COMP 3803 — Fall 2025 — Problem Set 2

Question 1: Consider the language A consisting of all strings over the alphabet $\{a, b\}$ that do not contain bb as a substring. Give a regular expression that describes the language A. As always, justify your answer.

Question 2: Let R_1 and R_2 be two arbitrary regular expressions over the same alphabet. Professor Taylor Swift claims that the regular expressions

$$(R_1 \cup R_2)^*$$

and

$$(R_1^* R_2^*)^*$$

describe the same language. If Professor Swift's claim correct? As always, justify your answer.

Question 3: In this question, the alphabet is $\{0, 1\}$. Let A be the language consisting of all bitstrings that are the binary representation of an integer at least equal to 40. (Assume that the leftmost bit in the binary representation of a positive integer is 1. For example, the integer 41 in binary is 101001 and not 0101001.) Give a regular expression that describes the language A. As always, justify your answer.

Question 4: Use the construction given in class to convert the regular expression

$$(a \cup bb)^* (ba^* \cup \varepsilon)$$

to an NFA. Do not simplify your NFA; just apply the construction rules "without thinking".

Question 5: Use the construction given in class to convert the following DFA to a regular expression.