# Program Structures & Algorithms

## Assignment No. 3

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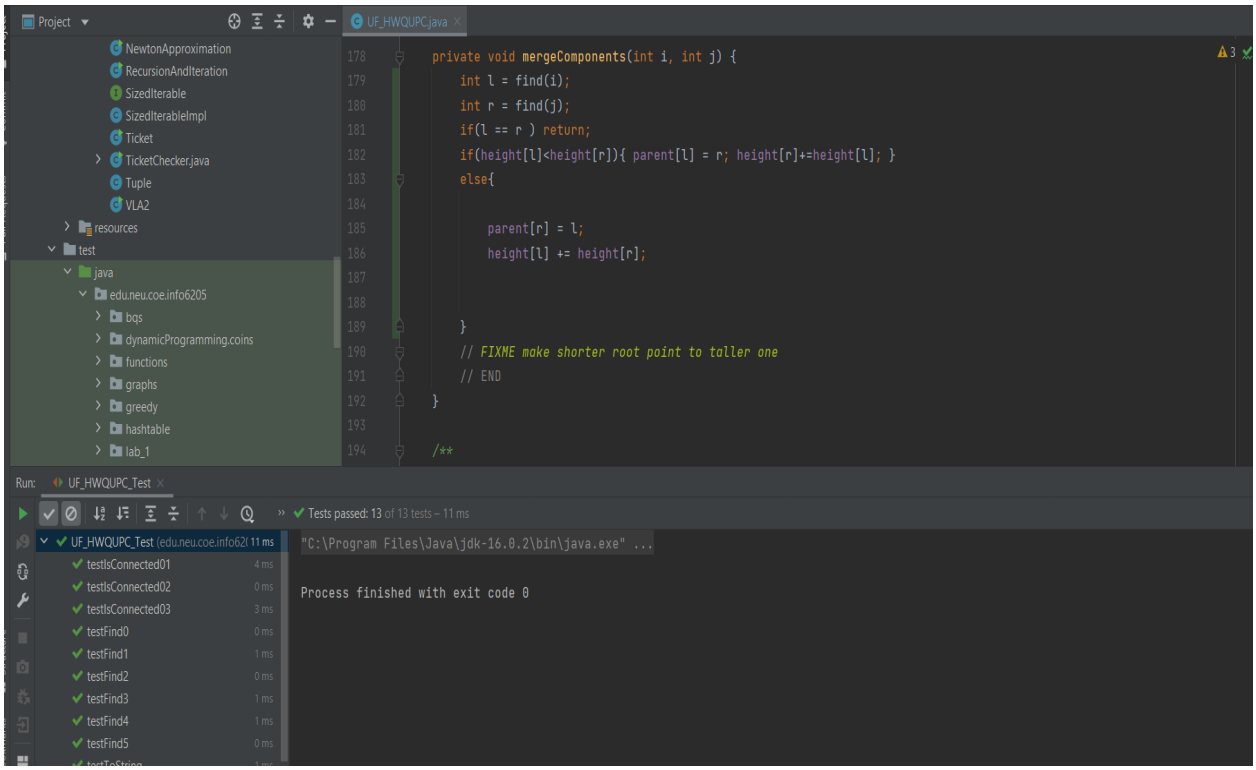
**Tasks:**

**1)** (a) Implement height-weighted Quick Union with Path Compression.
(b) Check that the unit tests for this class all work.

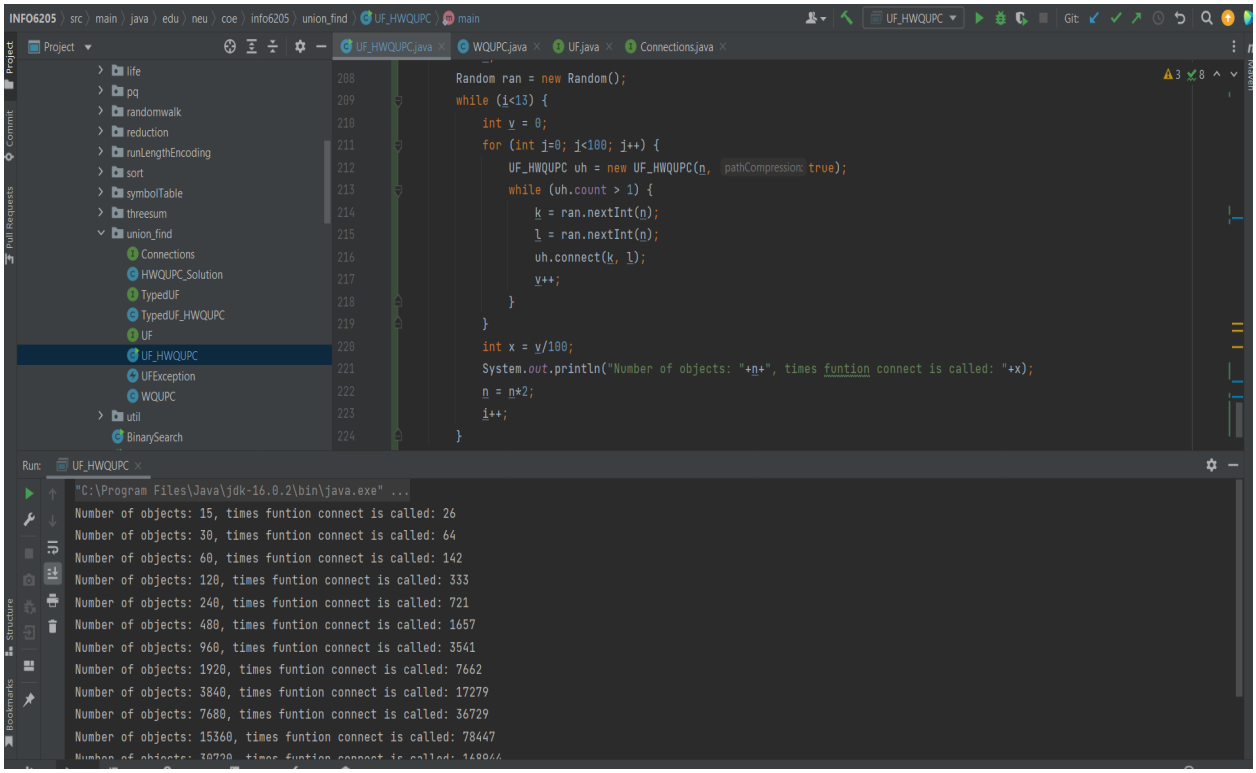
**2)** Create a main program that takes n from the command line, calls count() and prints the returned value.

