

Program Structures & Algorithms

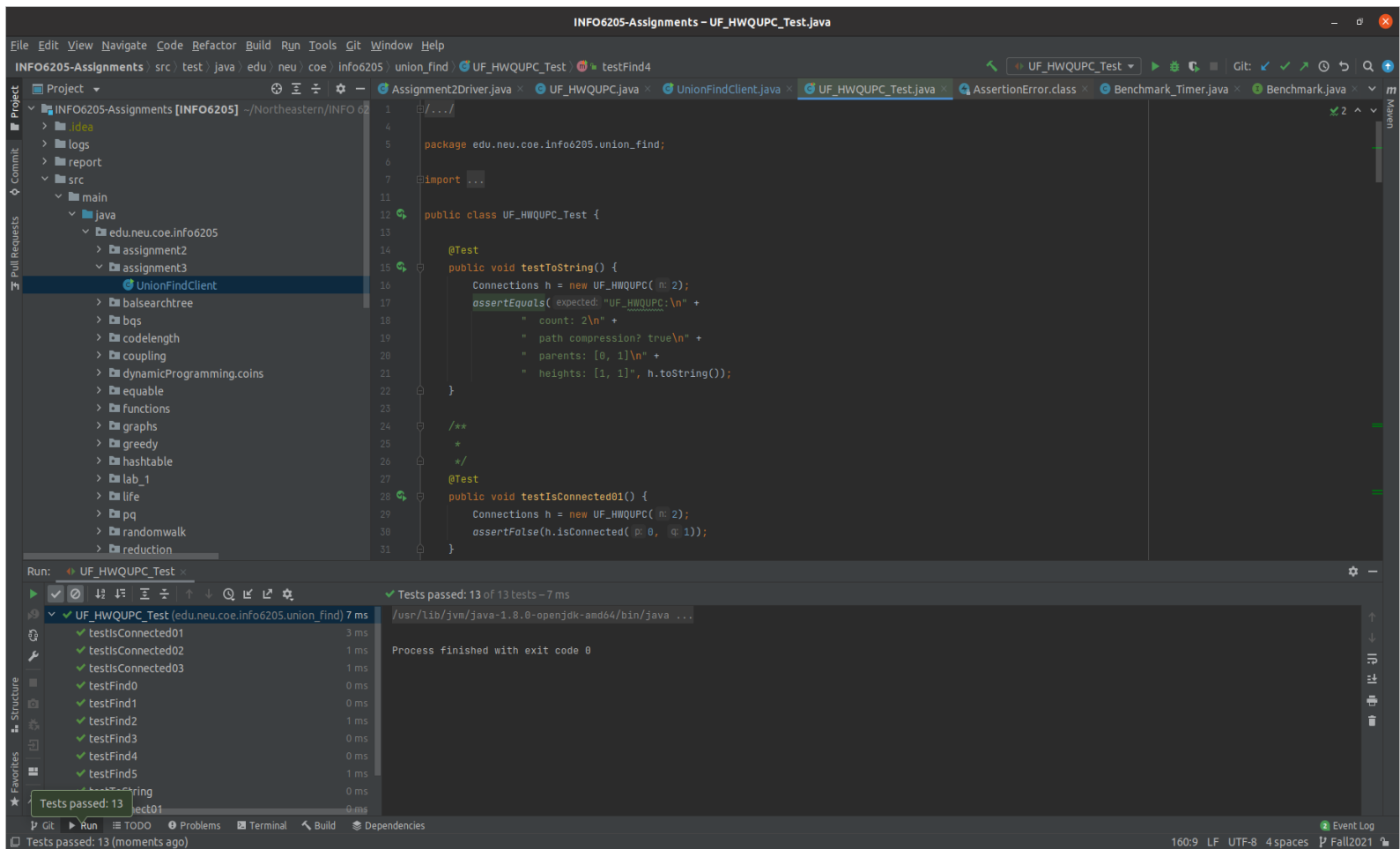
Fall 2021

Assignment No. 3

Tasks:

