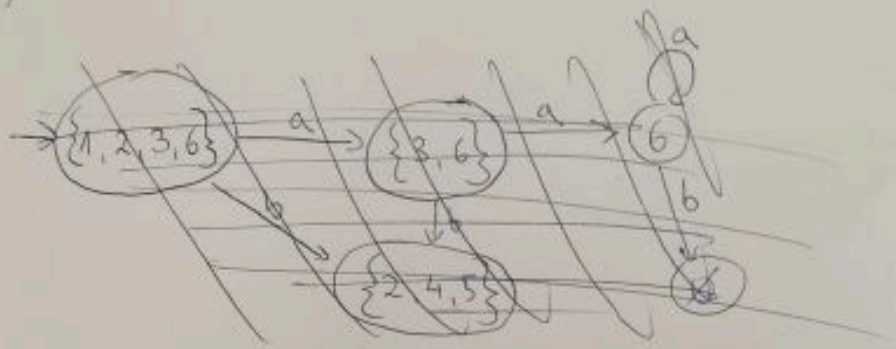
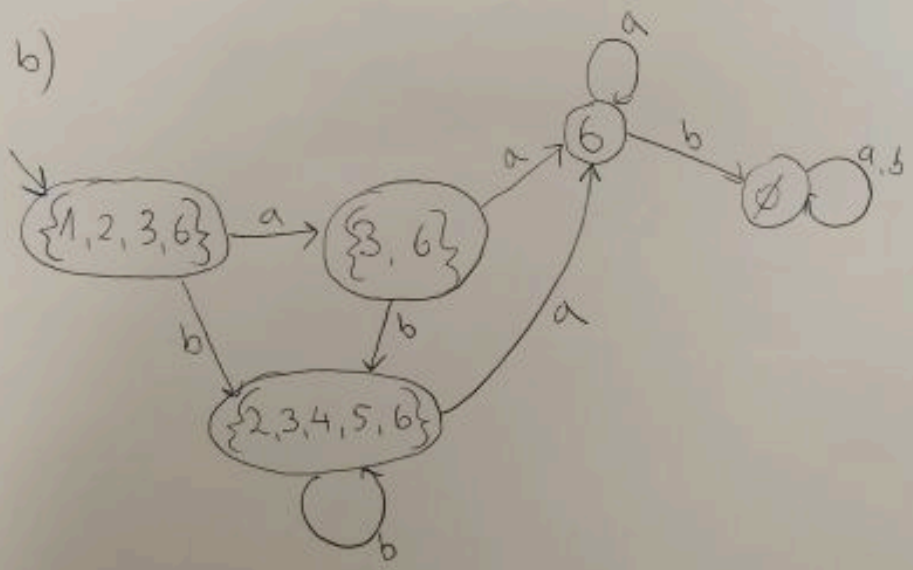
7.3

a) Because there are 6 nodes, there will be 2^6 states in DFA.

b)



b)



7.4

base step: $6 = 3 \cdot 2 \rightarrow$ divisible
$15 = 3 \cdot 5 \rightarrow$ divisible
$33 = 3 \cdot 11 \rightarrow$ divisible

$(s_1 + s_2) = (3 \cdot x_1 + 3 \cdot x_2) = 3 \cdot (x_1 + x_2)$ – it will always be divisible by 3

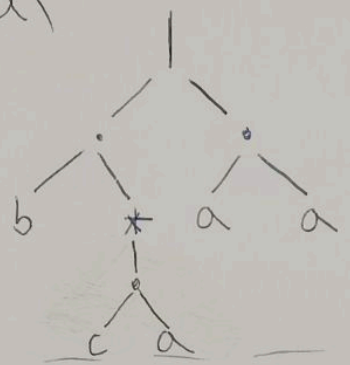
$(s_1 \cdot s_2) = 3 \cdot x_1 \cdot s_2 \rightarrow$ divisible

$s_1^2 = 3^2 \cdot x_1^2 \rightarrow$ divisible

Conlusion: If we take any expression, we can always divide it by 3

7.6

a)



$b(ca)^*|aa$

$b(ca)^*$

$(ca)^*$

ca

b)