Program Structures & Algorithms Spring 2022
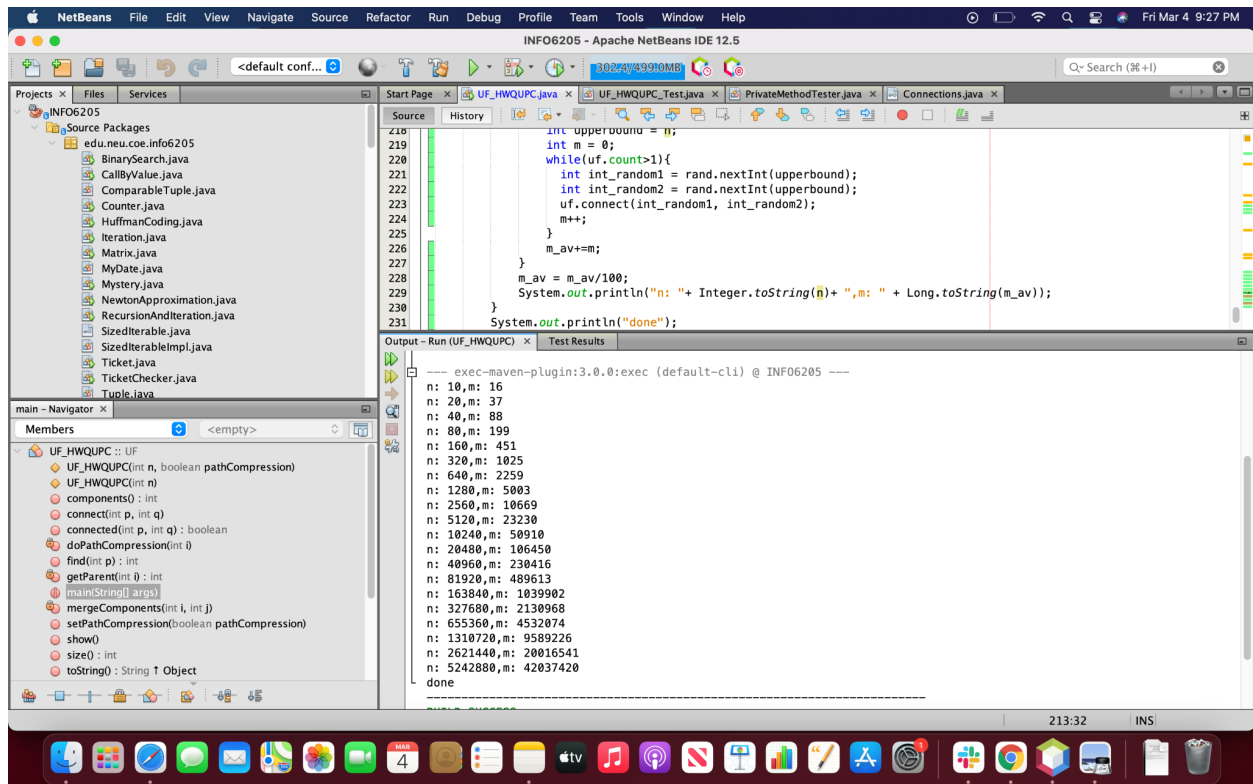## Assignment 3

