Devin Hardy

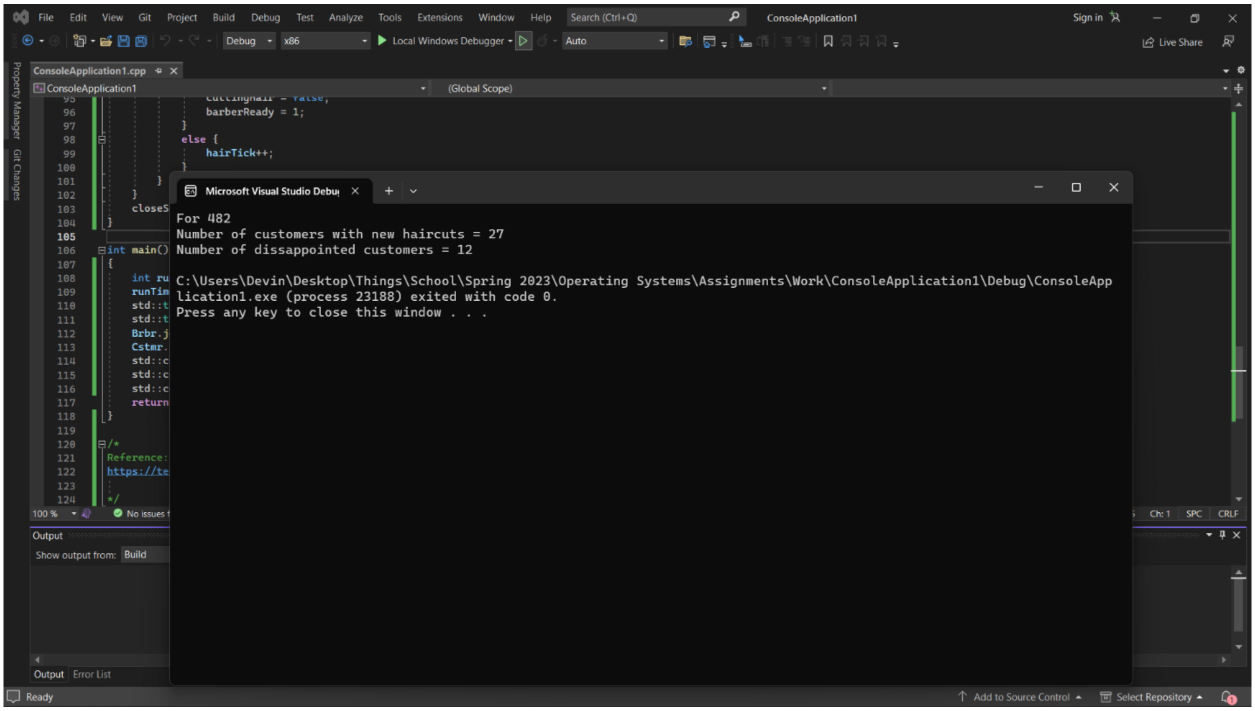
CS 415

ASG 4

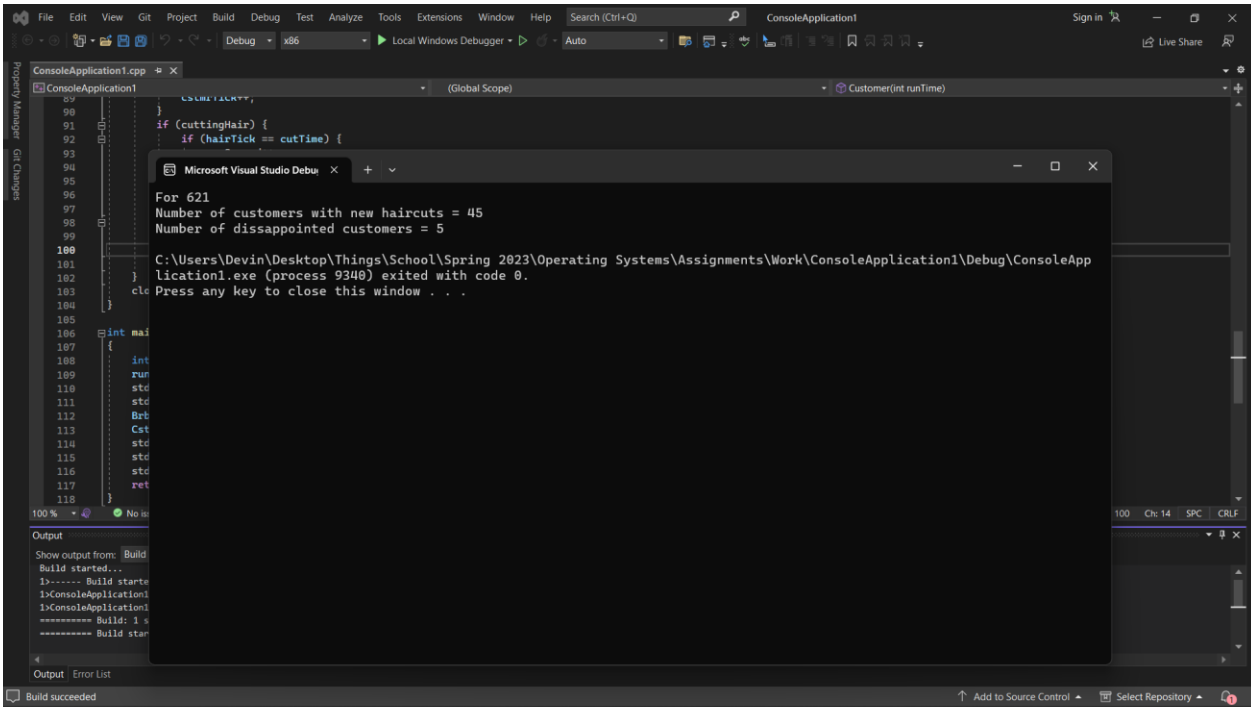
Code:

```
// Devin Hardy
// Asg 4
// Barber shop problem with 2 threads, 2 mutexes, and a condition variable

#include <iostream>
#include <random>
#include <thread>
#include <mutex>

// Synchron variables
int barberReady = 1; // IF barber is ready
int waitChairsCanBeAccessed = 0; // If customers can wait
bool cuttingHair = false;
bool closeShop = false;
int readyCustomers = 0; // # customers waiting
int NumChairs = 4; // max chairs to wait in
// global vars
int cutTime = 0;
int numServed = 0;
int numSad = 0; // Number of sad customers
// no more customers


//Random number generator
// pass in first the min number and second the max number
// for the possible random number to be between
int RandNum(int first, int second)
{
    std::random_device dev;
    std::mt19937 rng(dev());
    std::uniform_int_distribution<std::mt19937::result_type> dist6(first, second);
// distribution in range [1, 6]

    return (dist6(rng));
}

// Barber Algorithm
void Barber(int runTime) {
    while(!closeShop) {
        if (barberReady) {
            // if zero sleep
            if (readyCustomers == 0) {
                barberReady = 0;
            }
            // if not zero get customer and cut hair
            else {
                readyCustomers--;
                barberReady = 0;
                cutTime = RandNum(3, 12);
                cuttingHair = true;
            }
            waitChairsCanBeAccessed = 1;
        }
    }
}

// Customer Algoithm
void Customer(int runTime) {
    int getCustomer = 0;
    int cstmrTick = 0;
    int hairTick = 0;
    int cutTime = 0;
    bool addCustomer = false;
    for (int i = 0; i < runTime; i++) {
        if (addCustomer) {
            // any seats remaining?
