CSCI 301, Math Exercises # 4

YOUR NAME HERE

Due date: Midnight, May 14

- Build deterministic finite automata for each of the following languages.
- Create simple, meaningful automata (rather than, *e.g.*, using the algorithm to create a DFA from an NFA, which can be quite complex and confusing) and explain how they work.
- In all cases the alphabet is $\Sigma = \{0, 1\}$.
- Typeset your answers as neatly as possible with LaTeX and Ti*k*Z.

1. The language $\{100, 10, 011\}$.
2. The set of all strings that begin or end with a doubled digit, either 11 or 00.
3. The set of all strings that have exactly one doubled digit in them. In other words, either 11 or 00 occurs in the string, but not both, and it only occurs once.
4. The set of all strings such that every block of four consecutive digits has at least two 0's in it.
5. The set of all strings beginning with a 1 such that, interpreted as a binary representation of an integer, it has a remainder of 1 when divided by 3. For example, the binary number 1010_b is decimal 10. When you divide 10 by 3 you get a remainder of 1, so 1010 is in the language. However, the binary number 1111_b is decimal 15. When you divide 15 by 3 you get a remainder of 0, so 1111 is not in the language.

   Hint: if you have a binary string, such as 1100_b, which is 12 in decimal, what happens if you add a 0 to the right end? You get 11000_b which in decimal is 24. What happens if you add a 1 to the right end? You get 11001_b which is decimal 25. Think carefully about all cases: What happens to the remainder when you add a 0? What happens when you add a 1?