CSC236 – Problem Set 9

There are two components of this problem set. The preliminary question is not marked or submitted: it is there as a suggested exercise that you should do early to make sure that you're on track. The problem set itself is what you will submit for marks.

Get in the habit of starting work early – the less time you give yourself, the more stressed you'll find yourself each week!

To avoid suspicions of plagiarism: at the beginning of your submission, **clearly state any resources (people, print, electronic) outside of your group, the course notes, and the course staff, that you consulted**.

The PDF file you submit must be typed, scanned handwritten submissions will not be marked.

Preliminary: Not Marked

This question is an opportunity for you to check your understanding of the topics and practice writing formal solutions. This is a valuable *learning opportunity* – if you see that you're at a loss, get help quickly!

1. Give a 5-state DFA that accepts $L = \{w \in \{0,1\}^* \mid \text{the third symbol of } w \text{ is } 1\}$
2. For the following language, give an NFA with no ϵ-transitions that matches the language. Give informal justification for why your NFA is correct.

   $L = \{w \in \{0,1\}^* \mid w \text{ starts with 01 but does not end with 01}\}$

Problem Set: due December 2, 2016 22:00, required filename: ps9sol.pdf

Answer each question completely, always justifying your claims and reasoning. Your solution will be graded not only on correctness, but also on clarity.

Answers that are technically correct that are hard to understand will not receive full marks. Mark values for each question are contained in the [square brackets].

You may work in groups of up to THREE to complete these questions.

1. **[8]** Consider this language: $L = \{w \in \{a,b\}^* \mid w \text{ does not have any instances of } bba\}$

   (a) Give a 4-state DFA that accepts this language L. **Draw the state transition diagram** with circles and arrows. Clearly indicate the initial state and accepting states, and label each transition with the proper symbol.

   (b) Give a proper state invariant for each state of your DFA. Just write the invariants, no need to prove them.

   (c) Using the proof technique from lecture, prove that your DFA has the minimal number of states for accepting L.

2. **[4]** Use the subset construction algorithm from lecture to produce an equivalent DFA from the following NFA. Please show your work so that we know how each state is generated. Name your DFA states so that the link to the NFA states is clear; i.e. you should have DFA states that look like $\{q_0, q_1\}$.

Old State	Symbol	New State
q_0	0	q_2
q_0	0	q_3
q_0	ϵ	q_4
q_1	ϵ	q_3
q_1	1	q_1
q_2	ϵ	q_1
q_2	1	q_2
q_3	0	q_4
q_4	1	q_3

   The initial state of this NFA is q_0; the accepting (final) states are q_3 and q_4.

   Present your final result as a **state transition table** like the table above. No need to draw the state transition diagram with circles and arrows. Clearly state the initial state and accepting states of your DFA.

Appendix: How to include a picture in LaTeX

This may be the first time when you need to include a picture LaTeX, so here is an example of it. You can see the source code in the posted **ps9.tex**. I used Google Draw (Google "Google Draw") as the drawing tool and downloaded the image as a PNG file.

Below is a link with more info about inserting images in LaTeX.

`https://www.sharelatex.com/learn/Inserting_Images`