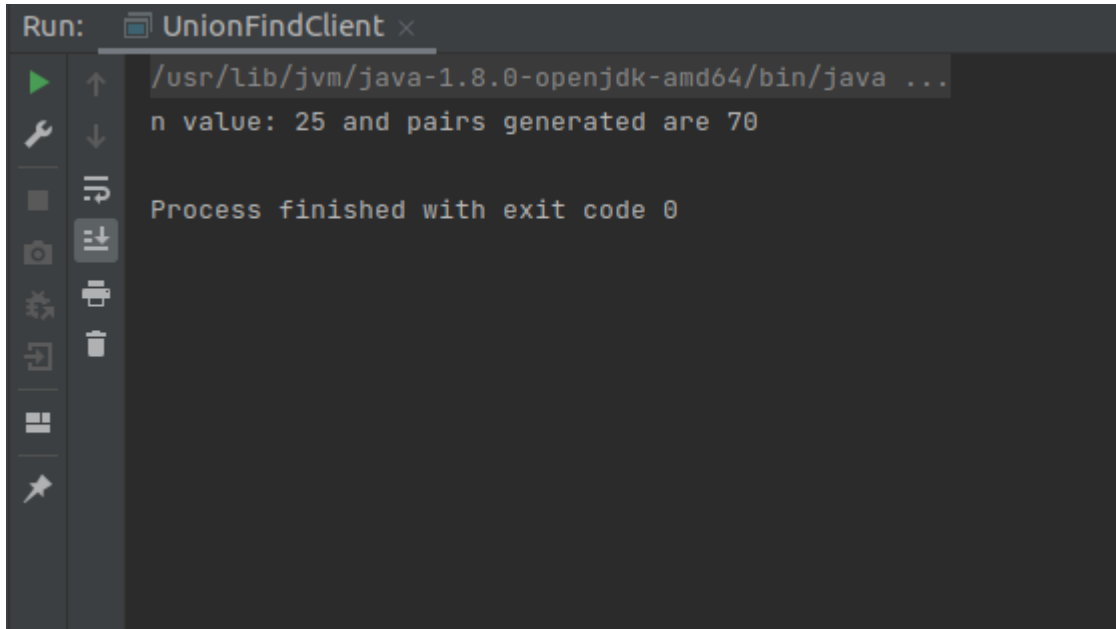
1. Implemented find(int p) method in UF_HWQUPC.java
2. Implemented mergeComponents(int i, int j) in UF_HWQUPC.java
3. Implemented doPathCompression(int i) in UF_HWQUPC.java
4. Ran test cases from UF_HWQUPC_Test.java (all passed)
5. Coded UnionFindClient.java in **edu.neu.coe.info6205.assignment3** package to run the experiments
6. Implemented a main() method to run the experiments for defined values of n
7. Implemented count() method calculate and return the pairs generated to reduce the components to 1
8. Ran the experiments for multiple values of “n” and 3 runs for each value of “n”
9. Tabulated the readings in excel and generated a graph to observe the trend

Tests passing screenshot:



Outputs:

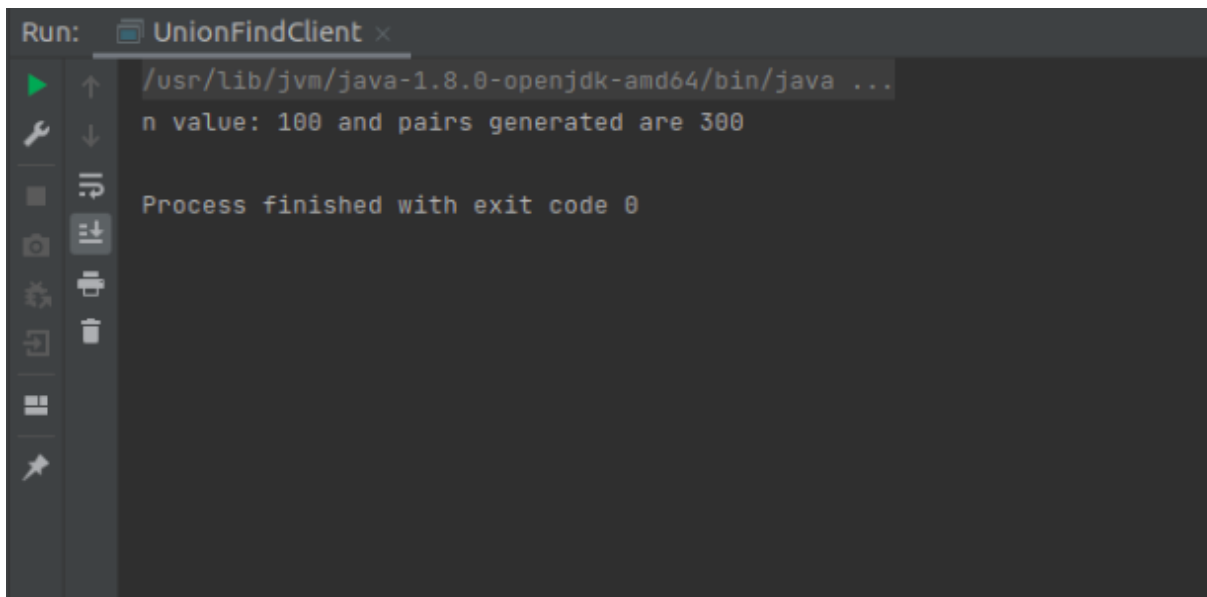
For $n = 25$

A screenshot of an IDE's Run console window. The title bar says "Run: UnionFindClient x". The console output shows the Java command path, the input value, the generated pairs, and the exit code.

```
Run: UnionFindClient x
/usr/lib/jvm/java-1.8.0-openjdk-amd64/bin/java ...
n value: 25 and pairs generated are 70

Process finished with exit code 0
```

