

CS 3800, Fall 2017 (Clinger's section)
Homework 1 (70 points)
Assigned: Wednesday, 6 September 2017
Due: Wednesday, 13 September 2017

1. [5 pts] For each of the following set operations, specify the result by listing its elements inside curly braces.
 - (a) $\{2, 4\} \cup \{1, 3, 4\} =$
 - (b) $\{2, 4\} \cap \{1, 3, 4\} =$
 - (c) $\{2, 4\} - \{1, 3, 4\} =$
 - (d) $\{1, 3, 4\} - \{1, 2\} =$
 - (e) $\{2, 4\} \times \{1, 3, 4\} =$
2. [6 pts] Write out each of the following power sets by listing their elements inside curly braces.
 - (a) $\mathcal{P}(\emptyset) =$
 - (b) $\mathcal{P}(\{8\}) =$
 - (c) $\mathcal{P}(\{6, 7, 8\}) =$
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 $|A| = 5$, $|B| = 3$, and $|C| = 4$. 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. [10 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) $\{w \mid w \text{ starts with } 0 \text{ and ends with } 0\}$
 - (e) $\{w \mid w \text{ contains an odd number of } 0\text{s and an even number of } 1\text{s}\}$
 - (f) $\{w \mid w \text{ is a binary numeral divisible by } 3\}$
 - (g) $\{w \mid \text{there exist strings } x \text{ and } y \text{ such that } w = x111y\}$
10. [10 pts] Do problem 1.37 in the textbook.