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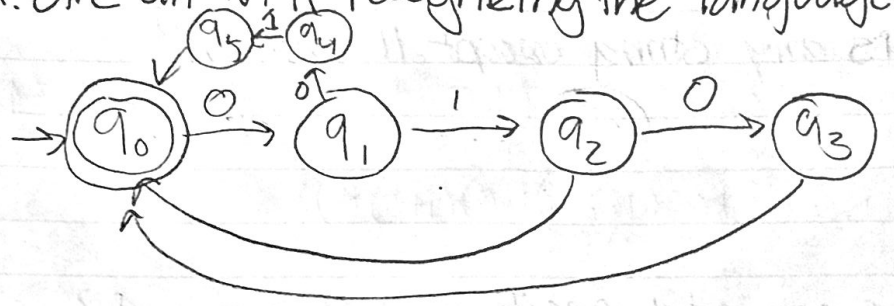
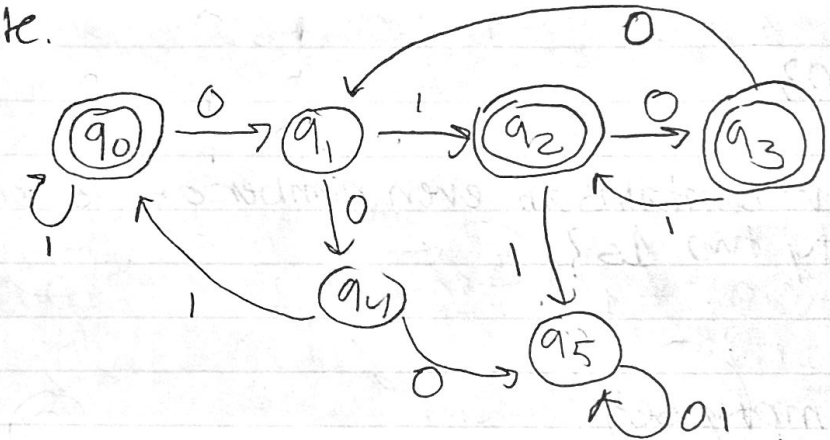
HomeWork 4

1.17 a. Give an NFA recognizing the language $(01 \cup 001 \cup 010)^*$



b. Convert this NFA to an equivalent DFA. Give only the portion of the DFA that is reachable from the start state.



1.18 Give regular expressions generating the language of exercise 1.6

a) $\{w \mid w$ begins with 1 and ends with a $0\}$

$1(0+1)^*0$

b) $\{w \mid w$ contains at least three 1s$\}$

$(0+1)^*1(0+1)^*1(0+1)^*1(0+1)^*$

c) $\{w \mid w$ contains the substring $0101\}$

$(0+1)^*0101(0+1)^*$

d) $\{w \mid w$ has length at least 3 and its 3rd symbol is a $0\}$

$(0+1)(0+1)0(0+1)^*$

e) $\{w \mid w$ starts with 0 and has odd length, or starts with 1 and has even length$)$

$(0+1(0+1))((0+1)(0+1))^*$

f) $\{w \mid w$ doesn't contain the substring $110\}$

$0^*(10^*)^*1^*$

g) {w | the length of w is at most 5}
$(\varepsilon + (0+1)^5)$

h) {w | w is any string except 11 and 111}
$(\varepsilon + (0+1) + (0(0+1)) + (10) + (0(0+1)(0+1)^*) + (10(0+1)) +$
$(11(0+1)) + ((1+0)(1+0)(1+0)(1+0)^*))$

i) {w | every odd position of w is a 1}
$1 + (1(0+1))^* + \varepsilon$

j) {w | w contains at least two 0s and at most one 1}
$00^*1 + 100^* + 0^*10^* + 00^*$

k) {ε, 0}
$\varepsilon + 0$

l) {w | w contains an even number of 0s or contains exactly two 1s}
$11 + (00)^* + 110^* + 0^*11 + 1(00)^* + (00)^*1$
$+ (0^*10^*)^*$

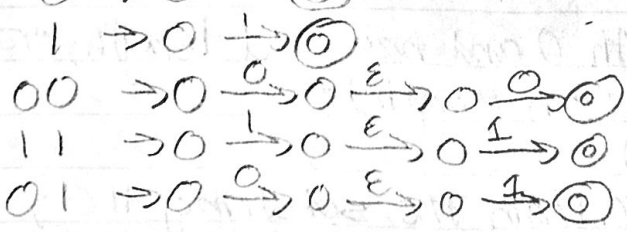
m) The empty set
$\emptyset$

n) All strings except the empty string
$(0+1)^+$

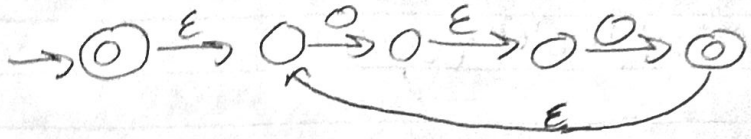
1.19 Use the procedure described in Lemma 1.55 to convert the following regular expressions to NFAs.

a) $(0 \cup 1)^*000(0 \cup 1)^*$
incorrectly spaced, work done after part c)

