CP-414 Winter 2025 Assignment 1
Due: Wednesday, January 29 (11:30 PM)

1. Give a **state transition diagram** of **DFA**s recognizing the following languages (the alphabet is **{0,1}**):

a) L1 = the set of all strings that start with **1** or have odd length
b) L2 = the set of all strings that start with **0** and have even length
c) L3 = the set of all strings that end with **1** and have even length
d) L1 ∩ L2
e) L2 ⋃ L3
f) L2 ∩ L3
g) The set of all strings such that every occurrence of **1** is followed by at least two **0**s, e.g., **0001000100, 100, 0, 000000000100000000100100** are in this language, but **1011, 1, 101** are not.
h) The set of all strings that does not contain pattern **0110**.
i) The set of all strings except **100** and **01**.

2. For each **NFA** below:
(1) start state q_1, accepting state q_2

	0	1	ε
-> q_1	$\{q_2\}$	$\{q_1, q_2\}$	Ø
* q_2	$\{q_1\}$	Ø	Ø

(2) start state q_1, accepting state q_2

	0	1	ε
-> q_1	Ø	Ø	$\{q_3\}$
* q_2	$\{q_2, q_3\}$	$\{q_3\}$	Ø
q_3	$\{q_3\}$	$\{q_2\}$	$\{q_3\}$

a) provide **NFA** state transition diagram

b) use the construction given in **Theorem 1.39** to convert the **NFA** to equivalent **DFA**. **Show your work (including ALL intermediate steps).**

3. Give nondeterministic finite automata accepting the set of strings of **0**'s and **1**'s such that there are two **1**'s separated by a number of positions that is a multiple of 3. (Note: 0 is not an allowable multiple of 3, so **11** is not in language while **0100110** is). Try to take advantage of nondeterminism as much as possible.

4. Let D = {w | w contains an even number of **0**'s & an odd number of **1**'s & does not contain the substring **01**}. Give a **DFA** with five states that recognizes D. Hint: describe D more simply. Justify that the simpler description defines the same language.

5. Problem **1.27** from the text.

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