Problem 1

Solve Sipser exercises (2nd edition) 1.7b, 1.7e, 1.16, 1.19, 1.21.

Problem 2

Find an equivalent NFA for the following regular expression:

$R = (0(10)^* \cup (1(0 \cup 1)^*)$

Problem 3

For the following languages, give a corresponding regular expression. The languages are defined over the alphabet $\Sigma = \{a, b\}$

    a. A_1: The set of all strings that contain "a" as a substring

    b. A_2: The set of all strings that do not contain "bb" as a substring

    c. A_3: The set of all string whose length is exactly three.

Problem 4

Using the pumping lemma, prove that:

$A_4 = \{w \in \Sigma^* | \ w \ contains \ more \ a's \ than \ b's\}$
with $\Sigma = \{a, b\}$, is not a regular language.

Problem 5

Are the following languages regular? Prove your answers.

- $C_1 = \{a^p b^q a^{p=q} \in \Sigma^* \mid p \geq 0, q \geq 0\}$

- $C_2 = \{a^{\binom{n}{s}} \in \Sigma^* \mid n \geq 2\}$