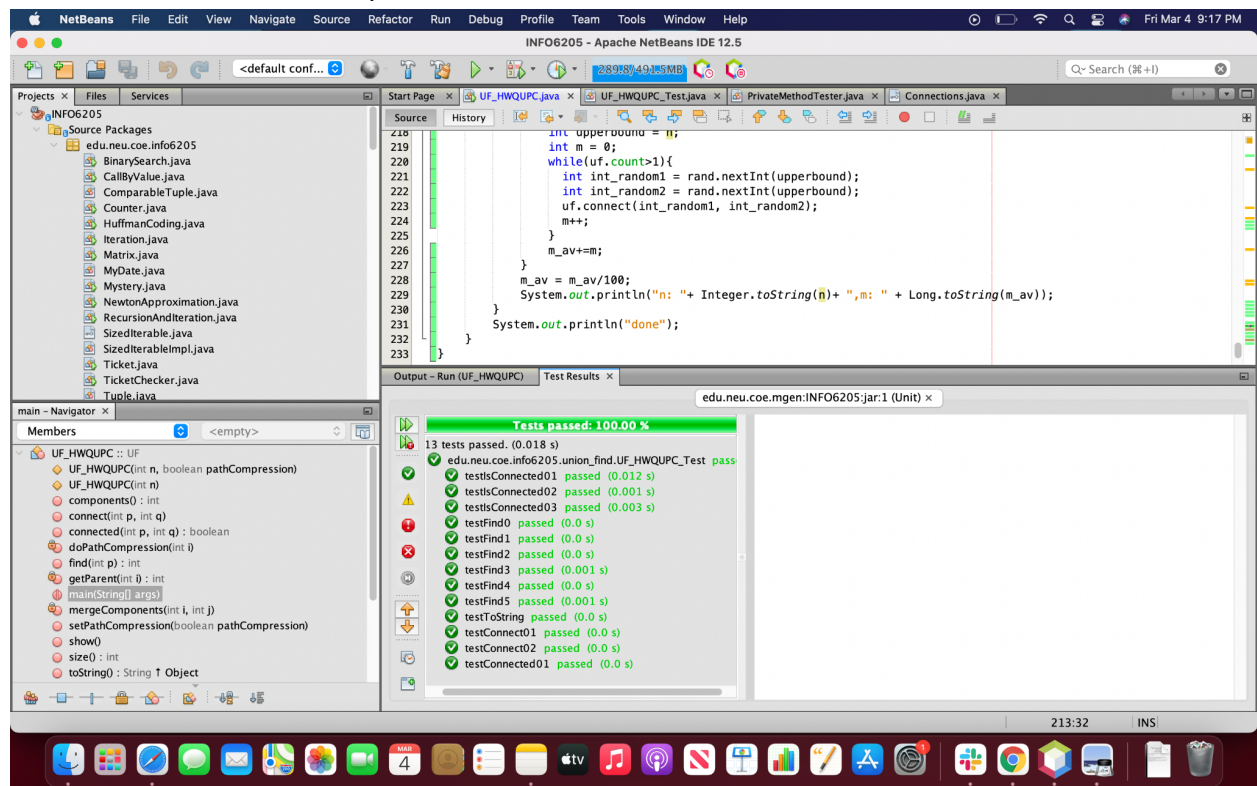Name: Sai Harish Reddy Gunda
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Task:

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)

Screenshot with Output:

Screenshot with Test cases passed

Conclusion/Relationship:

$$m \ \alpha \ nlogn$$

m varies "linearithmically" with n. To come to this conclusion I calculated n * log(n) base 10 and then calculated the ratio when m is divided by n*logn. The value of the ratio is approximately 1.2 which is fairly constant for all the values of m and n.

Evidence:

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	A	B	C	D	E
1	n	m	m/n	nlogn	m/nlogn
2	10	15	1.5	10	1.5
3	20	36	1.8	26.02059991	1.383519216
4	40	90	2.25	64.08239965	1.404441789
5	80	198	2.475	152.247199	1.300516537
6	160	449	2.80625	352.6591972	1.273183866
7	320	1036	3.2375	801.6479931	1.292337795
8	640	2264	3.5375	1795.955183	1.260610521
9	1280	5023	3.92421875	3977.228761	1.262939675
10	2560	10841	4.234765625	8725.094311	1.242508059
11	5120	23138	4.519140625	18991.4622	1.218336943
12	10240	49092	4.794140625	41065.47156	1.195456868
13	20480	107880	5.267578125	88296.03742	1.221798884
14	40960	236884	5.783300781	188922.2635	1.25387022
15	81920	480429	5.864611816	402504.9042	1.193597879
16	163840	1036095	6.323822021	854330.5629	1.212756566
17	327680	2159061	6.588931274	1807302.635	1.19463169
18	655360	4556063	6.952000427	3811888.287	1.195224691
19	1310720	9651298	7.363356018	8018342.611	1.203652484
20	2621440	19936078	7.605010223	16825817.29	1.184850498
21	5242880	41821823	7.976879692	35229898.73	1.187111644

m vs. n