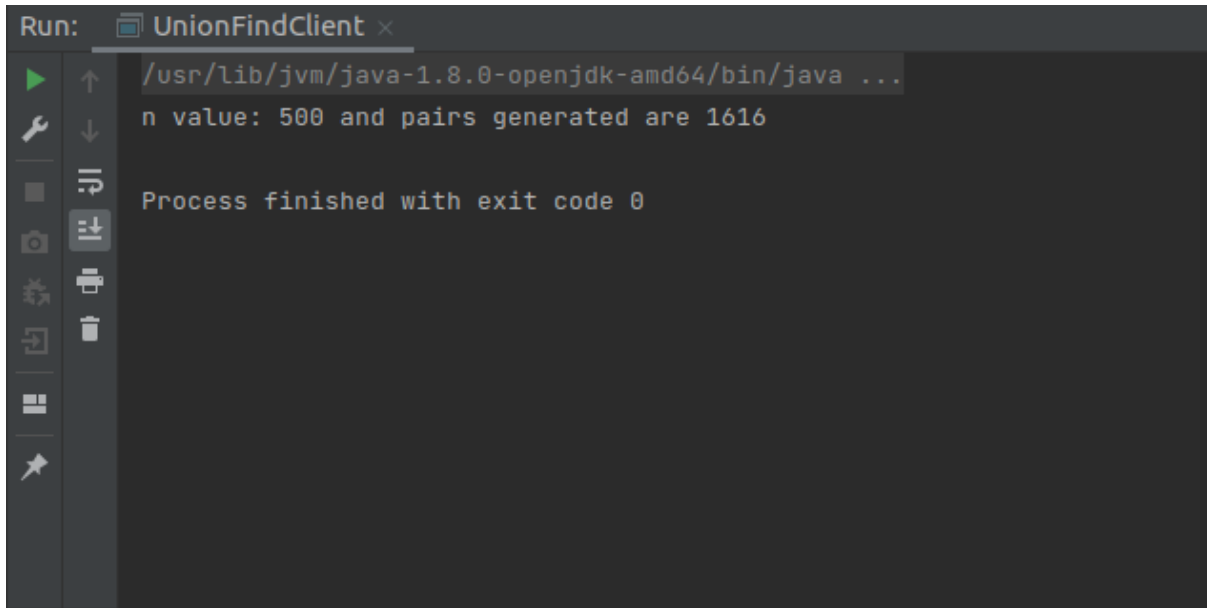
For $n = 100$

A screenshot of an IDE's Run console window. The title bar says "Run: UnionFindClient x". The console output shows the Java command path, the input value, the generated pairs, and the exit code.

```
Run: UnionFindClient x
/usr/lib/jvm/java-1.8.0-openjdk-amd64/bin/java ...
n value: 100 and pairs generated are 300

Process finished with exit code 0
```

