Quiz 6

Firstname Lastname: ___________________________ ID# ___________ Seat# ___

- Don’t sit next to anyone you know.
- Don’t turn over this paper until you are asked to.
- When you finish, put this side up once again.
- Most or all problems will be graded all-or-nothing.
- Relax, these quizzes are too insignificant to get stressed over.

Happy Friday!

phil rogaway
(1) Suppose you use the procedure described in class to convert the following NFA $M$ into a right-liner grammar $G = (V, \Sigma, R, S)$ for the same language. How many rules will $G$ have? (I’m only asking for the number of rules; no need to list them. Remember to include in your count both rules of the form $A \rightarrow aB$ and any of the form $A \rightarrow \varepsilon$, where $A$ and $B$ are variables and $a$ is a terminal.)

![NFA Diagram]

(2) Write the rules for a CFG $G = (V, \Sigma, R, S)$ for the language $L = \{a^n \# a^n : n \geq 0\}$. Two rules suffice, so please don’t use more. The alphabet is $\Sigma = \{a, \#\}$.

(3) Define what it means for a CFG $G = (V, \Sigma, R, S)$ to be ambiguous. Make your English grammatical and precise, and don’t use any form of the word “ambiguous” in your definition.

(4) Below is the Turing Machine $M$ described in class that accepts $L = \{a^n b^n : n \geq 1\}$.

![Turing Machine Diagram]

Suppose you run $M$ on $a^{10} b^{10}$. When it accepts, the tape will have on it how many $a$’s, $b$’s, $A$’s, and $B$’s?

- $a$: 
- $b$: 
- $A$: 
- $B$: 

(5) Darken the box if the statement is true.

- [ ] Every regular language is context free.
- [ ] An unrestricted grammar could have a rule $A d \rightarrow cB$ (with $A, B$ variables, $c, d$ terminals)