

Practice Problems for Final Exam: Recursion

- 1) Write a recursive Java method that counts the number of occurrences of the character 'a' in a string. Hint: a method signature that works is `public static int countA(String s)`. You can test your method in Eclipse. Consider using the `charAt` or `startsWith` methods in `String`.
 - a) Prove that your method is correct.
 - b) Prove that your method terminates.

- 2) Suppose you have a `List<Character>` that contains a simple mathematical expression involving positive integers with one digit (0, 1, ..., 9), plus signs, and minus signs, with no parentheses. For example, the list might look contain `[0, +, 1, -, 9, -, 5]` representing the expression `0 + 1 - 9 - 5`. Write a recursive Java method that returns true if the list contains a valid expression, and false otherwise. You can test your method in Eclipse.
 - a) Prove that your method is correct.
 - b) Prove that your method terminates.

- 3) Suppose you have an array of integers. Write a recursive Java method that returns true if the array is sorted from smallest to largest, and false otherwise. You can test your method in Eclipse.
 - a) Prove that your method is correct.
 - b) Prove that your method terminates.

- 4) Suppose you have a string made up of only the letters 'a' and 'b'. Write a recursive Java method that checks if the string was generated using the following rules:
 - a) the string begins with an 'a'
 - b) each 'a' is followed by nothing or an 'a' or "bb"
 - c) each "bb" is followed by nothing or an 'a'