CS 3800, Spring 2016 (Clinger's section)
Homework 1 (60 points)
Assigned: Friday, 15 January 2016
Corrected: Wednesday, 20 January 2016 (problem 7)
Due: Friday, 22 January 2016

1. [5 pts] For each of the following set operations, specify the result by listing its elements inside curly braces.

    (a) $\{1, 3\} \cup \{2, 3, 4\} =$

    (b) $\{1, 3\} \cap \{2, 3, 4\} =$

    (c) $\{1, 3\} - \{2, 3, 4\} =$

    (d) $\{2, 3, 4\} - \{1, 2\} =$

    (e) $\{1, 3\} \times \{2, 3, 4\} =$

2. [6 pts] Write out each of the following power sets by listing their elements inside curly braces.

    (a) $\mathcal{P}(\emptyset) =$

    (b) $\mathcal{P}(\{5\}) =$

    (c) $\mathcal{P}(\{5, 6, 7\}) =$

3. [6 pts] If S is any set, then we use the notation $|S|$ to indicate the number of elements in S. Suppose A, B, and C are sets with $|A| = 6$, $|B| = 4$, and $|C| = 3$. Compute the number of elements in each of the following sets.

    (a) $|A \times A| =$

    (b) $|B \times C| =$

    (c) $|A \times B \times C| =$

    (d) $|\mathcal{P}(A)| =$

    (e) $|\mathcal{P}(A \times B)| =$

    (f) $|\mathcal{P}(A \times C)| =$

4. [5 pts] Do Problem 0.11 in the textbook (both parts).

5. [5 pts] Do Problem 0.12 in the textbook.

6. [5 pts] Write down the formal (5-tuple) description of the DFA pictured in Exercise 1.21(b) on page 86 of the textbook.

7. [5 pts] Draw the state transition diagram for the DFA whose formal description is
$$(\{q_1, q_2, q_3\}, \{a, b\}, \delta, q_1, \{q_1, q_2\})$$
where δ is the function listed within the following table:

	a	b
q_1	q_2	q_3
q_2	q_2	q_1
q_3	q_3	q_3

8. [4 pts] Describe the language recognized by the DFA whose formal description was given above.

9. [14 pts] For each of the following languages, draw the state transition diagram for a DFA with alphabet $\{0, 1\}$ that recognizes the language.

   (a) $\{\}$

   (b) $\{\epsilon\}$

   (c) $\{01, 10\}$

   (d) $\{w \mid w$ starts with 0 and ends with 0$\}$

   (e) $\{w \mid w$ contains an odd number of 0s and an even number of 1s$\}$

   (f) $\{w \mid w$ is a binary numeral divisible by 3$\}$

   (g) $\{w \mid$ there exist strings x and y such that $w = x111y\}$

10. [5 pts] Do problem 1.32 in the textbook.