Problem 1 (NFAs).

1. Give an NFA for the language \( L_1 = \{a^nba^m : n \geq 0, m \geq 0 \} \).

2. Give an NFA for the language \( T \cup L_1 \).

3. Using the procedure described in Section 2.3 of the book, convert the NFA you have constructed for language \( L_1 \), to an equivalent DFA. Illustrate all the intermediate steps of the conversion.

Problem 2 (Regular Expressions).

1. Find regular expressions for the following languages:
   
   (a) \( \{a^n b^m : n \geq 4, m \geq 5 \} \)
   
   (b) \( \{a^n b^m : n = 2k_1 + 1, m = 2k_2 + 1, \text{ and } k_1, k_2 \geq 0 \} \)
   
   (c) \( \{a^n b^m : m + n = 2k, \text{ and } m, n, k \geq 0 \} \).

2. Let \( r_1 \) and \( r_2 \) be regular expressions. Determine whether or not the following claims are true. Prove your answers.

   (a) \( L(r_1^* r_2^*) = L(r_1^*) \).
   
   (b) \( L((r_1 + r_2)^* r_1^*) = L((r_1 + r_2)^*) \).
   
   (c) \( L((r_1 r_2)^*) = L(r_1^* r_2^*) \).