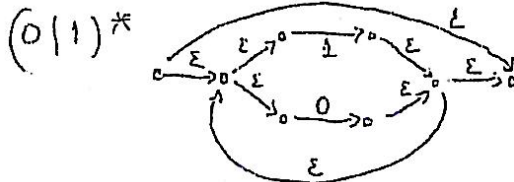
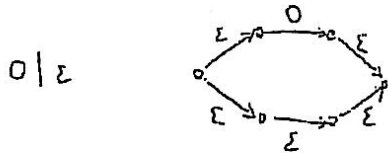


## FORMATIVE EXERCISES (1)

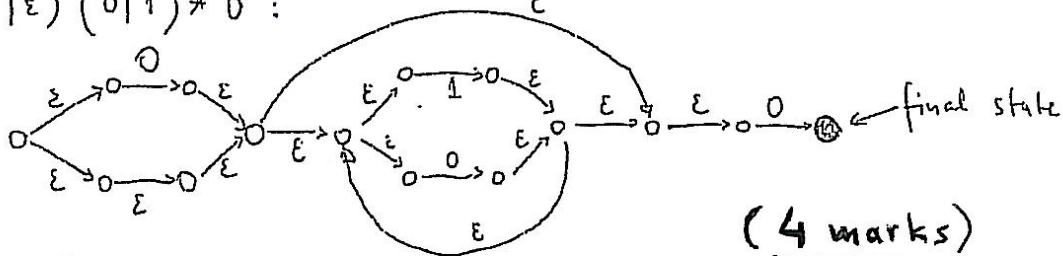
a) The regular expression is:  $a((a|b)\text{any\_char } c^*)^*d|e$

b)

i) NFA using Thompson's construction:

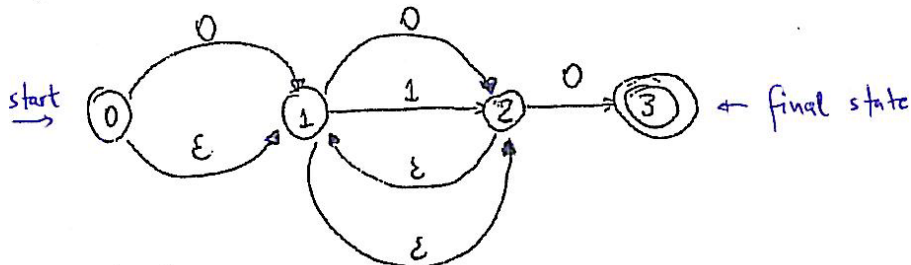


$(0|\epsilon)(0|1)^*0$ :



(4 marks)

ii) Simplified version of the NFA:



Subsets

construction:  
 $\epsilon\text{-closure}(\text{move}(\dots, 0))$

$\epsilon\text{-closure}(\text{move}(\dots, 1))$

$A = \{0\}$

$\{1, 2, 3\}$

$\{1, 2\}$

$B = \{1, 2, 3\}$

$\{1, 2, 3\}$

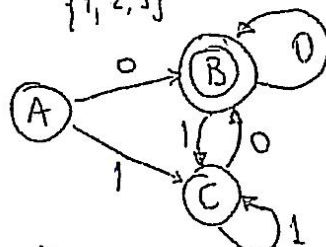
$\{1, 2\}$

$C = \{1, 2\}$

$\{1, 2, 3\}$

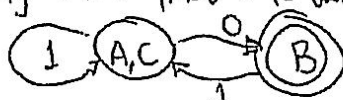
$\{1, 2\}$

DFA:



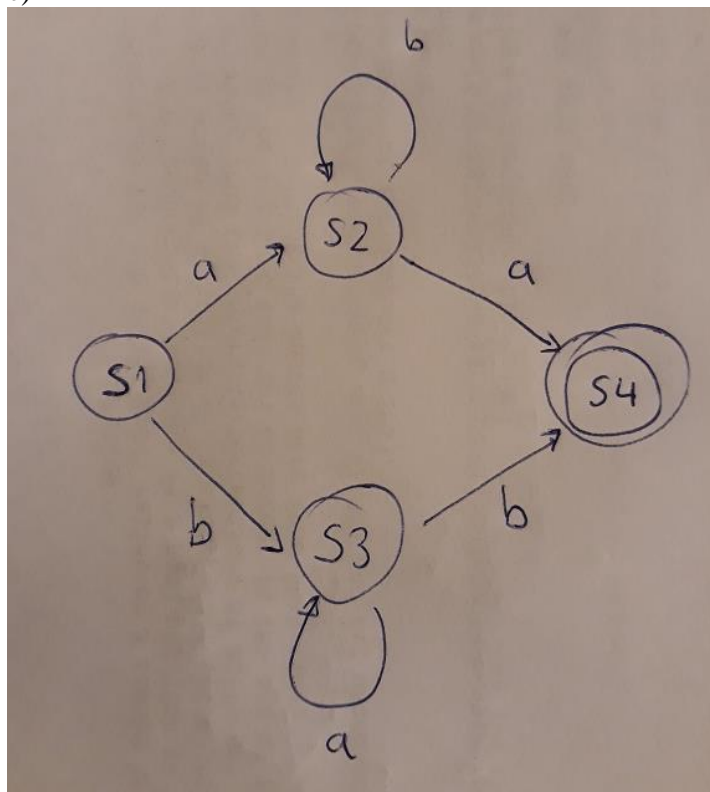
(8 marks)

iii) Starting with final and non-final states, this is clearly a minimised DFA:



(4 marks)

c)



d)

Clearly any integer greater than 798 will have either 4 digits at least or 3 digits and the first one will be 8 or 9, or it will be 799. Hence, the regular expression is:

$\text{integer}_{798} \rightarrow \text{digit}_0 \text{ digit digit digit digit}^* \mid 8 \text{ digit digit} \mid 9 \text{ digit digit} \mid 799$

where digit is any digit (0 to 9) and digit<sub>0</sub> is any digit except 0.