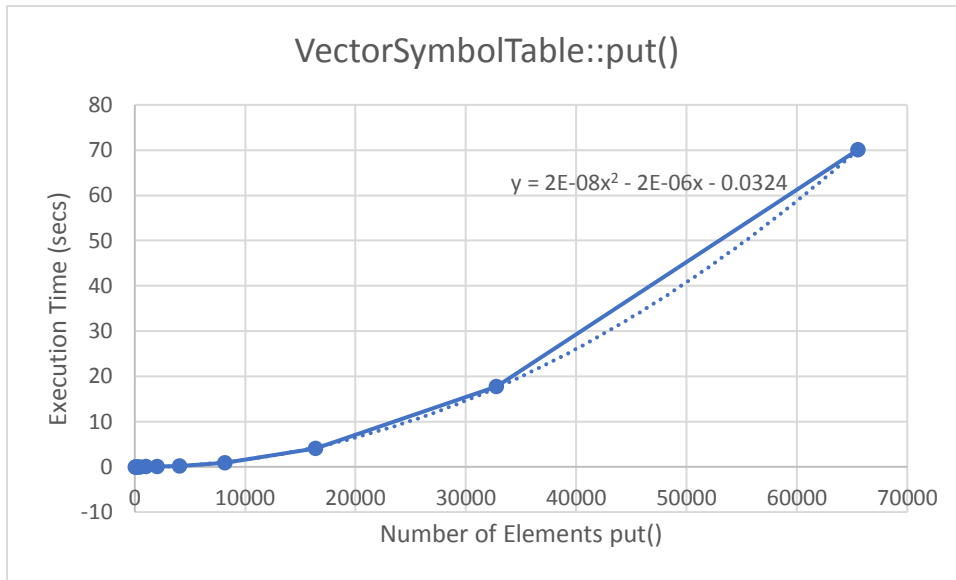## Proof Of Execution


```
C:\Users\John Markey\Documents\_School\_Sophomore Year\Spring\CS210\...
Linked Symbol Table
        Test constructor...
        Test put...
        Test get...
        Test remove...
        Test min...
        Test max...
        Test floor...
        Test ceiling...
        Test rank...
        Test select...
        Test deleteMin()...
        Test deleteMax()...
        Test size(int, int)...
        Test selectKeys()...
        Test allKeys()...
Linked Symbol Table Error Report:
        Test allKeys: 0 errors.
        Test ceiling: 0 errors.
        Test constructor: 0 errors.
        Test deleteMax: 0 errors.
        Test deleteMin: 0 errors.
        Test floor: 0 errors.
        Test get: 0 errors.
        Test keys: 0 errors.
        Test max: 0 errors.
        Test min: 0 errors.
        Test put: 0 errors.
        Test rank: 0 errors.
        Test remove: 0 errors.
        Test select: 0 errors.
        Test size: 0 errors.
        Total number of checks: 790
        Total number of errors: 0
Timing Linked Symbol Table...
        Time put... 64 128 256 512 1024 2048 4096 8192 16384 32768 65536
        Time remove... 64 128 256 512 1024 2048 4096 8192 16384 32768 65536
Linked Symbol Table Timing Report:
        Operation: |put 64|      0; 0s.
        Operation: |put 128|     0; 0s.
        Operation: |put 256|     1; 0.001s.
        Operation: |put 512|     4; 0.004s.
        Operation: |put 1024|    13; 0.013s.
        Operation: |put 2048|    53; 0.053s.
        Operation: |put 4096|    238; 0.238s.
        Operation: |put 8192|    896; 0.896s.
        Operation: |put 16384|   4134; 4.134s.
        Operation: |put 32768|   17697; 17.697s.
        Operation: |put 65536|   70107; 70.107s.
        Operation: |remove 64|   0; 0s.
```

```
C:\Users\John Markey\Documents\_School\_Sophomore Year\Spring\CS210\...
        Operation: |remove 64|   0; 0s.
        Operation: |remove 128|  0; 0s.
        Operation: |remove 256|  0; 0s.
        Operation: |remove 512|  1; 0.001s.
        Operation: |remove 1024|       2; 0.002s.
        Operation: |remove 2048|      10; 0.01s.
        Operation: |remove 4096|      39; 0.039s.
        Operation: |remove 8192|     157; 0.157s.
        Operation: |remove 16384|    638; 0.638s.
        Operation: |remove 32768|   2602; 2.602s.
        Operation: |remove 65536|  10607; 10.607s.
        Sum of operation times: 107.199s.
        Total time: 204.388s.
Press any key to continue . . . _
```

Verification of Proper Memory Management


```cpp
        {
            clear();
        }

        //puts key-value pair into table
        void put(const Key& key, const Value& val = Value{})
        {
            if(empty())
                _pairs.push_back(NodePair(key, val));

            else
            {
                _pairs.push_back(NodePair(key, val));
                //sorts deque upon entering using insertion sort
                for (int i = 0; i < size(); i++)
                {
                    int j = i;

                    while (j > 0 && keyLessThan(_pairs.at(j)._key, _pairs.at(j - 1)._key))
                    {
                        NodePair temp = _pairs[j];
                        _pairs[j] = _pairs[j - 1];
                        _pairs[j - 1] = temp;
                        j--;
                    }
                }
            }
```

```
Output
Show output from: Debug
    'Project3.exe' (Win32): Loaded 'C:\Windows\System32\api-ms-win-crt-environment-l1-1-0.dll'. Symbols loaded.
    'Project3.exe' (Win32): Loaded 'C:\Windows\System32\ucrtbase.dll'. Symbols loaded.
    Application "\??\C:\windows\system32\cmd.exe" found in cache
    The program '[6372] Project3.exe' has exited with code 0 (0x0).
```

VectorSymbolTable::put() Timing

VectorSymbolTable::put()

Execution Time (secs) vs Number of Elements put()

$$y = 2E\text{-}08x^2 - 2E\text{-}06x - 0.0324$$

VectorSymbolTable::remove() Timing

VectorSymbolTable::remove()

Execution Time (secs) vs Number of Elements remove()

$$y = 3E\text{-}09x^2 - 3E\text{-}06x + 0.0034$$