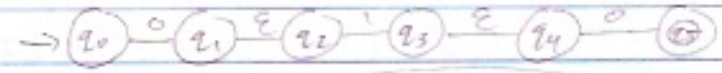
Lynne Diep
CMPS 130
HW #4

1.17 a) NFA $(01 \cup 001 \cup 010)^*$

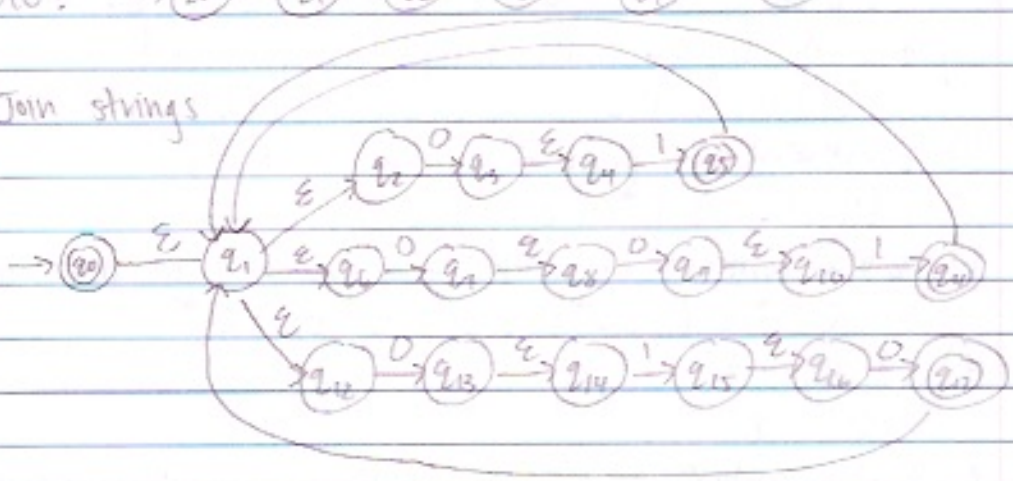
01:

001:

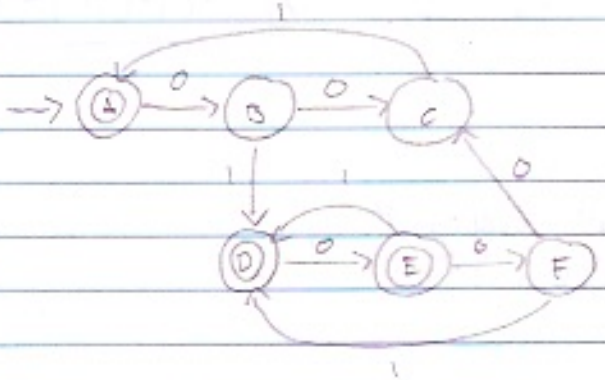
010:



Join strings



b) Convert NFA to DFA



1.18 Regular expressions of 1.6

a) {w|w begins with a 1 and ends with a 0}

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

b) {w|w contains at least three 1's}

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

c) {w|w contains substring 0101}

$(1 \cup 0)^* 0101 (1 \cup 0)^*$

d) {w|w has length at least 3 and 3rd symbol is 0}

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

e) {w|w starts with 0, odd length or starts with 1, even length}
$0(00 \cup 01 \cup 11 \cup 10)^* \cup 1((00 \cup 01 \cup 11 \cup 10)^*(0 \cup 1))$

f) {w|w doesn't contain substring 110}
$0^*(100^*)1^*$

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

h) {w|w is any string except 11 and 111}
$(\varepsilon \cup 1) \cup (0 \cup 10 \cup 110 \cup 1110 \cup 1111)(0 \cup 1)^*$

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

j) {w|w contains at least two 0s and at most one 1}
$000^* \cup (000^*1 \cup 010 \cup 100)0^*$

k) {ε, 0}
$0 \cup \varepsilon$

l) {w|w contains an even # of 0's or contains exactly two 1's}
even # of 1's : $(1^*01^*01^*)^*$ } combine :
exactly two 1's $0^*10^*10^*$ } $(1^*01^*01^*)^* \cup 0^*10^*10^*$

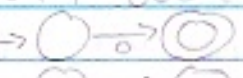
m) empty set
$\emptyset$

n) all strings except empty string
$\Sigma^+ = (0 \cup 1)^+$

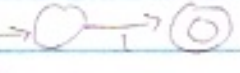
1.19 Convert to NFA

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

0:

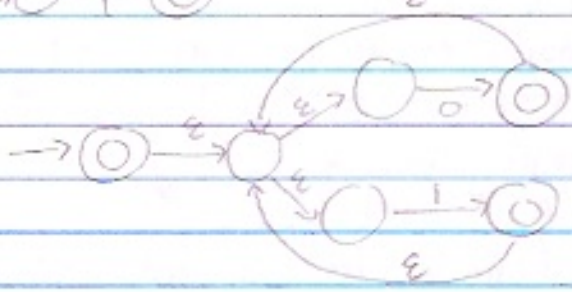


1:



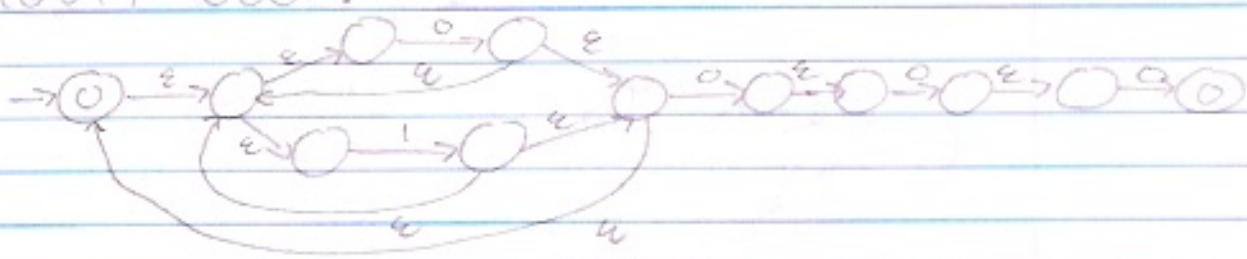
$0 \cup 1$:

$(0 \cup 1)^*$:

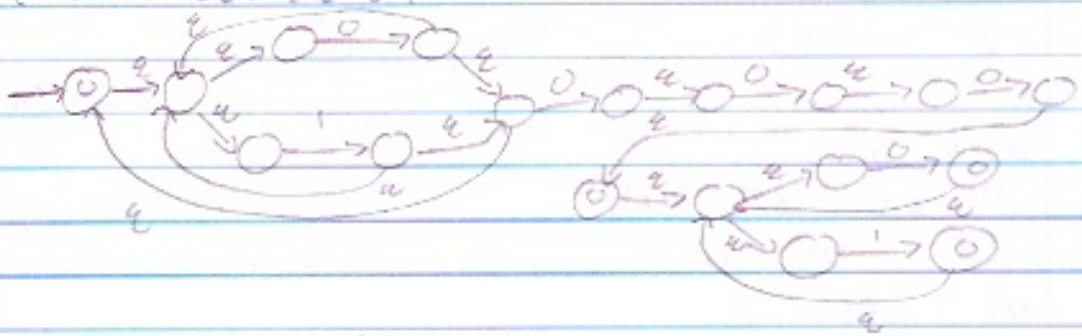


000:

(0 ∪ 1)* 000 :



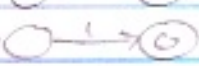
(0 ∪ 1)* 000 (0 ∪ 1)* :



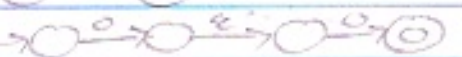
b) (((00)* (11)) ∪ 01)*

0:

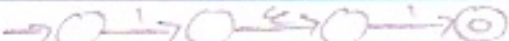
1:



00:

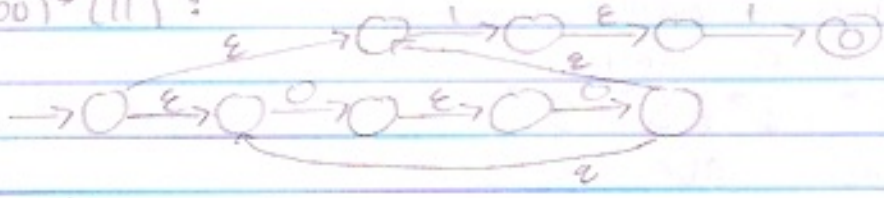


11:

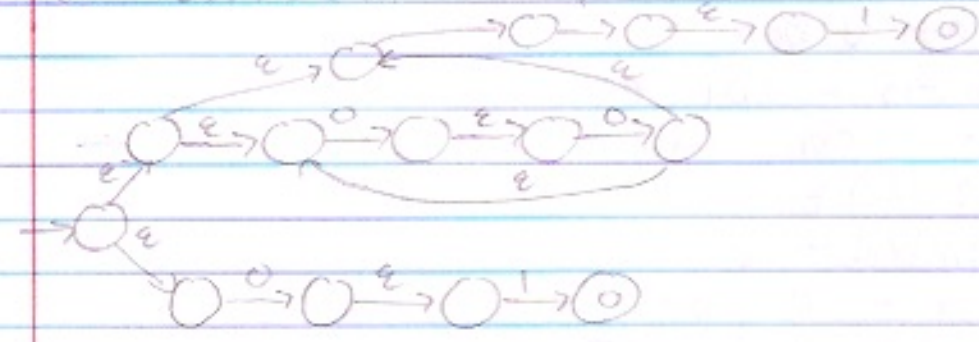


01:

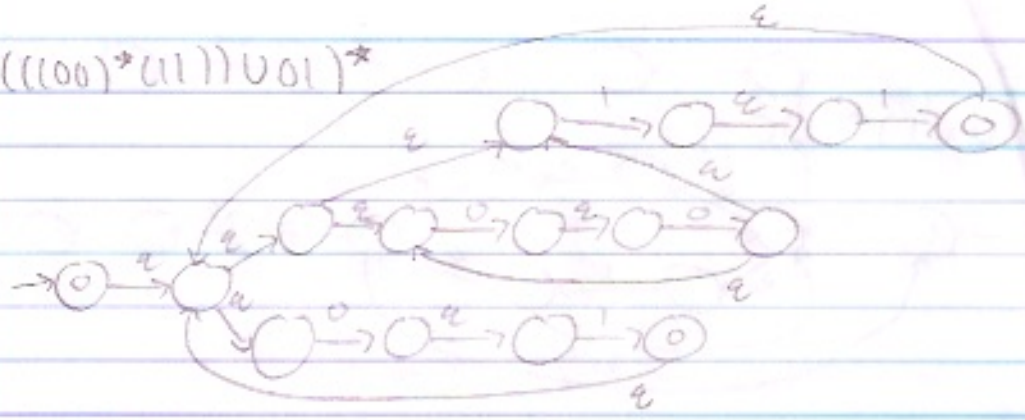
(00)* (11) :



(00)* (11) ∪ 01



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



c) $\emptyset^*$

$\emptyset$: ⇒○ $\emptyset^*$: ⇒◎