**3)** Determine the relationship between the number of objects (n) and the number of pairs (m)

**Part I : Unit tests result**



**Output Screen Shot:**




**CONCLUSION:**

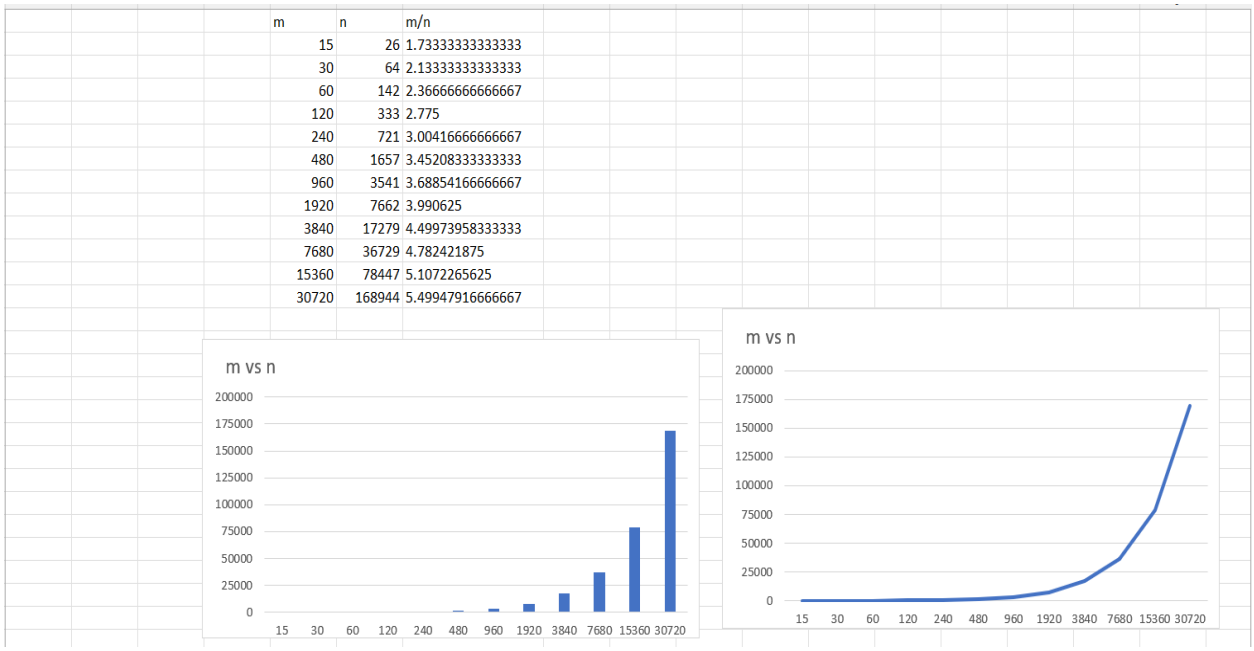
As the number of objects(n) are increasing the number of pairs(v) changes linearithmic with n. To be more precise m is increasing n times the log of n to the base 5 which can be approximated to below expression.

$$m = n \times log\ (n)$$

For larger values of n which is around 5000 to 20000, m value is nearly 5 times of n which can be seen in the evidence graph.

$$m = 5 \times n$$

## EVIDENCE / GRAPH:




| m | n | m/n |
|---|---|---|
| 15 | 26 | 1.73333333333333 |
| 30 | 64 | 2.13333333333333 |
| 60 | 142 | 2.36666666666667 |
| 120 | 333 | 2.775 |
| 240 | 721 | 3.00416666666667 |
| 480 | 1657 | 3.45208333333333 |
| 960 | 3541 | 3.68854166666667 |
| 1920 | 7662 | 3.990625 |
| 3840 | 17279 | 4.49973958333333 |
| 7680 | 36729 | 4.782421875 |
| 15360 | 78447 | 5.1072265625 |
| 30720 | 168944 | 5.49947916666667 |