Assignment 3 – INFO 6205(PSA)

Eswara Sai Nath Adusumalli

NUID : 001565578

Task:

Step 1: (a) Implement height-weighted Quick Union with Path Compression.

(b) Check that the unit tests for this class all work.

Step 2:
Using your implementation of UF_HWQUPC, develop a UF ("union-find") client that takes an integer value n from the command line to determine the number of "sites."

Step 3:
Determine the relationship between the number of objects (*n*) and the number of pairs (*m*) generated to accomplish this.

Relation:

After performing series of experiments for various values of n, I can conclude that number of random pairs (m) is equal to ½ nlogn where 'n' is the number of objects.

$$m \approx \frac{1}{2} n \ln n$$

Findings:

Number of random pairs generated for n = 1000 is: 3699

½ n ln n= 3453

Number of random pairs generated for n = 2000 is: 7422

½ n ln n = 7600

Number of random pairs generated for n = 3000 is: 12141

½ n ln n = 12009

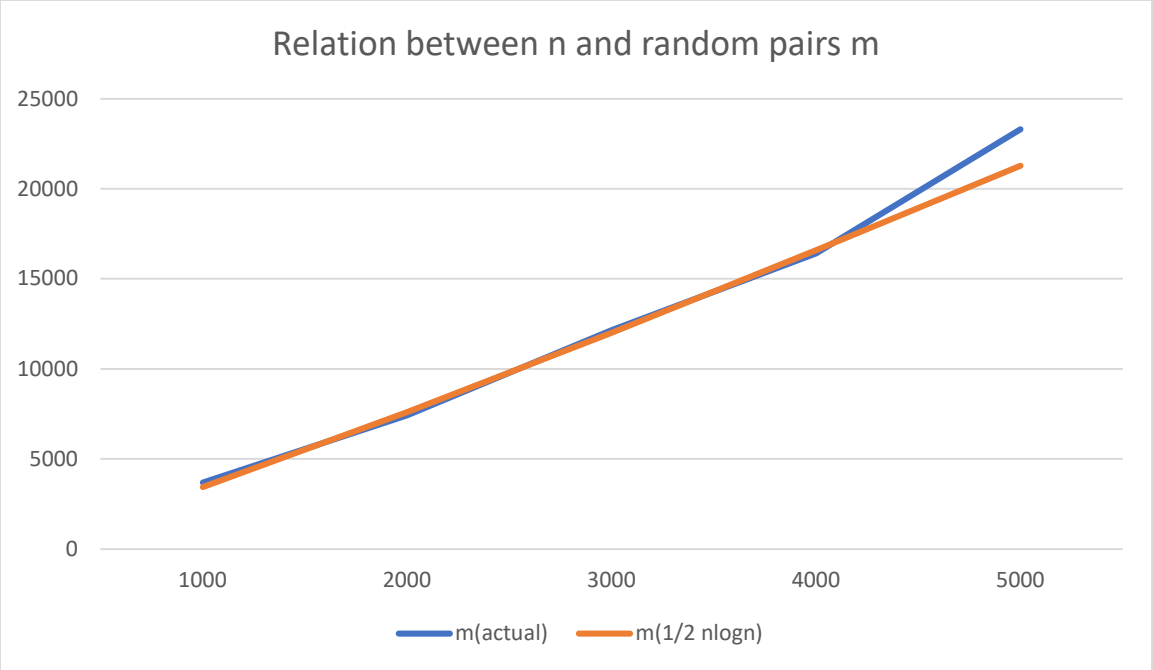
Number of random pairs generated for n = 4000 is: 16416

½ n ln n = 16588

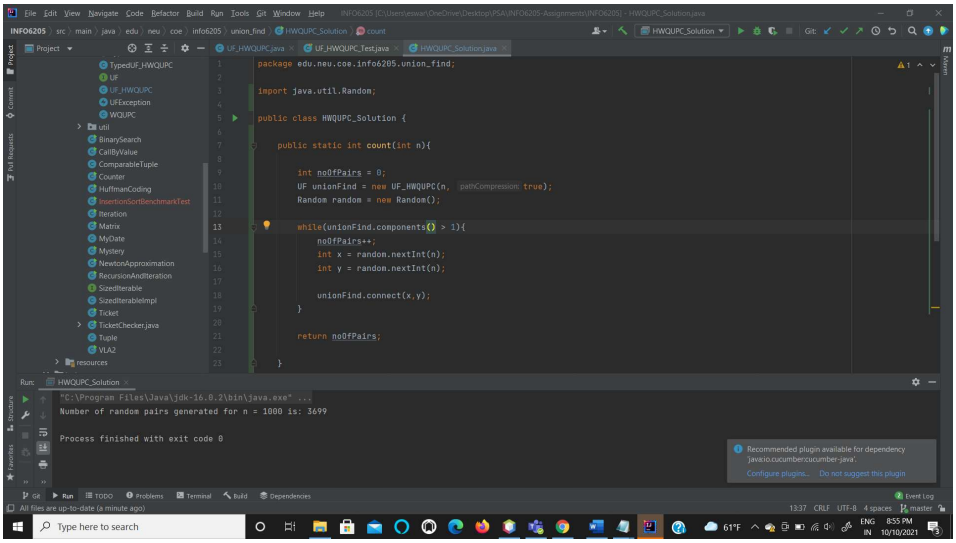
Number of random pairs generated for n = 5000 is: 20989