For n = 500

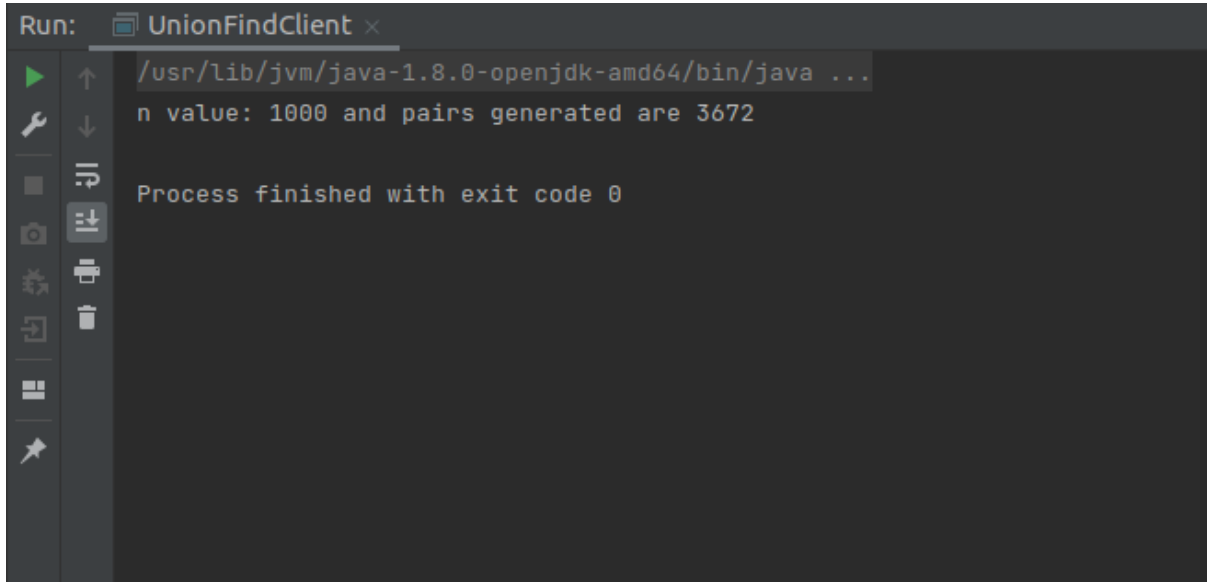


The screenshot shows the 'Run' console of an IDE. The title bar reads 'Run: UnionFindClient x'. The console output is as follows:

```
/usr/lib/jvm/java-1.8.0-openjdk-amd64/bin/java ...  
n value: 500 and pairs generated are 1616  
  
Process finished with exit code 0
```

The left sidebar contains standard IDE icons: a green play button, a wrench, a square, a camera, a magnifying glass, a trash can, a window, and a star.

For n = 1000

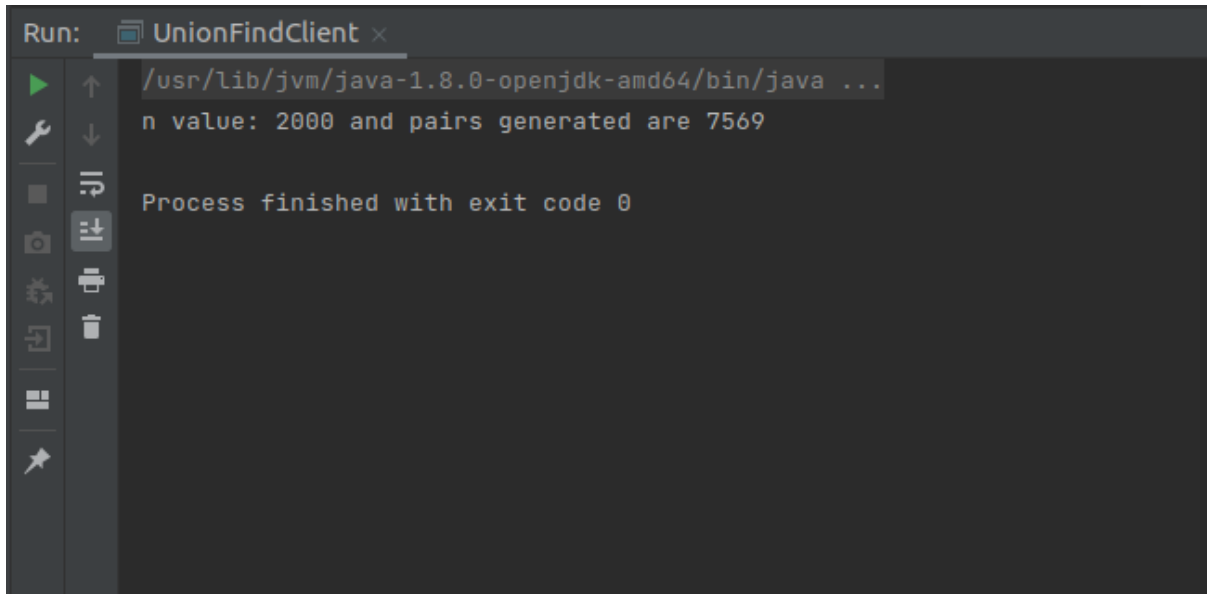


The screenshot shows the 'Run' console of an IDE. The title bar reads 'Run: UnionFindClient x'. The console output is as follows:

```
/usr/lib/jvm/java-1.8.0-openjdk-amd64/bin/java ...  
n value: 1000 and pairs generated are 3672  
  
Process finished with exit code 0
```

The left sidebar contains standard IDE icons: a green play button, a wrench, a square, a camera, a magnifying glass, a trash can, a window, and a star.

