

# CSCI 539 Algorithms

## Homework 1

Due: September 27, 2001

1. Describe an algorithm that uses a stack to determine whether a string is in the language  $L$ , where
  - (a)  $L = \{w \in \{A, B\}^* : w \text{ contains equal numbers of } A\text{'s and } B\text{'s}\}$
  - (b)  $L = \{w \in \{A, B\}^* : w \text{ is of form } A^n B^n \text{ for some } n \geq 0\}$

2. A *deque* is a data structure consisting of a list of items, on which the following operations are possible:

- *push*( $x$ ): Insert  $x$  on the front end of the deque.
- *pop*(): Remove the front item from the deque and return it.
- *inject*( $x$ ): Insert  $x$  on the rear end of the deque.
- *eject*(): Remove the rear item from the deque and return it.

Describe routines to support the deque that take constant number of steps for each operation. You may use array-based or pointer-based implementation.

3. Solve the following recursive function by iterating, assuming  $n = 4^k$  (i.e.,  $k = \log_4 n$ ) for some  $k$ .

$$f(n) = \begin{cases} 1 & \text{if } n = 1 \\ 3f(\frac{n}{4}) + n & \text{if } n \geq 2 \end{cases}$$

4. Consider palindromes that consist only of lowercase letters from  $\{a, b, \dots, z\}$ . Let  $C(n)$  be the number of palindromes of length  $n$ . Write a recursive definition of  $C(n)$ .