

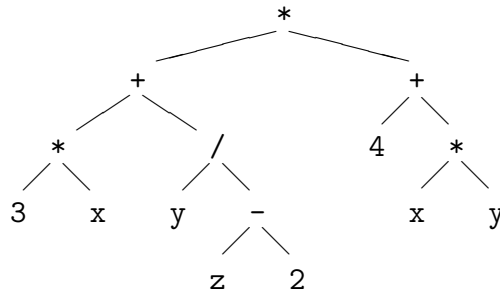
NAME : *answers***Open book, open notes, but please do not ask questions.****Write all answers on these sheets.**

question	1	2	3	4	5	total
points						
maximum	20	20	20	20	20	100

1. Use a tree to convert the expression $(3*x+y/(z-2))*(4+x*y)$ into postfix form.

Answer:

The expression tree:

The postfix form: $3\ x\ *\ y\ z\ 2\ -\ /\ +\ 4\ x\ y\ *\ +\ *$

2. The Lucas numbers L_n are defined by

$$L_1 = 1, \quad L_2 = 3, \quad L_n = L_{n-1} + L_{n-2}, \quad \text{for } n > 2.$$

(a) Write a recursive C++ function to calculate L_n for any positive integer n .

Answer:

```
int L ( int n )
{
    if(n == 1)
        return 1;
    else if(n == 2)
        return 3;
    else
        return L(n-1) + L(n-2);
}
```

(b) Make a more efficient version of your function via memoization, by storing the results of previous function calls in a vector, maintained by the function. The vector is initialized to hold 50 elements when calling the function with $n = 0$.

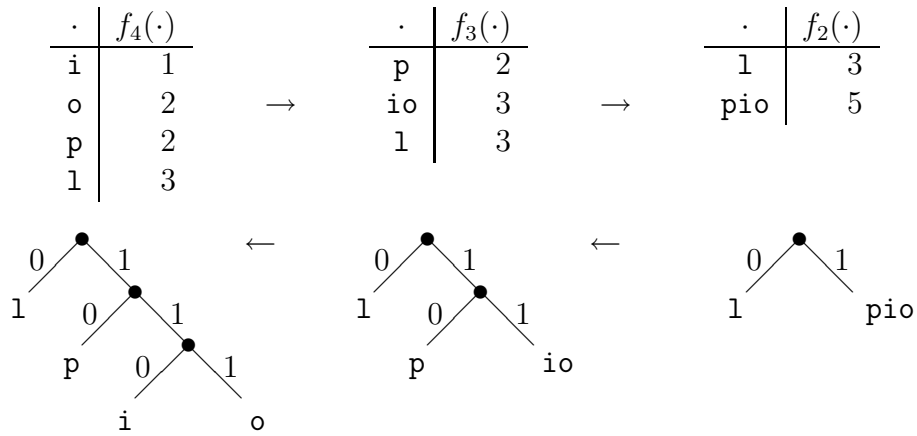
Answer:

```
#include<vector>
int L ( int n )
{
    static vector<int> v;
    if(n == 0)
    {
        v.reserve(50);
        for(int i=0; i<50; i++) v[i] = -1;
        return 0;
    }
    else
    {
        if(v[n] != -1)
            return v[n];
        else
        {
            int result;
            if(n == 1)
                result = 1;
            else if(n == 2)
                result = 3;
            else
                result = L(n-1) + L(n-2);
            v[n] = result;
            return result;
        }
    }
}
```

3. Make a Huffman code for the message "lollipop".

Given the frequency table of the characters occurring in the message, draw all intermediate stages in the creation of the Huffman tree.

