1. [10 pts] Let \( L \) be the language over the alphabet \( \{a, b\} \) defined by
   
   (i) Basis: \( \lambda \in L \).
   
   (ii) Recursion: If \( u \in L \) and \( u = xyz \), then \( xaybz \in L \) and \( xbyaz \in L \).
   
   (iii) Closure: A string \( u \in L \) only if \( u \) can be obtained by a finite number of applications of the recursive step.

   Describe \( L \) (Example 2.2.3 on page 46), i.e., what are the strings in \( L \)?

2. [16 pts] Give a recursive definition of the set of strings over \( \{a, b\} \) that contains twice as many \( a \)'s as \( b \)'s. (Problem 8 on page 59).

3. [2 pts] True or False. \( \{ \lambda \} \), the language consisting of only the null string, is a language over any alphabet.

4. [2 pts] True or False. \( \emptyset \), the empty language, is a language over any alphabet.

5. Give a regular expression that represents each of the following described sets:
   
   (a) [10 pts] The set of strings over \( \{a, b\} \) in which every \( a \) is either immediately preceded or immediately followed by \( b \), e.g., \( baab, aba \), and \( b \). (Problem 28 on page 60)
   
   (b) [10 pts] The set of strings over \( \{a, b\} \) that do not contain the substring \( \text{aaa} \). (Problem 31 on page 60)