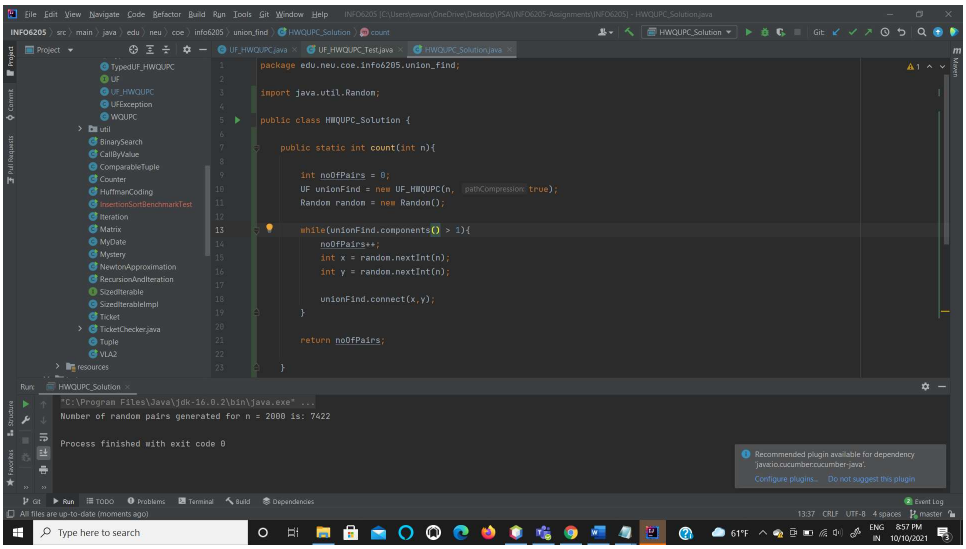
½ n ln n = 21292

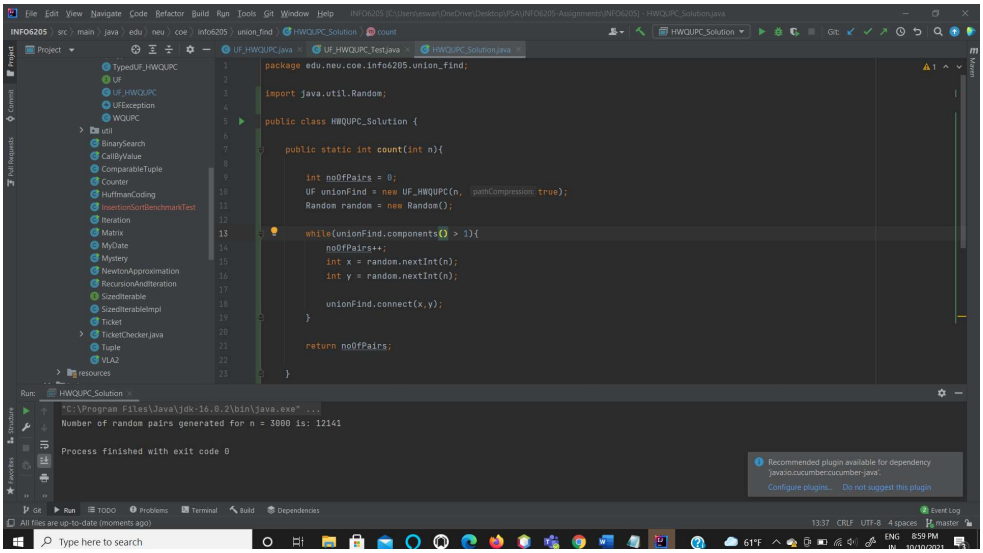
n	m(actual)	m = ½ n ln n(Expected)
1000	3699	3453
2000	7422	7600
3000	12141	12009
4000	16416	16588
5000	20989	21292