            if (readyCustomers < NumChairs)
            {
                readyCustomers++;
                // if barber is not cutting hair
                if (cuttingHair == false) {
                    // and if barber is asleep then awaken them
                    if (barberReady == 0 && readyCustomers != 0) {
                        barberReady = 1;
                    }
                }
            }
            else // No seats? I'm sorry
            {
                numSad++;
            }
            addCustomer = false;
        }
        if (cstmrTick == getCustomer) {
            addCustomer = true;
            getCustomer = RandNum(3, 15);
            cstmrTick = 0;
        }
        else {
            cstmrTick++;
        }
        if (cuttingHair) {
            if (hairTick == cutTime) {
                numServed++;
                hairTick = 0;
                cuttingHair = false;
                barberReady = 1;
            }
            else {
                hairTick++;
            }
        }
    }
    closeShop = true;
}

int main()
{
    int runTime = 0;
    runTime = RandNum(100, 1000);
    std::thread Brbr(Barber, runTime);
    std::thread Cstmr(Customer, runTime);
    Brbr.join();
    Cstmr.join();
    std::cout << "For " << runTime << std::endl;
    std::cout << "Number of customers with new haircuts = " << numServed << 
std::endl;
    std::cout << "Number of dissappointed customers = " << numSad << std::endl;
    return 0;
}

/*
Reference:
https://techtipqa.wordpress.com/2015/08/21/tech-qa-9-the-sleeping-barber-problem/

*/
```

Output:



```
For 482
Number of customers with new haircuts = 27
Number of dissappointed customers = 12

C:\Users\Devin\Desktop\Things\School\Spring 2023\Operating Systems\Assignments\Work\ConsoleApplication1\Debug\ConsoleApp
lication1.exe (process 23188) exited with code 0.
