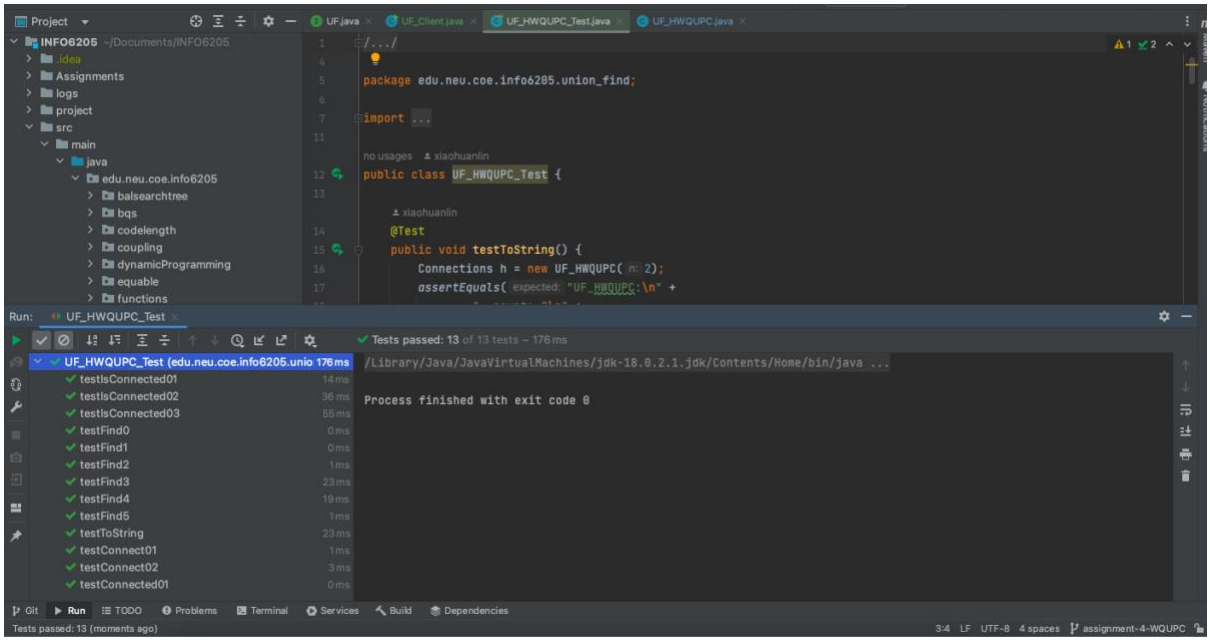
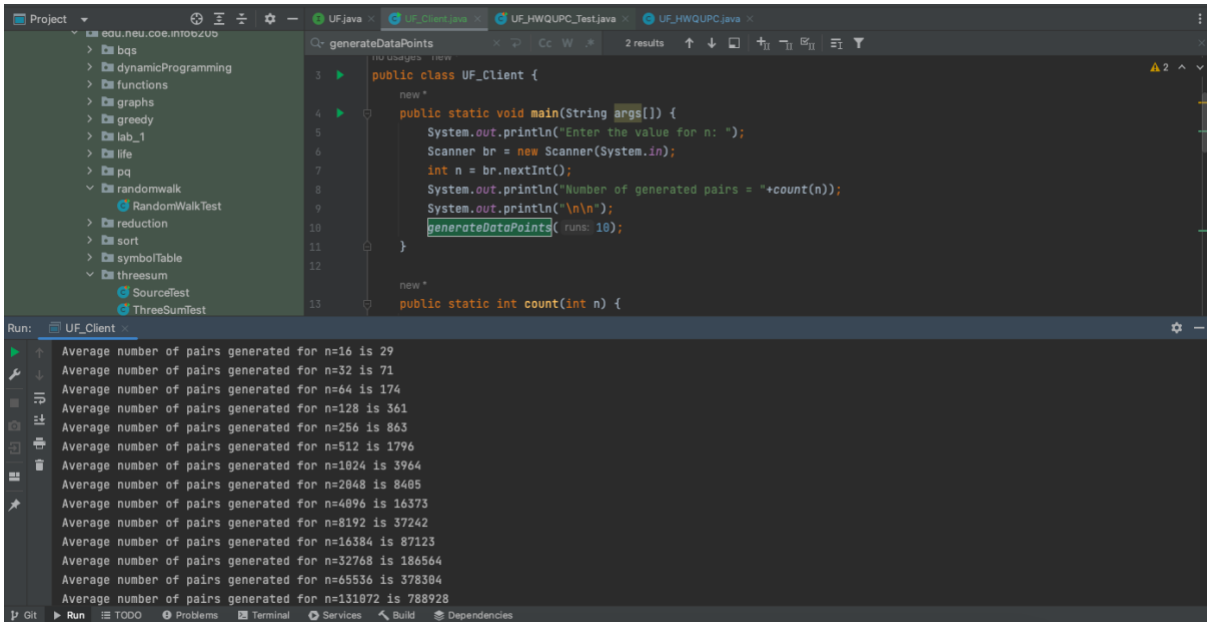
Assignment 4