For n = 2000

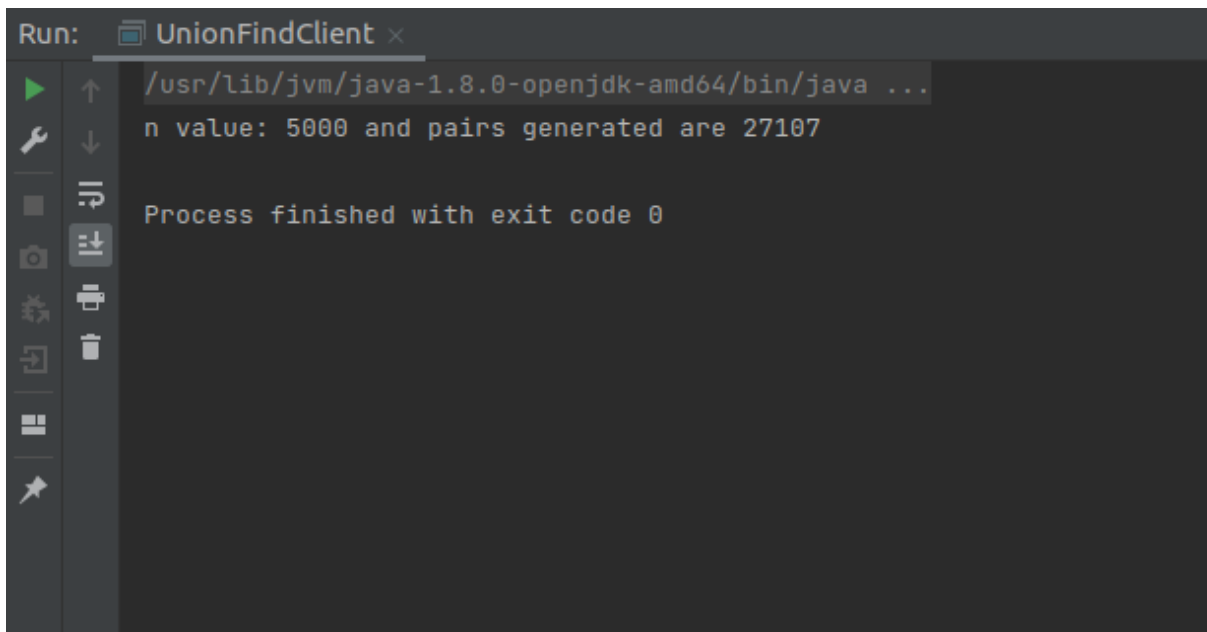


The screenshot shows a dark-themed IDE window with a tab titled "Run: UnionFindClient x". The console output is as follows:

```
/usr/lib/jvm/java-1.8.0-openjdk-amd64/bin/java ...  
n value: 2000 and pairs generated are 7569  
  
Process finished with exit code 0
```

The left sidebar contains standard IDE icons: a green play button, up and down arrows, a wrench, a square, a refresh icon, a camera, a printer, a trash can, a window icon, and a pin icon.

For n = 5000

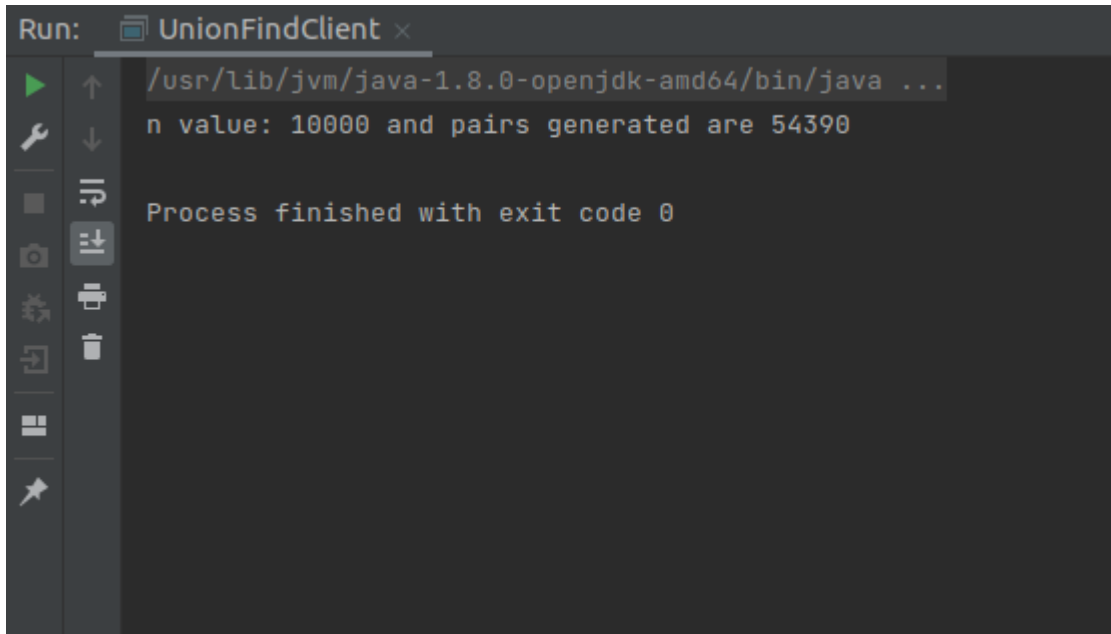


The screenshot shows a dark-themed IDE window with a tab titled "Run: UnionFindClient x". The console output is as follows:

```
/usr/lib/jvm/java-1.8.0-openjdk-amd64/bin/java ...  
n value: 5000 and pairs generated are 27107  
  
Process finished with exit code 0
```

The left sidebar contains standard IDE icons: a green play button, up and down arrows, a wrench, a square, a refresh icon, a camera, a printer, a trash can, a window icon, and a pin icon.

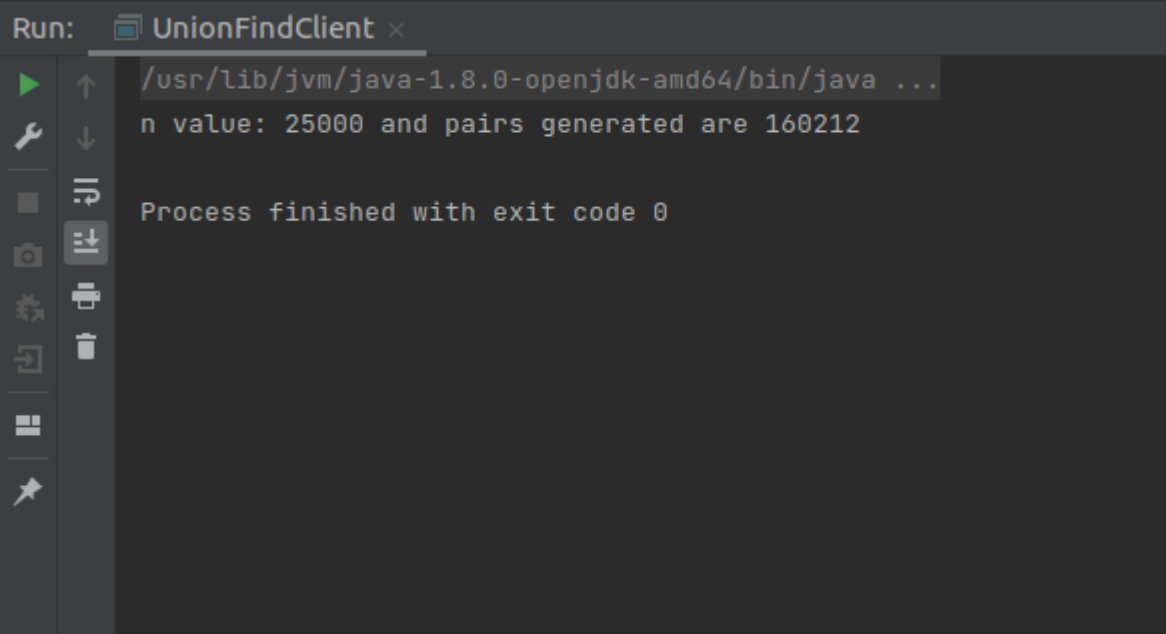
For n = 10000



The screenshot shows an IDE console window titled "Run: UnionFindClient x". The console output displays the command `/usr/lib/jvm/java-1.8.0-openjdk-amd64/bin/java ...`, the input `n value: 10000`, and the result `pairs generated are 54390`. It also shows `Process finished with exit code 0`. The left sidebar contains standard IDE icons for running, debugging, and viewing files.

```
Run: UnionFindClient x
/usr/lib/jvm/java-1.8.0-openjdk-amd64/bin/java ...
n value: 10000 and pairs generated are 54390
Process finished with exit code 0
```

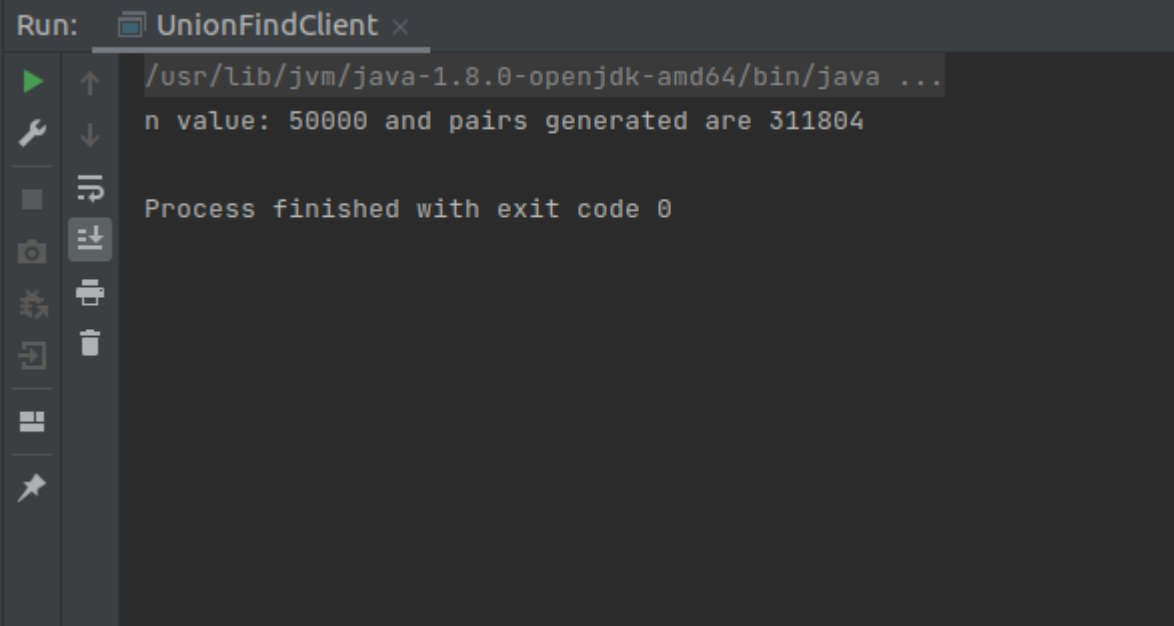
For n = 25000



The screenshot shows an IDE console window titled "Run: UnionFindClient x". The console output displays the command `/usr/lib/jvm/java-1.8.0-openjdk-amd64/bin/java ...`, the input `n value: 25000`, and the result `pairs generated are 160212`. It also shows `Process finished with exit code 0`. The left sidebar contains standard IDE icons for running, debugging, and viewing files.

```
Run: UnionFindClient x
/usr/lib/jvm/java-1.8.0-openjdk-amd64/bin/java ...
n value: 25000 and pairs generated are 160212
Process finished with exit code 0
```

For n = 50000

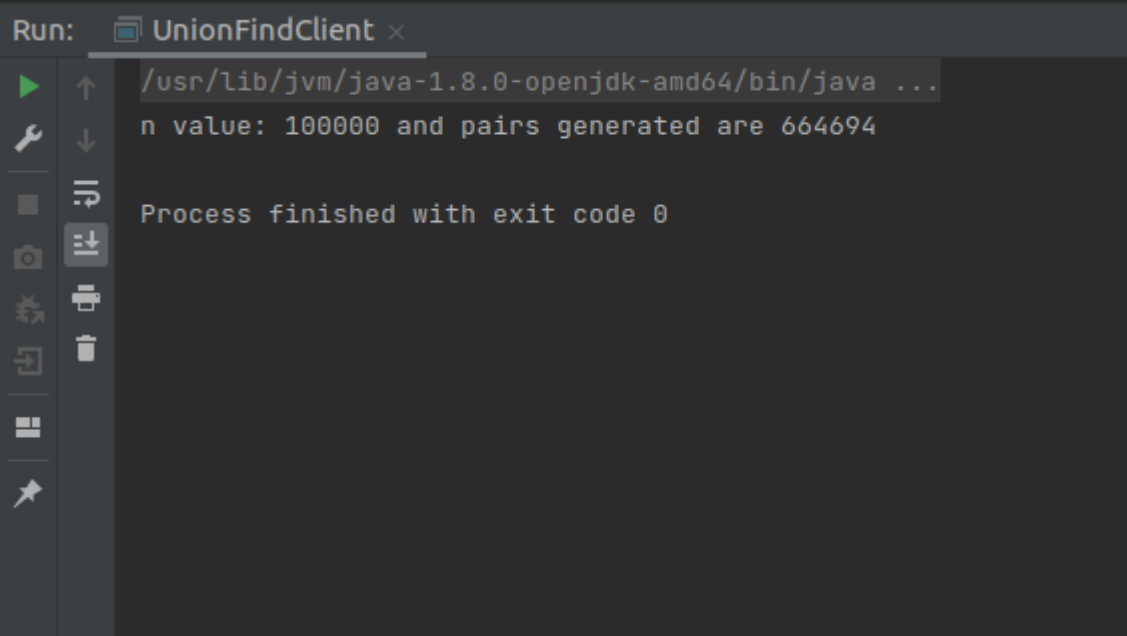


The screenshot shows a dark-themed IDE console window titled "Run: UnionFindClient x". The console output is as follows:

```
/usr/lib/jvm/java-1.8.0-openjdk-amd64/bin/java ...  
n value: 50000 and pairs generated are 311804  
  
Process finished with exit code 0
```

The left sidebar of the IDE contains various icons for debugging and development tools.

