

Thread Safe Balanced And Unbalanced Binary Search Tree

Introduction

The main objective of this project is the implementation of multithreading using Pthread library in cpp. Multiple threads are created. To avoid race condition synchronisation is done among multiple threads by using Pthread_lock and Pthread_unlock functions. Each thread first tries to acquire lock (entry section) before entering in the critical section and after executing the critical section it releases the lock(exit section).

Content

The following files are included in our project :

1.Binarytree.cpp : This file contains implementation of UNBALANCED binary search tree. Whenever a thread tries to access the tree by using any of its function ,it first tries to get the lock and then enter the function.If it does not gets the lock it waits until other thread exits the critical section and releases the lock.

2.Reader_writer_unbalanced_bin_tree.cpp: This file is similar to the first one except the tree is implemented as a reader writer problem.Insert and delete functions correspond to writers whereas search and display corresponds to readers.An additional mutex for writer and a variable for readcount is introduced.

3.redblack.cpp:This file implements the BALANCED binary search tree using red-black trees.

To keep the tree balanced functions like left rotate, right_rotate ,insert_fix ,delete_fix , etc have been introduced.

4.reader_writer_rb_tree.cpp:This file is similar to third one except contains reader writer implementation.

5.Modified_btree.cpp:Unlike others here the locking occurs only in a particular subtree.Files 1,2,3,4 all have a full mutex which locks the complete tree when a thread accesses it.

However here we just lock the subtree of the node and unlock the parent at each iteration.So this process is faster as compared to other process as only a part of tree is blocked not the whole tree.

How To Run these Files :

1. Install the Pthreads library in your OS system. For ubuntu run the following command in terminal: `apt-get install libpthread-stubs0-dev`
2. Open the terminal at your file location .
3. Compile file using following command : `g++ -pthread filename.cpp`
4. Run the file : `./a.out`
5. Follow the instructions that now appear on your terminal to give the desired input.