Part 1 – Union-find test cases success

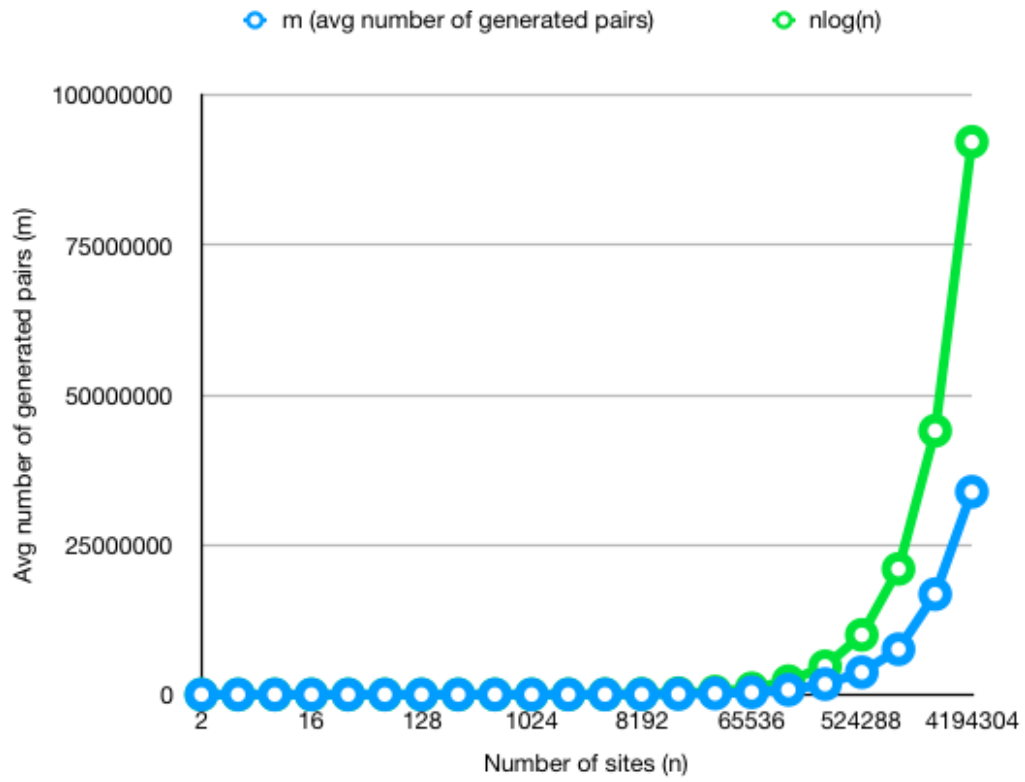


Part 2 – Output for Random Pair Generation Count



Part 3 – Relationship between n and number of random pairs generated

n (number of components)	m (number of generated pairs)	log(n)	nlog(n)	k = (m/nlogn)	avg k	
2	2	1	2	1	0.429955701117455	
4	5	2	8	0.625		
8	12	3	24	0.5		
16	29	4	64	0.453125		
32	71	5	160	0.44375		
64	174	6	384	0.453125		
128	361	7	896	0.402901785714286		
256	863	8	2048	0.42138671875		
512	1796	9	4608	0.389756944444444		
1024	3964	10	10240	0.387109375		
2048	8405	11	22528	0.373091264204545		
4096	16373	12	49152	0.333109537760417		
8192	37242	13	106496	0.349703275240385		
16384	87123	14	229376	0.379826136997768		
32768	186564	15	491520	0.3795654296875		
65536	378304	16	1048576	0.36077880859375		
131072	788928	17	2228224	0.354061351102941		
262144	1745827	18	4718592	0.36998897128635		
524288	3729922	19	9961472	0.374434822484067		
1048576	7570502	20	20971520	0.360989665985107		
2097152	16755262	21	44040192	0.380453881763277		
4194304	33852580	22	92274688	0.366867455569181		



The above chart represents the relationship between number of sites(n) and the average (over 10 runs) number of random pairs generated (m) to fully connect a disjoint set. The values of n were generated as powers of 2 from 2 to 4194304. We also have another line representing the values of nlogn.

From the graph, we can observe that the growth rate of the relationship between m and n is nlogn with a constant factor k. We can conclude the following

$m \propto nlogn$
$m = knlogn$

The value of k derived from the values generated is 0.4299 which can be approximated to 0.5. So, the above equation can be approximately written as -

$m = 0.5 * nlogn$