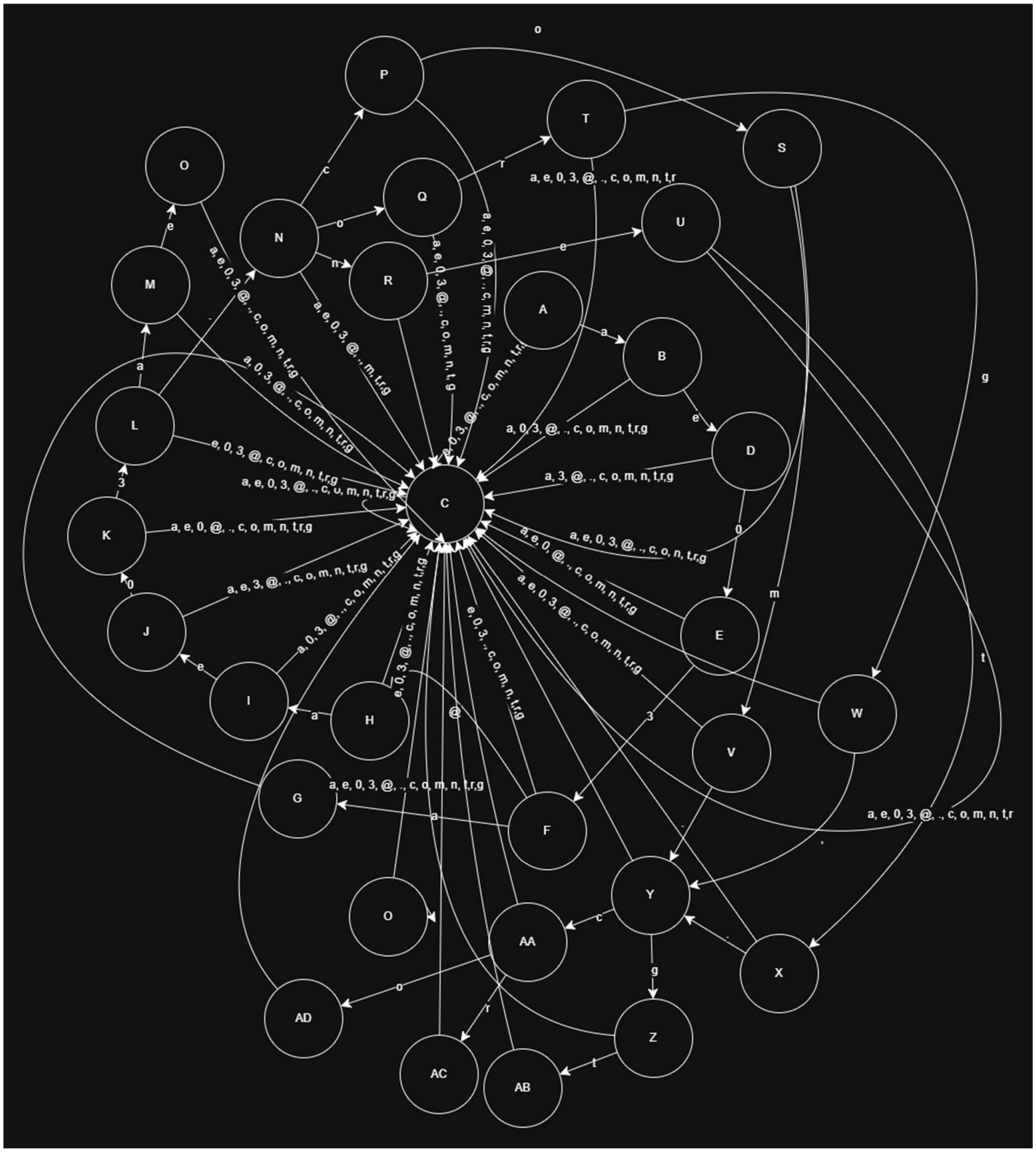
Estados (AFN)	iε*	fε*	aε*	eε*	nε*	lε*	sε*	jε*	(ε*	)ε*	{ε*	}ε*
{0}=A	{1} = B	{} =C	{} =C	{} =C	{} =C	{} =C	{} =C	{} =C	{} =C	{} =C	{} =C	{} =C
{1} = B	{} =C	{2} = D	{} =C	{} =C	{} =C	{} =C	{} =C	{} =C	{} =C	{} =C	{} =C	{} =C
{} =C	{} =C	{} =C	{} =C	{} =C	{} =C	{} =C	{} =C	{} =C	{} =C	{} =C	{} =C	{} =C
{2} = D	{} =C	{} =C	{} =C	{} =C	{} =C	{} =C	{} =C	{} =C	{3} = E	{} =C	{} =C	{} =C
{3} = E	{} =C	{} =C	{4} = F	{} =C	{} =C	{} =C	{} =C	{} =C	{} =C	{} =C	{} =C	{} =C
{4} = F	{} =C	{} =C	{} =C	{5,6,9} = G	{} =C	{} =C	{} =C	{} =C	{} =C	{} =C	{} =C	{} =C
{5,6,9} = G	{} =C	{} =C	{7} = H	{} =C	{} =C	{} =C	{} =C	{} =C	{} =C	{10} = I	{} =C	{} =C
{7} = H	{} =C	{} =C	{} =C	{6,8,9} = J	{} =C	{} =C	{} =C	{} =C	{} =C	{} =C	{} =C	{} =C
{10} = I	{} =C	{} =C	{} =C	{} =C	{} =C	{} =C	{} =C	{} =C	{} =C	{} =C	{11} = K	{} =C
{6,8,9} = J	{} =C	{} =C	{7} = H	{} =C	{} =C	{} =C	{} =C	{} =C	{} =C	{} =C	{10} = I	{} =C
{11} = K	{} =C	{} =C	{} =C	{12} = L	{} =C	{} =C	{} =C	{} =C	{} =C	{} =C	{} =C	{} =C
{12} = L	{13,14,17}=M	{} =C	{} =C	{} =C	{} =C	{} =C	{} =C	{} =C	{} =C	{} =C	{} =C	{} =C
{13,14,17}=M	{} =C	{} =C	{} =C	{15} = N	{} =C	{} =C	{} =C	{} =C	{} =C	{} =C	{} =C	{18, 19, 33, 34, 35} = Ñ
{15} = N	{14,16,17} = O	{} =C	{} =C	{} =C	{} =C	{} =C	{} =C	{} =C	{} =C	{} =C	{} =C	{} =C
{18, 19, 33, 34, 35} = Ñ	{} =C	{} =C	{} =C	{} =C	{20} = P	{} =C	{} =C	{} =C	{} =C	{} =C	{} =C	{} =C
{14,16,17} = O	{} =C	{} =C	{} =C	{15} = N	{} =C	{} =C	{} =C	{} =C	{} =C	{} =C	{} =C	{18, 19, 33, 34, 35} = Ñ
{20} = P	{} =C	{} =C	{} =C	{21} = Q	{} =C	{} =C	{} =C	{} =C	{} =C	{} =C	{} =C	{} =C
{21} = Q	{} =C	{} =C	{} =C	{} =C	{} =C	{22} = R	{} =C	{} =C	{} =C	{} =C	{} =C	{} =C
{22} = R	{} =C	{} =C	{} =C	{} =C	{} =C	{} =C	{23} = S	{} =C	{} =C	{} =C	{} =C	{} =C
{23} = S	{} =C	{} =C	{} =C	{24} = T	{} =C	{} =C	{} =C	{} =C	{} =C	{} =C	{} =C	{} =C
{24} = T	{} =C	{} =C	{} =C	{} =C	{} =C	{} =C	{} =C	{} =C	{} =C	{} =C	{25} = U	{} =C
{25} = U	{} =C	{} =C	{} =C	{} =C	{} =C	{} =C	{} =C	{26} = V	{} =C	{} =C	{} =C	{} =C
{26} = V	{} =C	{} =C	{} =C	{} =C	{} =C	{27, 28, 31} = X	{} =C	{} =C	{} =C	{} =C	{} =C	{} =C
{27, 28, 31} = X	{} =C	{} =C	{} =C	{} =C	{} =C	{} =C	{} =C	{29} = Y	{} =C	{} =C	{} =C	{32, 35} = Z
{29} = Y	{} =C	{} =C	{} =C	{} =C	{} =C	{25,30,31} = A1	{} =C	{} =C	{} =C	{} =C	{} =C	{} =C
{32, 35} = Z	{} =C	{} =C	{} =C	{} =C	{} =C	{} =C	{} =C	{} =C	{} =C	{} =C	{} =C	{} =C
{25,30,31} = A1	{} =C	{} =C	{} =C	{} =C	{} =C	{} =C	{} =C	{26} = V	{} =C	{} =C	{} =C	{32, 35} = Z




n)[a-e0-3]+@[a-e0-3]+.(com|net|org)(.(gt|cr|co))?
Σ={a,e,0,3,@,.,c,o,m,n,t,r,g}
S={0,1,2,...,49}
S0={0}
F={14,49}
a e 0 3 @ . c o m n t r g ε*
0 1 q0
1 2 q1
2 3 q2
3 4 q3
4 q4,5,10
5 6 q5,10
6 7 q6
7 8 q7
8 9 q8
9 q9,10
10 11 q10
11 12 q11
12 13 q12
13 14 q13
14 15 q14
15 q15,16,21
16 17 q16,21
17 18 q17
18 q18
19 20 q19
20 q20,21
21 22 q21
22 q22,23,27,31
23 24 q23
24 25 q24
25 26 q25
26 q26,35,36,48,49

	a e o 3 @ . c o m	n t r g	ε*
28	29		4284
29		30	4294
30			430,35,36,48,494
31	32		4314
32		33	4324
33		34	4334
34			434,35,36,48,494
35			435,36,48,494
36			4364
37	37		437,38,41,444
38		39	4384
39		40	4394
40			440,47,494
41	42		4414
42		43	4424
43			443,47,494
44	45		4444
45	46		4454
46			446,47,494
47			447,494
48			448,494
49			4494

