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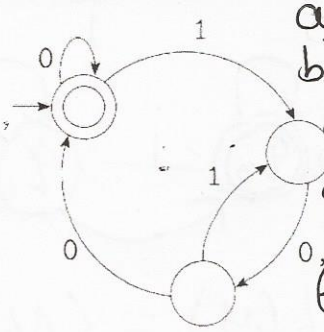
Introduction to Computation Theory
Quiz 5 – In-class (20 pts)

Answer all questions

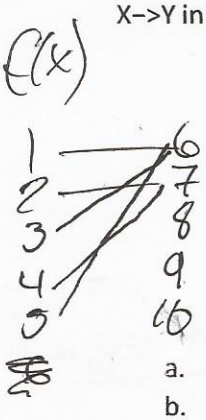
1. [6 pts] Answer all parts for the following DFA M and give reasons for your answers.




a. Is $\langle M, 0100 \rangle \in A_{DFA}$? a) Yes the string 0100 is Ac
b. Is $\langle M, 011 \rangle \in A_{DFA}$? b) No 011 is rejected
c. Is $\langle M \rangle \in A_{DFA}$? c) Bad input No!
d. Is $\langle M, 0100 \rangle \in A_{REX}$? d) Not using a regex No
e. Is $\langle M \rangle \in E_{DFA}$? e) No M is not empty
f. Is $\langle M, M \rangle \in EQ_{DFA}$? f) Yes M equals M

2. [6 pts] Let X be the set {1, 2, 3, 4, 5} and Y be the set {6, 7, 8, 9, 10}. We describe the functions f : X->Y and g : X->Y in the following tables. Answer each part and give a reason for each negative answer.

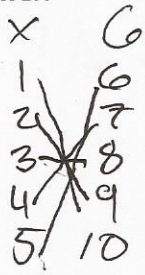
f(x)




| $n$ | $f(n)$ |
|---|---|
| 1 | 6 |
| 2 | 7 |
| 3 | 6 |
| 4 | 7 |
| 5 | 6 |

| $n$ | $g(n)$ |
|---|---|
| 1 | 10 |
| 2 | 9 |
| 3 | 8 |
| 4 | 7 |
| 5 | 6 |

x g(x)




a. Is f one-to-one? No
b. Is f onto? No
c. Is f a correspondence? yes
d. Is g one-to-one? yes
e. Is g onto? yes
f. Is g a correspondence? yes

Hint:

- A function f from A to B is called onto if for all b in B there is an a in A such that f(a) = b.
- A function is a correspondence between two sets where each element in the first set, called the domain, corresponds to exactly one element in the second set, called the range.

3. [4 pts] Let A = {<M>| M is a DFA that doesn't accept any string containing an odd number of 1s}. Show that A is decidable. *Hint*: Write the algorithm and design the $M_{DFA}$

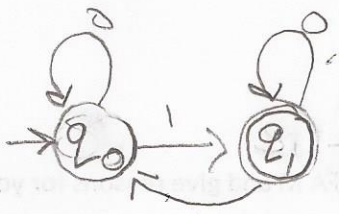
On back (pg 2)

4. [4 pts] Let $BAL_{DFA}$ = {<M>| M is a DFA that accepts some string containing an equal number of 0s and 1s}. Show that $BAL_{DFA}$ is decidable. (Hint: Write the algorithm and design the decider. Theorems about Context Free Languages are helpful here.)

On back (pg 2)

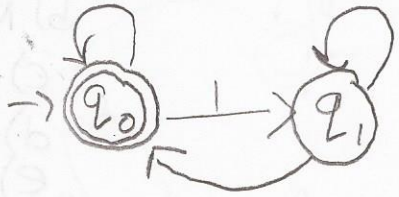
(3) Rejects strings with odd # of 1

$O_{dfa}$ =




Decidable

$M_{dfa}$ =




$L(B) = L(O) \cap L(M) = \langle M \rangle$

We can reach a final state with the language $\langle M \rangle$ of A!

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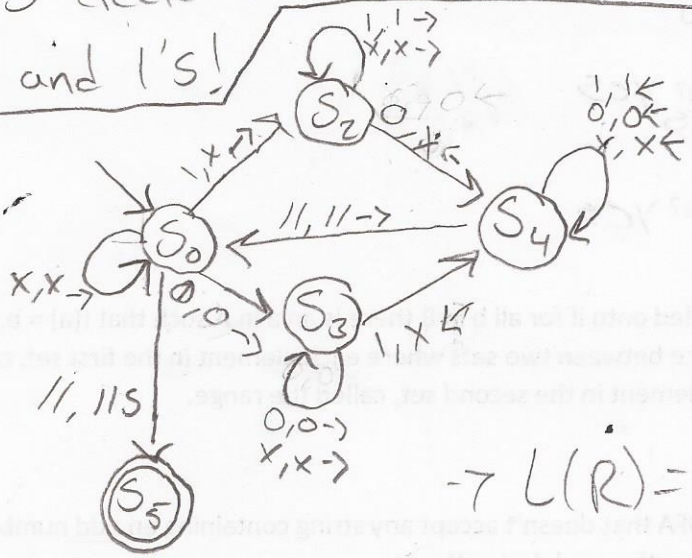
(4) $Bal_{DFA}$ is decidable when M accepts strings of equal #'s of 0's and 1's!

Answer:

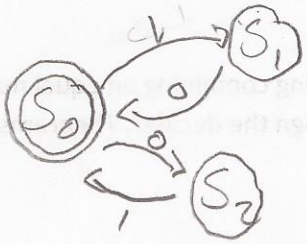
TM M ->




-> $L(R) = L(M) \cap L(PDA)$

$L(R) \neq \emptyset$

PDA ->




We have accept states reachable by the language $\langle M \rangle$ and the cros