Press any key to close this window . . .
```



```
            }
            if (cuttingHair) {
                if (hairTick == cutTime) {
```

```
For 621
Number of customers with new haircuts = 45
Number of dissappointed customers = 5

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lication1.exe (process 9340) exited with code 0.
Press any key to close this window . . .
```
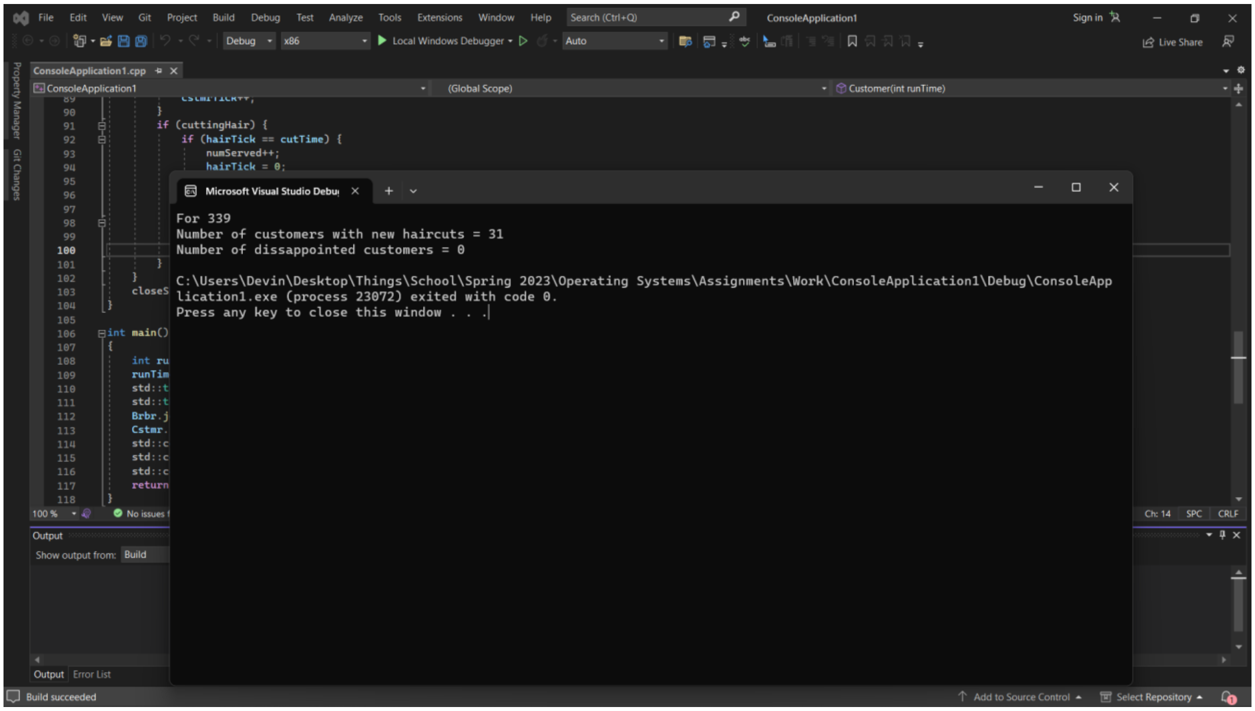

```
Build started...
1>------ Build starte
1>ConsoleApplication1
1>ConsoleApplication1
========== Build: 1 s
========== Build star
```



```
            }
            if (cuttingHair) {
                if (hairTick == cutTime) {
                    numServed++;
                    hairTick = 0;
```

```
For 339
Number of customers with new haircuts = 31
Number of dissappointed customers = 0

C:\Users\Devin\Desktop\Things\School\Spring 2023\Operating Systems\Assignments\Work\ConsoleApplication1\Debug\ConsoleApp
lication1.exe (process 23072) exited with code 0.
Press any key to close this window . . .
```