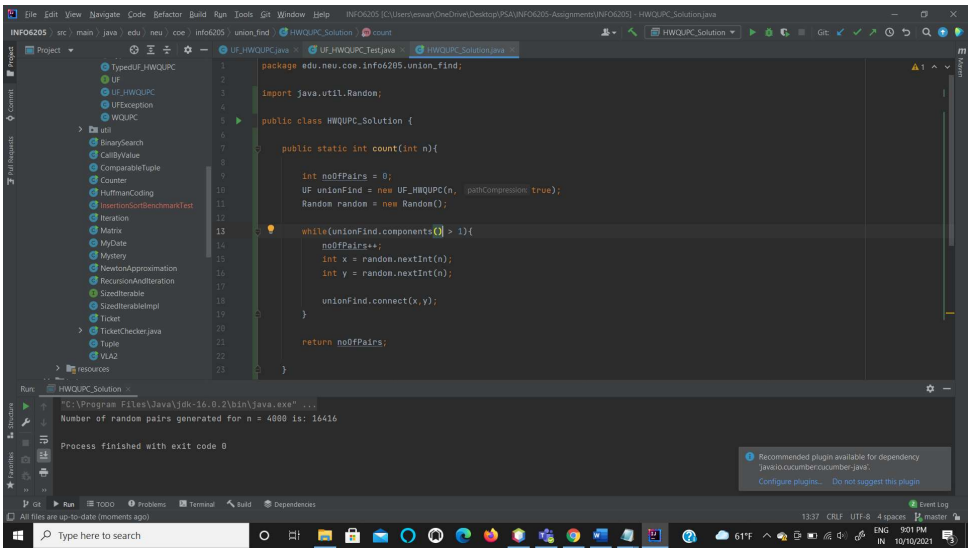


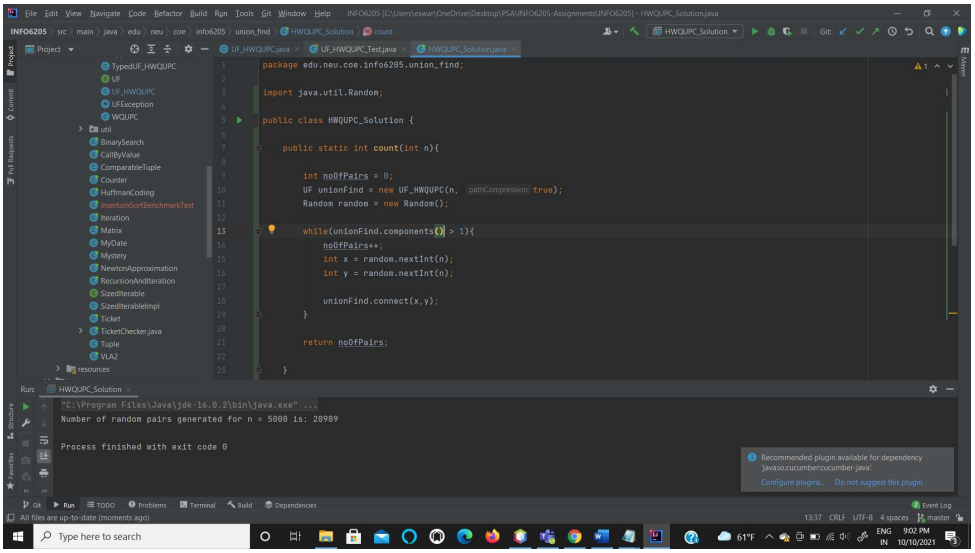
Output Screenshots:




package edu.neu.coe.info6205.union_find;
import java.util.Random;
public class HWQUPC_Solution {
public static int count(int n){
int noOfPairs = 0;
UF unionFind = new UF_HWQUPC(n, pathCompression: true);
Random random = new Random();
while(unionFind.components() > 1){
noOfPairs++;
int x = random.nextInt(n);
int y = random.nextInt(n);
unionFind.connect(x,y);
}
return noOfPairs;
}
"C:\Program Files\Java\jdk-16.0.2\bin\java.exe" ...
Number of random pairs generated for n = 2000 is: 7422
Process finished with exit code 0
Recommended plugin available for dependency 'javaio.cucumber:cucumber-java':
Configure plugins... Do not suggest this plugin
Type here to search


package edu.neu.coe.info6205.union_find;
import java.util.Random;
public class HWQUPC_Solution {
public static int count(int n){
int noOfPairs = 0;
UF_HWQUPC unionFind = new UF_HWQUPC(n, pathCompression: true);
Random random = new Random();
while(unionFind.components() > 1){
noOfPairs++;
int x = random.nextInt(n);
int y = random.nextInt(n);
unionFind.connect(x,y);
}
return noOfPairs;
}
"C:\Program Files\Java\jdk-16.0.2\bin\java.exe" ...
Number of random pairs generated for n = 3000 is: 12141
Process finished with exit code 0
Recommended plugin available for dependency 'javaio.cucumber:cucumber-java':
Configure plugins... Do not suggest this plugin
Type here to search





Unit test screenshot: