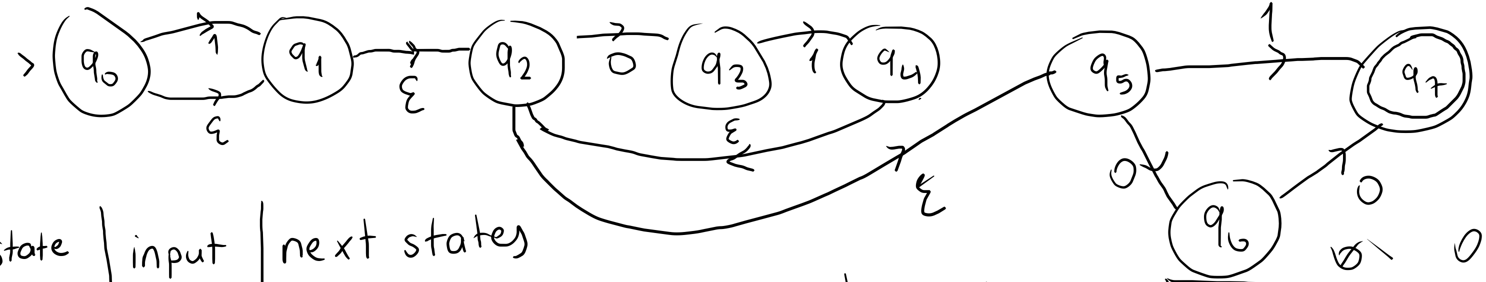
Convert the regular expression R = (1 + e)(01)*(00 + 1) to an ε-NFA. Convert it to DFA and minimize the DFA.

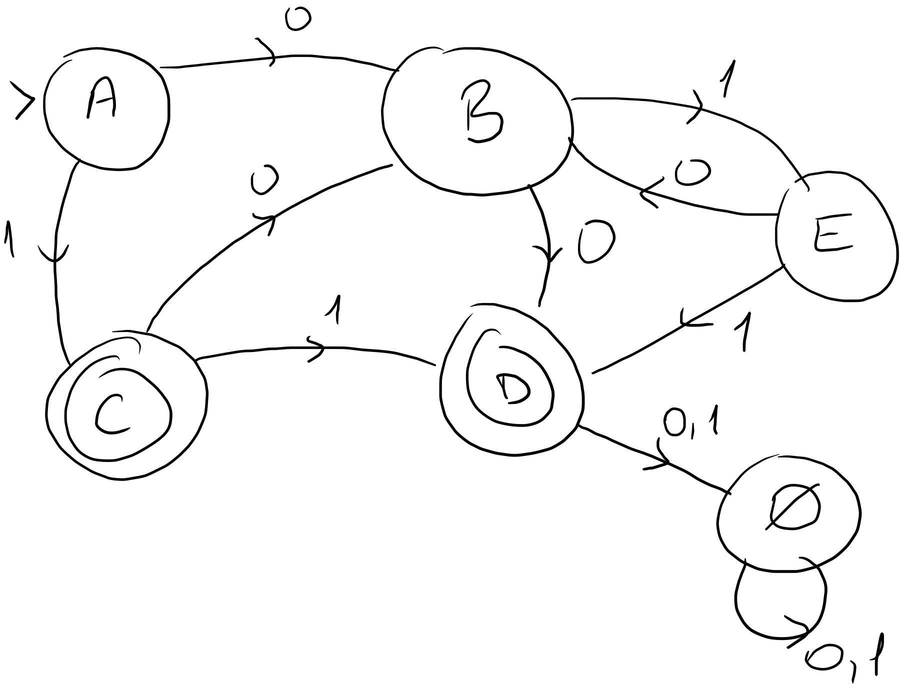


state	input	next states
$>q_0$	0	$\{q_3, q_6\}$
	1	$\{q_1, q_7, q_2, q_5\}$
$>q_1$	0	$\{q_3, q_6\}$
	1	q_7
$>q_2$	0	$\{q_3, q_6\}$
	1	q_7
q_3	0	$\emptyset$
	1	q_2, q_4, q_5
q_4	0	q_3, q_6
	1	q_7

$>q_5$	0	q_6
	1	q_7
q_6	0	q_7
	1	$\emptyset$
$*q_7$	0	$\emptyset$
	1	$\emptyset$

$\emptyset$ 0, 1 $\emptyset$

state	input	next state
$>$ A $\{q_0, q_1, q_2, q_5\}$	0	q_3, q_6 B
	1	C q_1, q_2, q_5, q_7
B q_3, q_6	0	q_7 D
	1	q_2, q_4, q_5 E
C * q_1, q_2, q_5, q_7	0	q_3, q_6 B
	1	q_7 D
D * q_7	0	$\emptyset$
	1	$\emptyset$
E q_2, q_4, q_5	0	q_3, q_6 B
	1	q_7 D



	A	B	E	∅	C	D
A		1	2	1	0	0
B			1	1	0	0
E				1	0	0
∅					0	0
C						1
D						

$\delta(A,0) = B, \quad \delta(A,1) = C$

Prove whether $L = \{w \in \{0,1\}^* \mid w = 0^n1^m; n \leq m\}$ is regular or not.

pumping length n: $w = 0^n 1^n$ $|w| = 2n \geqslant n$

$w = x \cdot y \cdot z$

1 $|xy| \leqslant n$ 2 $|y| > 0$ 3 $xy^iz \in L$ $i = 0, 1, 2 \dots$ $i \in \mathbb{N}$

$x = 0^p$, $y = 0^q$, $z = 0^{n-p-q} \cdot 1^n$

$xy^2z = 0^p \cdot 0^{2q} \cdot 0^{n-p-q} \cdot 1^n = 0^{n+q} \cdot 1^n$

$q > 0 \Rightarrow n+q > n$

$\Rightarrow \underbrace{xy^2z \notin L}_{\text{Contradiction}}$

Construct a CFG that generates the set of strings with twice as many 0s as 1s.

$G = (\{S$ [redacted] $\}, \{0, 1\}, R, S)$

V, T, R, S

R:

$S \to S0S0S1S \mid S0S1S0S \mid S1S0S0S \mid e$

Construct a CFG that generates all strings which are not palindromes of {0, 1}.

$G = (\{S, X\}, \{0, 1\}, R, S)$

R:

$S \to 0S0 \mid 1S1 \mid 0X1 \mid 1X0$

$X \to 0X \mid 1X \mid e$

$\underbrace{\dots}_{n} \overset{0}{1} \dots \overset{1}{0} \underbrace{\dots}_{n}$