Answer:



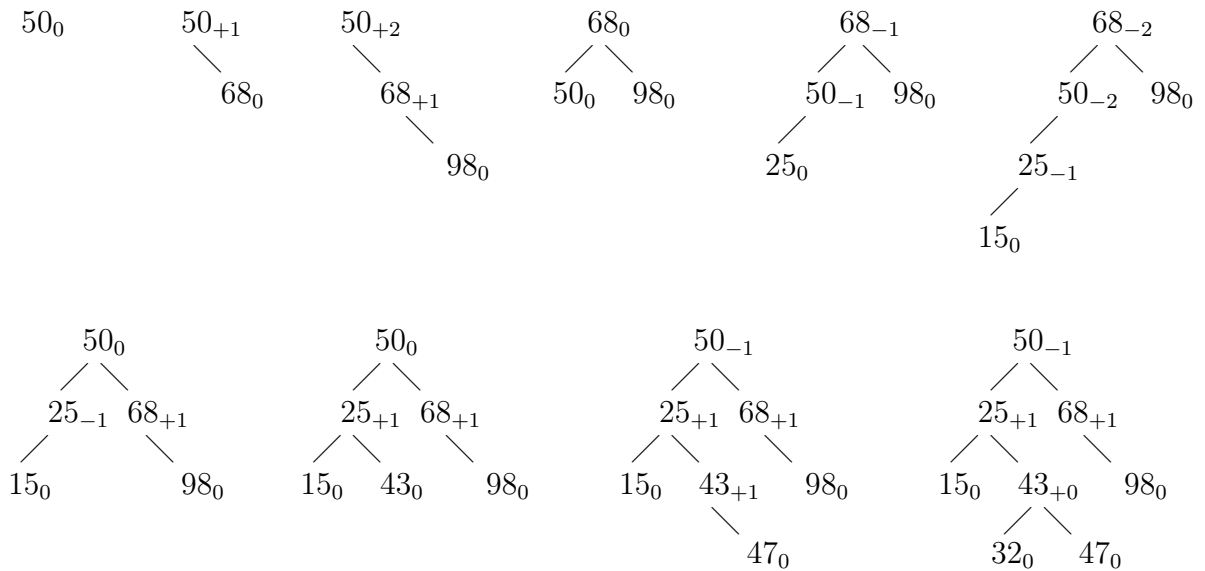
The Huffman code for the message "lollipop" is 0111001101011110.

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4. Insert the numbers 50 68 98 25 15 43 47 32 into an AVL tree.

Draw all intermediate trees.

Answer:



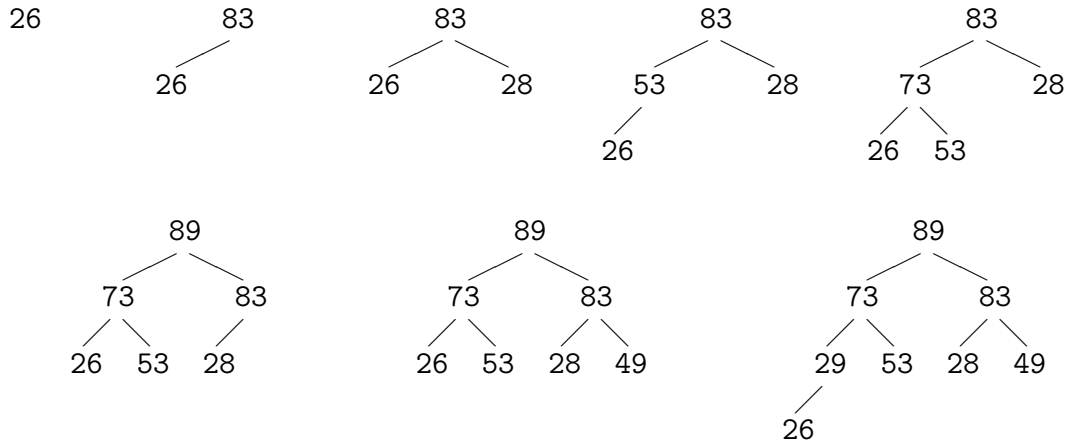
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5. Consider the sequence 26 83 28 53 73 89 49 29.

Apply heap sort to order the sequence in increasing order.

Show the evolution of the heap when inserting and removing.

Answer: The evolution of the heap inserting 26 83 28 53 73 89 49 29 is below:



Then we insert the top of the heap to the front of a sequence S , the evolution of the heap is below:

