

BU CAS CS 320 (SPRING SEMESTER, 2002)
CONCEPTS OF PROGRAMMING LANGUAGES

Assignment 5

Out: Tuesday, 19 February 2002

Due: Friday, 1 March 2002

Total: 250 points

Exercise 1 (50 points) Please do Exercise 2.69 in the textbook on page 168.

Exercise 2 (50 points) Let us use 'E for the empty binary tree and ('B x lt rt) for a nonempty binary tree such that the entry stored in the root node is x and its left and right subtrees are lt and rt, respectively. Please implement a procedure list->braintree that takes a list l of integers and generates an ordered Braun tree t where the stored entries consist of all the integers in l.

Exercise 3 (100 points) Given a sequence s consisting of n elements a_1, \dots, a_n , we represent s as follows.

- If $n = 0$, that is, s is empty, we use nil to represent s;
- If $n = 2k$ for some $k > 0$, we use ('even xs) to represent s, where xs represents the following sequence of pairs;

$$(a_1 a_2), \dots, (a_{n-1} a_n)$$

- If $n = 2k + 1$ for some $k \geq 0$, we use ('odd x xs) to represent s, where x represents a_1 and xs represents the following sequence of pairs.

$$(a_2 a_3), \dots, (a_{n-1} a_n)$$

We use the name random-access list for such a representation of l. Please implement the following operations on random-access lists. All the implementations should be of $O(\log n)$ -time complexity in order to receive full credit.

1. (20 points) Given an element x and a random-access list xs, (racons x xs) generates a random-access list whose head and tail are x and xs, respectively.
2. (20 points) Given a nonempty random-access list xs, (rauncons xs) return a pair consisting of the head and tail of xs.
3. (30 points) Given a number n and a random-access list xs, (ralookup n xs) returns the nth element (counting starts with 0) in xs or issues an error if the length of the random-access list is less than or equal to n.
4. (30 points) Given a number n and a random-access list xs, (raupdate n x xs) updates the nth element (counting starts with 0) in xs with x or issues an error if the length of the random-access list is less than or equal to n.

Exercise 4 (50 points) Please do Exercise 2.85 in the textbook on page 201.