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CS150 Homework 2

due Monday, October 25th 5:00 PM

Problem 1.

a) Compute the e-closure of each state.

ECLOSE(p) = {p, q, r}

ECLOSE(q) = {q}

ECLOSE(r) = {r}

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

All possible strings of length 3 or less from alphabet {a,b,c} are accepted by this automaton, including ϵ **EXCEPT** bba, bbb, bbc!

c) Convert the automaton to a DFA.

DFA			
	a	b	c
$\rightarrow *${p, q, r}	{p, q, r}	{q,r}	{p,q,r}
*{q, r}	{p, q, r}	{r}	{p, q, r}
*{r}	ϕ	ϕ	ϕ
ϕ	ϕ	ϕ	ϕ

Problem 2. Write regular expressions for the following languages:

a) The set of strings of 0's and 1's whose 10th symbol from the right is a 0.

ANS: $(0+1)^*0(0+1)^9$

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

ANS: $(1+01)^*(00+0+\epsilon)(1+10)^*$

Problem 3.

DFA		
	0	1
→ ∗a	b	c
b	a	d
c	d	a
*d	c	b

Make a new initial state "s" that epsilon transitions to state "a". State "a" is no longer the initial state
Make a new final state "f" that has epsilon transitions going to it from states "a" and "d". States a and d are no longer final states.

1) Eliminate state b
a to d – (01)
a to a – (00)
d to a – (10)
d to d – (11)

2) Eliminate state c
a to d – (10)
a to a – (11)
d to a – (01)
d to d – (00)

3) Eliminate state d
a to a (from b and c eliminations)– (00) + (11)
a to a (from d elimination)– (01 + 10)(00 + 11)*(10 + 01)
a to f (from d elimination)– (01 + 10)(00 + 11)*

4) Eliminate state a
s to f – ((00) + (11) + (01 + 10)(00 + 11)*(10 + 01))* + (01 + 10)(00 + 11)*

Regex (simply s to f)–
((00) + (11) + (01 + 10)(00 + 11)*(10 + 01))* + (01 + 10)(00 + 11)*

Problem 4.
c) The set of prefixes of strings in L
d) The union of the set of prefixes of strings in L (part c) and the set of suffixes of strings in L (part b)

Problem 5.
e) (R+S)T = RT +ST.
Replace R, S, and T with {a}, {b}, and {c} respectively, + with $\cup$, and $\cdot$ with x
({a}$\cup${b})x{c} = {a}x{c} $\cup$ {b}x{c}
LHS: ({a}$\cup${b})x{c} = {a, b}x{c}
LHS: {a, b}x{c} = **{ac, bc}**
RHS: {ac} $\cup$ {bc}
RHS: **{ac, bc}**
Both LHS and RHS are equal, the identity (R+S)T = RT +ST holds. Q.E.D.

g) (ϵ+R)* = R*.
Replace ϵ with {ϵ} and R with {a}, + with $\cup$
({ϵ}$\cup${a})* = {a}*
LHS: {ϵ, a}*
This is simply the set of all strings of the empty string (ϵ) and a's, which is simply the set of all strings of a's. Because no matter how many ϵ are concatenated to a's, the string remains a string of a's.
The set of all strings of a's is : LHS: **{a}***
RHS: **{a}***
Both LHS and RHS are equal, the identity (e+R)* = R* holds. Q.E.D.