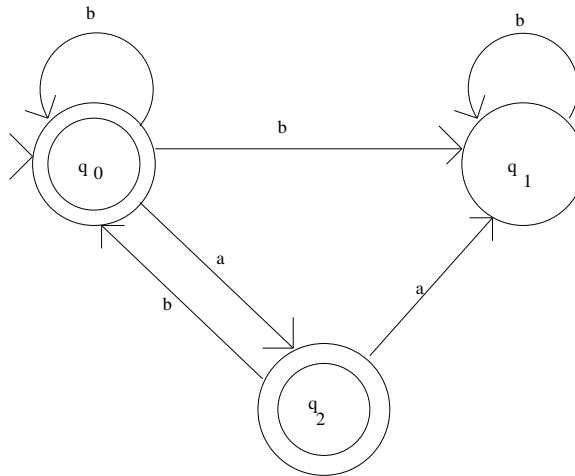


CS 3133 Foundations of Computer Science
C term 2018

Practice Final Exam

These problems are sample problems for the final exam, so you may expect similar problems in the final. Do not hand in your solutions. Solutions will be posted on the website. The final exam is a closed book exam, but you may use one sheet of paper (written on both sides) with notes on it. The exam is from the material of the whole course. Each problem is worth 20 points.

1. Construct the state diagram of a DFA equivalent to the following NFA



2. Consider the following grammar G :

$$\begin{aligned} S &\rightarrow aSdd|A \\ A &\rightarrow bAc|bc \end{aligned}$$

- (a) Give a leftmost derivation of $aabbccddddd$.
- (b) Build the derivation tree for the derivation in part (a).
- (c) What is $L(G)$?

3. Consider the following regular grammar G :

$$\begin{aligned} S &\rightarrow aB|a \\ B &\rightarrow bS. \end{aligned}$$

- (a) Build an NFA M that accepts $L(G)$.
 - (b) Construct a regular grammar G' from M that generates $L(M)$.
What is the difference between G and G' ?
 - (c) Give a regular expression for $L(G)$.
4. Construct a PDA with $\Sigma = \{a, b\}$ that accepts the language

$$\{a^i b^{2i} | i \geq 0\}.$$

Is this language context-free? Is this language regular? Justify your answers!

5. Design a standard Turing machine with $\Sigma = \{a, b\}$ that accepts the language

$$\{a^{2i} b^i | i \geq 0\}.$$

Is this language recursive?