Ma2201/CS2022
Quiz 1001

# Foundations of C.S.

Spring, 2022

PRINT NAME: _____
*SIGN*: _____

1. (2 pts) Let $G$ be the grammar defined below. Convert to an equivalent grammar with no left recursion.

$$\begin{array}{rcl} G: S & \rightarrow & AB \mid BC \mid \lambda \\ A & \rightarrow & aa \mid ABC \mid Aa \\ B & \rightarrow & bb \mid BBC \mid b \\ C & \rightarrow & cc \mid ccc \mid c \end{array}$$

♣ Only $B$ and $A$ have left recursive rules, so only they need to be altered. $A$ will be replaced by

$$\begin{array}{rcl} A & \rightarrow & aa \mid aaX \\ X & \rightarrow & BC \mid a \mid BCX \mid aX \end{array}$$

and $B$ is replaced by

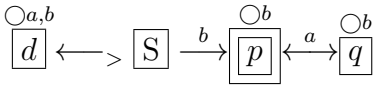
$$\begin{array}{rcl} B & \rightarrow & bb \mid b \mid bbY \mid bY \\ Y & \rightarrow & BC \mid BCY \end{array}$$

♣

2. (5 pts) Let $L$ be the language of all strings on $\{a, b\}$ with an even number of $a$'s and which start with $b$. Draw the state diagram of a deterministic finite automaton $M$ such that $L(M) = L$.

Give a short description of the role of each state.

♣ Please forgive my ugly diagram:




$S$: path is empty
$p$: paths from $S$ begin with $b$ and have an even number of $a$'s.
$q$: paths from $S$ begin with $b$ and have an odd number of $a$'s.
$d$: paths from $S$ begin with $a$. ♣

3. (3 pts) Draw the transition table of your machine in question 2.

♣

| | $a$ | $b$ |
|---|---|---|
| $S$ | $d$ | $p$ |
| $p$ | $q$ | $p$ |
| $q$ | $p$ | $q$ |
| $d$ | $d$ | $d$ |

♣