CS 373: Theory of Computation (Spring 2009)
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Problem Set 8

Submission instructions: Submit each problem on a **separate sheet of paper**, put your name on each sheet, and write your discussion section time and day (e.g. Tuesday 10am) in the upper righthand corner. These details may sound picky, but they make the huge pile of homeworks much easier to grade quickly and more importantly, since we return them in the discussion sections, easier for you to get them back.

Also, write on each exercise the name/netid of your group members.

Due: Wednesday, April 8, 2009 at 12:30 in Elaine Wilson office (SC 3229). If the door is locked, slide your solutions under the door.
Version: **1.01**

(Q1) Building Turing Machines.
[**Category**: Construction, **Points**: 50]

Give the state diagram for a Turing Machine for the following language.

$$L = \left\{ \$\mathtt{a}^{2n}\mathtt{b}^{n}\mathtt{c}^{3n} \;\middle|\; n \geq 0 \right\}.$$

For example, the input may look like $\$\mathtt{abc}$.

You do not need to draw transitions that lead to the (implicit) reject state. Hence, any transition that is not present in your diagram will be assumed to lead to the reject state. Indicate which symbol (e.g. $\sqcup$) you are using for the special blank symbol that fills the end of the tape.

(Q2) Building Turing Machines II.
[**Category**: Construction, **Points**: 50]

Give the state diagram for a Turing Machine for the following language.

$$L = \left\{ \$\mathtt{a}^{2^n}\#\mathtt{b}^{n} \;\middle|\; n \geq 0 \right\}.$$

For example, the input may look like $\$\mathtt{aaaa\#bb}$ or $\$\mathtt{aaaaaaaa\#bbb}$

You do not need to draw transitions that lead to the (implicit) reject state. Hence, any transition that is not present in your diagram will be assumed to lead to the reject state. Indicate which symbol (e.g. $\sqcup$) you are using for the special blank symbol that fills the end of the tape.