Formal Languages Homework 3

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1 Problem 2.5.2

Consider the following ϵ-NFA

	ϵ	a	b	c
$\to p$	$\{q, r\}$	$\emptyset$	$\{q\}$	$\{r\}$
q	$\emptyset$	$\{p\}$	$\{r\}$	$\{p, q\}$
$*r$	$\emptyset$	$\emptyset$	$\emptyset$	$\emptyset$

1.1 a) Compute the ϵ-closure of each state
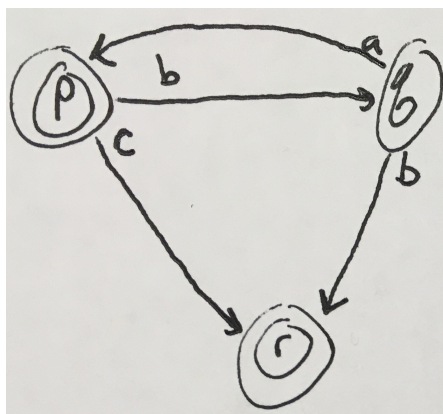
$ECLOSE(p) = \{p, q, r\}$.
$ECLOSE(q) = \{p, q, r\}$.
$ECLOSE(r) = \emptyset$.

1.2 b) Give all strings of length three or less accepted by the automaton

$\{\epsilon, b, c, ab, cb, bb, bc, aab, bab, abb, cbb, bcb, ccb, cab, acb\}$.

1.3 c) Convert the automaton to an NFA

2 Problem 3.1.1

Write regular expressions for the following languages:

2.1 a) The set of strings over alphabet $\{a, b, c\}$ containing at least one a and at least one b

$(a + b + c)^*(a(a + b + c)^*b + b(a + b + c)^*a)(a + b + c)^*$

2.2 b) The set of 0's and 1's whose tenth symbol from the right end is 1

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

2.3 c) The set of strings of 0's and 1's with at most one pair of consecutive 1's

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

3 Problem 3.1.2

Write regular expressions for the following languages:

3.1 a) The set of all strings of 0's and 1's such that every pair of adjacent 0's appears before any pair of adjacent 1's

$(0 + 01)^*(1 + 01)^*$

3.2 b) The set of strings of 0's and 1's whose number of 0's is divisible by five

$(1^*01^*01^*01^*01^*)^*$

4 Problem 3.1.4

Give English descriptions of the languages of the following regular expressions:

4.1 a) $(1 + \epsilon)(00^*1)^*0^*$.

Set of strings that have no consecutive 1's.

4.2 b) $(0^*1^*)^*000(0 + 1)^*$.

Set of strings with at least 3 consecutive 0's.

4.3 c) $(0 + 10)^*1^*$.

The set of strings such that there are no consecutive 1's.