For n = 100000

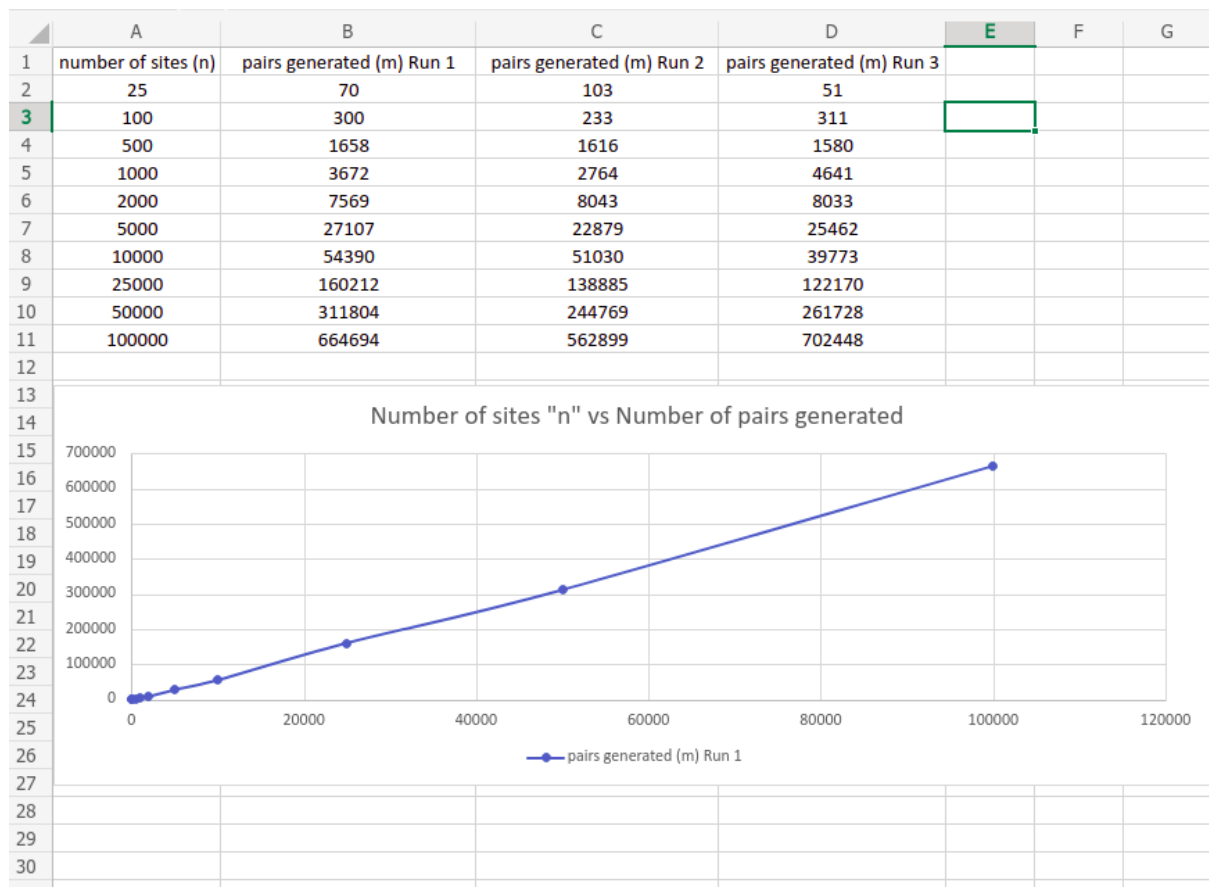


The screenshot shows a dark-themed IDE console window titled "Run: UnionFindClient x". The console output is as follows:

```
/usr/lib/jvm/java-1.8.0-openjdk-amd64/bin/java ...  
n value: 100000 and pairs generated are 664694  
  
Process finished with exit code 0
```

The left sidebar of the IDE contains various icons for debugging and development tools.

Tabulation/ Graph:



Conclusion:

From the readings obtained, it is seen that as the number of sites (n) increases, the number of pairs generated (m) also increases (Exponentially large in the case of larger values of n) and generates a linear graph. so I believe that "n" and "m" are directly proportional.

$$n \propto m$$