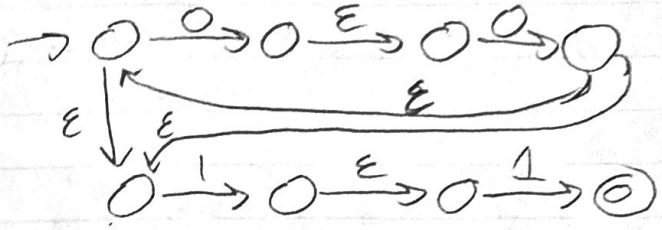
b) $((00)^*(11)) \cup 01)^*$



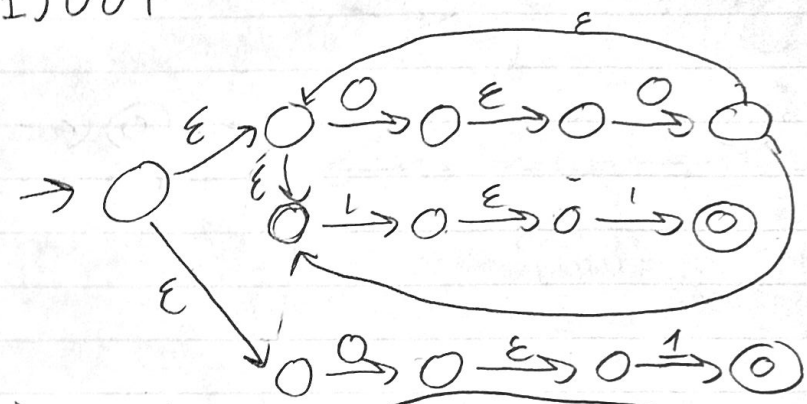
$(00)^*$



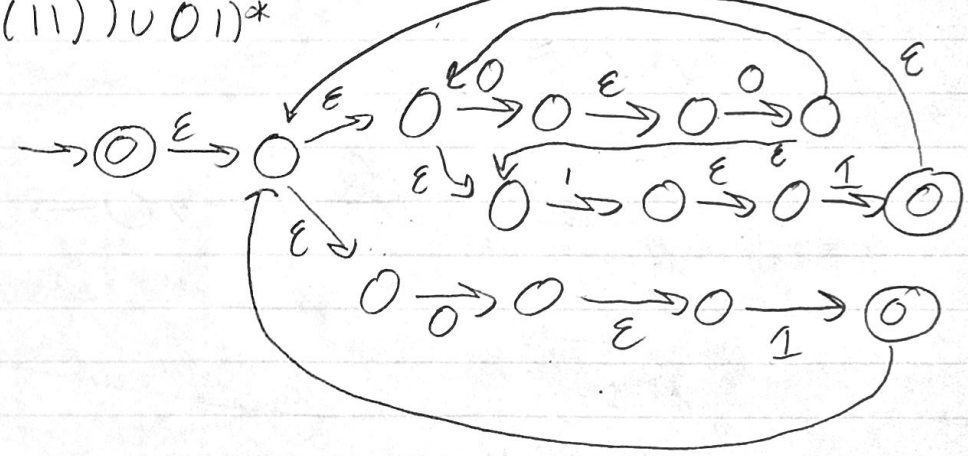
$(00)^*11$



$(00)^*(11) \cup 01$



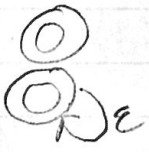
$((00)^*(11)) \cup 01)^*$



c) $\emptyset^*$

$\emptyset$

$\emptyset^*$



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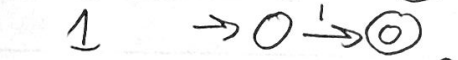
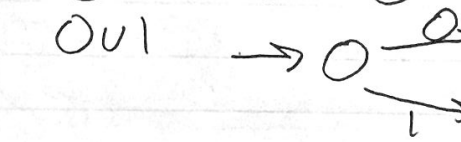
a) $(0 \cup 1)^*000(0 \cup 1)^*$

0

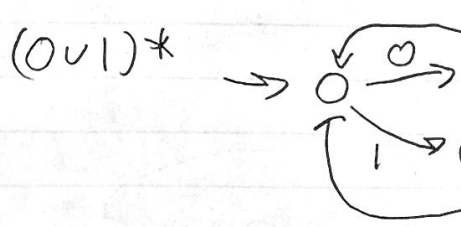
1



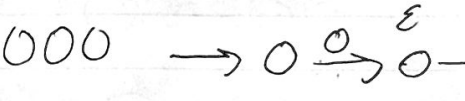
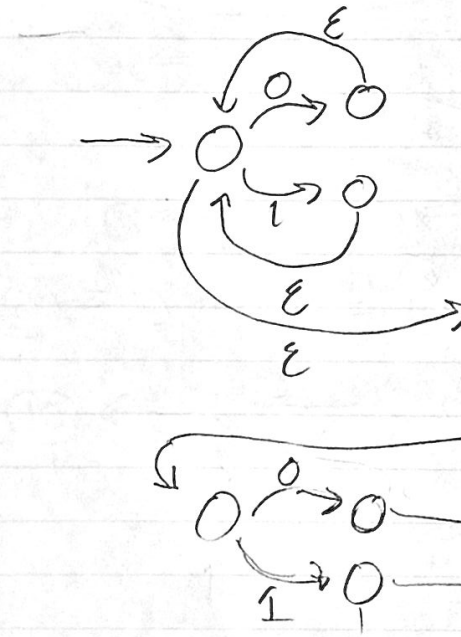
$0 \cup 1$



$(0 \cup 1)^*$



000



$(0 \cup 1)^*000(0 \cup 1)^*$