CS610 PROGRAMMING FOR PERFORMANCE
Assignment 5

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Note

- Problem 2, I tested on my machine as well as KD lab system. KD lab CSE4 machine was used to test.
- I didn't included the bin files that were asked to use. As the zip file size was becoming too large.

Ans: **Problem - 1**

Ans: **Problem - 2**

Commands Used

```
>>> g++ -std=c++17 -O3 problem2.cpp -o problem2.out
>>> ./problem2.out -ops=$((10**6)) -rns=100 -add=0 -rem=0
```

Note: The stack_out print function call is commented on at the end of the program. To print the content of the stack, comment out the function call.

Result Analysis

I tested the code with threads 1, 8, and 16 for all 3 number operations 1e5,1e6,1e7

The snapshots of some output that I executed on my machine is down below at the end.
To further analyze the execution performance, **I used the perf tool to record some events.** I searched online for data race tools and found this. The output of the record of one execution is present in the report.txt file in the folder.

Output snapshots

```
(base) rubbish@rubbish:~/assign5/prob2/problem2$ ./a.out -ops=$((10**6)) -rns=100 -add=0 -rem=0
NUM OPS: 1000000 ADD: 0 REM: 0 FIND: 1000000 THREADS LAUNCHED: 1
Unable to read the file /home/rubbish/assign5/prob2/problem2/random_keys_insert.bin: Success
Unable to read the file /home/rubbish/assign5/prob2/problem2/random_values_insert.bin: Success
Unable to read the file /home/rubbish/assign5/prob2/problem2/random_keys_delete.bin: Success
Time taken by insert kernel (ms): 0
Time taken by delete kernel (ms): 0
Time taken by search kernel (ms): 0

This below part is extended part of problem 1 for concurrent stacks
Total time for 1000000 operations with 1 threads: 66507 ms
Total push operations: 839937
Total pop operations: 160063
```

The above image is of 1e6 and 1 thread. 1e7 was taking a lot of time, so I stopped in between and calculated for 1e6 only.

```
(base) rubbish@rubbish:~/assign5/prob2/problem2$ ./a.out -ops=$((10**7)) -rns=100 -add=0 -rem=0
NUM OPS: 10000000 ADD: 0 REM: 0 FIND: 10000000 THREADS LAUNCHED: 8
Unable to read the file /home/rubbish/assign5/prob2/problem2/random_keys_insert.bin: Success
Unable to read the file /home/rubbish/assign5/prob2/problem2/random_values_insert.bin: Success
Unable to read the file /home/rubbish/assign5/prob2/problem2/random_keys_delete.bin: Success
Time taken by insert kernel (ms): 0
Time taken by delete kernel (ms): 0
Time taken by search kernel (ms): 0

This below part is extended part of problem 1 for concurrent stacks
Total time for 10000000 operations with 8 threads: 85266 ms
Total push operations: 6276320
Total pop operations: 3684967
```

The above image is of 1e7 and 8 thread. Since 1e7 was a number of operations, that's why the time is greater than 1 thread 1e6 operations.

```
(base) rubbish@rubbish:~/assign5/prob2/problem2$ ./a.out -ops=$((10**7)) -rns=100 -add=0 -rem=0
NUM OPS: 10000000 ADD: 0 REM: 0 FIND: 10000000 THREADS LAUNCHED: 16
Unable to read the file /home/rubbish/assign5/prob2/problem2/random_keys_insert.bin: Success
Unable to read the file /home/rubbish/assign5/prob2/problem2/random_values_insert.bin: Success
Unable to read the file /home/rubbish/assign5/prob2/problem2/random_keys_delete.bin: Success
Time taken by insert kernel (ms): 0
Time taken by delete kernel (ms): 0
Time taken by search kernel (ms): 0

This below part is extended part of problem 1 for concurrent stacks
Total time for 10000000 operations with 16 threads: 39108 ms
Total push operations: 6066218
Total pop operations: 3914462
```

The above image is of 1e7 and 16 thread. We can see the 16-thread time is less than 8 threads for the same number of operations

Perf output report is present in the folder. Commands used for perf analysis.

perf record ./problem2.out -ops=$((10**6)) -rns=100 -add=0 -rem=0
perf report >> report.txt

Output snapshots of KD system

```
NUM OPS: 1000000 ADD: 1000000 REM: 0 FIND: 0 THREADS LAUNCHED: 1
Unable to read the file /users/mtech/tanuja24/sahil/random_keys_delete.bin: Success
Unable to read the file /users/mtech/tanuja24/sahil/random_keys_search.bin: Success
Time taken by insert kernel (ms): 0
Time taken by delete kernel (ms): 0
Time taken by search kernel (ms): 0

This below part is extended part of problem 1 for concurrent stacks
Total time for 1000000 operations with 1 threads: 51107 ms
Total push operations: 839400
Total pop operations: 160600
```

1 Thread and 1e6 operations. 1e7 was running for long time, so stopped it.

```
NUM OPS: 10000000 ADD: 10000000 REM: 0 FIND: 0 THREADS LAUNCHED: 8
Unable to read the file /users/mtech/tanuja24/sahil/random_keys_delete.bin: Success
Unable to read the file /users/mtech/tanuja24/sahil/random_keys_search.bin: Success
Time taken by insert kernel (ms): 0
Time taken by delete kernel (ms): 0
Time taken by search kernel (ms): 0

This below part is extended part of problem 1 for concurrent stacks
Total time for 10000000 operations with 8 threads: 65782 ms
Total push operations: 6260976
Total pop operations: 3683500
```

8 Thread and 1e7 operations.

```
NUM OPS: 10000000 ADD: 10000000 REM: 0 FIND: 0 THREADS LAUNCHED: 16
Unable to read the file /users/mtech/tanuja24/sahil/random_keys_delete.bin: Success
Unable to read the file /users/mtech/tanuja24/sahil/random_keys_search.bin: Success
Time taken by insert kernel (ms): 0
Time taken by delete kernel (ms): 0
Time taken by search kernel (ms): 0

This below part is extended part of problem 1 for concurrent stacks
Total time for 10000000 operations with 16 threads: 28789 ms
Total push operations: 6054867
Total pop operations: 3889852
```

16 Thread and 1e7 operations.