Estados del AFN	aε*	eε*	0ε*	3ε*	"@"ε*	.ε*	cε*	oε*	mε*	nε*	tε*	rε*	gε*
A = {0}	B = {1}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}
B = {1}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}
C = {1}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}
D = {2}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}
E = {3}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}
F = {4,5,10}	C = {}	C = {}	C = {}	C = {4,5,10	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}
G = {6}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}
H = {11}	C = {}	C = {}	C = {}	C = {}	H = {11}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}
I = {12}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}
J = {13}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}
K = {14}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}
L = {15,16,21}	C = {}	C = {}	C = {}	L = {15,16,2	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}
M = {17}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}
N = {22,23,27,31}	C = {}	C = {}	C = {}	C = {}	C = {}	N = {22,23,27,31	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}
O = {18}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}
P = {24}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	P = {24}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}
Q = {32}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	Q = {32}	C = {}	C = {}	C = {}	C = {}	C = {}
R = {28}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	R = {28}	C = {}	C = {}	C = {}
S = {25}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	S = {25}	C = {}	C = {}	C = {}	C = {}	C = {}
T = {33}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	T = {33}	C = {}	C = {}
U = {29}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}
V = {26,35,36,48,49}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	V = {26	C = {}	C = {}	C = {}	C = {}
W = {34,35,36,48,49}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	W = {34,35,36,48,49}
X = {30,35,36,48,49}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	X = {30,3	C = {}	C = {}
Y = {37,38,41,44}	C = {}	C = {}	C = {}	C = {}	C = {}	Y = {37,38,41,44	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}
Z = {39}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	Z = {39}
AA = {42,45}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	AA = {42	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}
AB = {40,47,49}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	AB = {40	C = {}	C = {}
AC = {43,47,49}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	AC = {43,47,49	C = {}
AD = {46,47,49}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	C = {}	AD = {46	C = {}	C = {}	C = {}	C = {}	C = {}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a, e, 0, 3, @, ., c, o, m, n, t, g
a, e, 0, 3, @, ., c, m, n, t,r,g

Ejercicio No. 2 (25%) – Escriba código en el lenguaje de programación de su gusto para implementar un algoritmo capaz de balancear expresiones en formato infix. Implemente el uso de una pila para llevar track de los símbolos de interés, i.e., (), [], {}, para definir el buen balanceo.

La ejecución de su programa debe ser la siguiente:

- Su programa debe leer un archivo de texto y procesar cada línea en este archivo.
- Por línea procesada, su programa deberá de indicar si la expresión regular en cuestión se encuentra bien balanceada o no.
- Deberá mostrar la secuencia de pasos de la pila para validar que el algoritmo implementado use esta misma de forma adecuada para validar el buen balanceo de la expresión.
- En el video que adjunte para su ejecución, asegúrese de mostrar en pantalla el archivo a ejecutar y el resultado de la ejecución y cada uno de sus pasos y que se refleje en la grabación que ese archivo está siendo ejecutado y no es otro o es código *hardcoded*.
- Utilice las siguientes expresiones regulares (una por línea en el archivo):
  - $a(a|b)*b+a?$
  - $\big((a|b)b\big)*[az]b]$
  - $(a*b*c*d*(a|e|i|o|u))e*f*g*h)\{1,2\}$
  - $\text{^}[aZ].com\{5,30\}$
  - $([[az][AZ]](((((.|;)|;)|.)|.)|.)\{10,20\})*)+$
- De no cumplir con los rubros anteriores la nota de este inciso será de 0 puntos.

Ejercicio No. 3 (50%) – Escriba código en el lenguaje de programación de su gusto para implementar el algoritmo de Shunting Yard para convertir expresiones regulares en notación infix a notación postfix. Siga las siguientes instrucciones:

- Investigue sobre el algoritmo de Shunting Yard y provea una breve explicación escrita de cómo funciona el algoritmo.
- Implemente en código de alto nivel el algoritmo en cuestión, para lo que deberá recibir como input un archivo de texto con expresiones regulares por línea. Procese cada línea en el archivo, dando como output la siguiente información:
  - La expresión en formato postfix.
  - Los pasos realizados para llegar a la conversión a postfix.
- Utilice como referencia el siguiente pseudocódigo: https://gist.github.com/gbrolo/1a80f67f8d0a20d42828fb3fdb7be4de
  - Se recomienda altamente que utilice este pseudocódigo por el factor tiempo, pero se incita a que comprenda en realidad cómo funciona el algoritmo.
- Las expresiones regulares que deberá de utilizar para este inciso son las mismas del Ejercicio No. 1.
  - Deberá implementar en su algoritmo un verificador de caracteres escapados por \.
  - Tenga cuidado con el pseudo código, este es una versión muy sencilla de Shunting Yard y utiliza caracteres comunes para expresar concatenaciones explícitas, por ejemplo, como el uso de "."
  - Esto le dará problemas al procesar expresiones regulares con ".", por ejemplo.
  - Deberá implementar también una validación para convertir las extensiones de expresiones regulares tales como "+" y "?" para el correcto funcionamiento del algoritmo.
- De no cumplir con los rubros anteriores la nota de este inciso será de 0 puntos.