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Program Structures & Algorithms
Fall 2021
Assignment No. 3

- **Task (List down the tasks performed in the Assignment)**
    1. Completed the implementation of methods in the `UF_HWQUPC` class.
    2. Created new test class `UF_HWQUPC_TestRandomPair` to test `UF_HWQUPC` class with custom inputs and recorded it in the screenshot
    3. Ran unit tests successfully under src/test/java/edu/neu/coe/info6205/union_find/UF_HWQUPC_Test.java and recorded in the screenshot
    4. With the output from custom inputs, plotted the chart and found the relationship between number of sites and the number of connections

- **Relationship Conclusion: (For ex : z = a * b)**
    - Considering the values of number of sites and number of connections. It is very clear that the relationship is

      number of sites = NLOGN/2

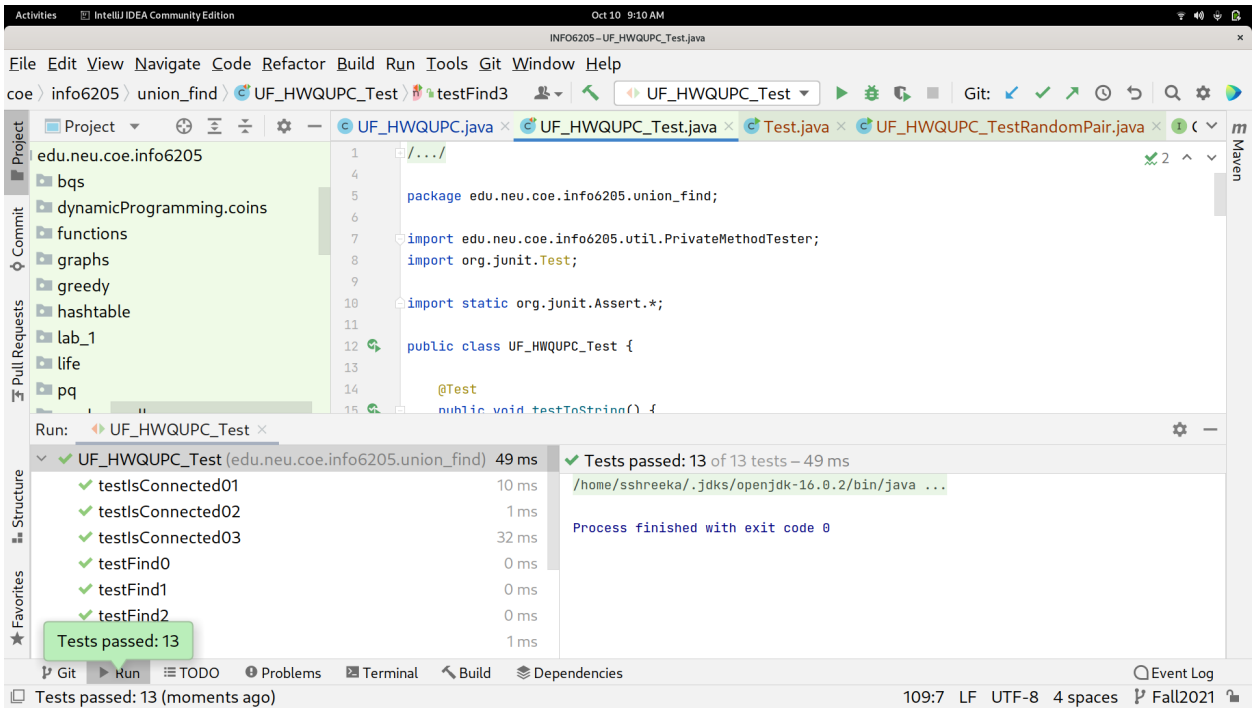
    - When considered with concurrent and increasing values of number of sites, it is evident that this relationship holds good.

    - Since the N*log of of no of steps is not exactly equal to mean no of pairs obtained, it can be justified as an approximated value rather than exact value.

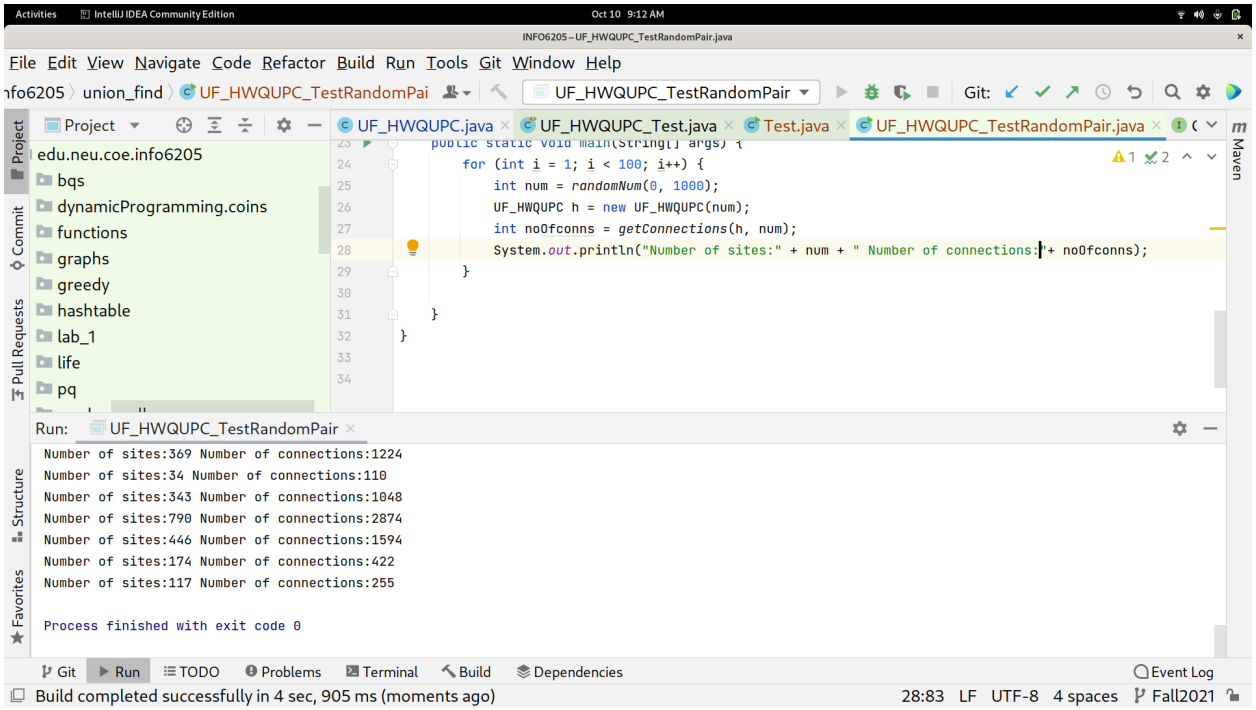
- These values are calculated for the series of experiments and for each step value. Hence it can be concluded that this mathematical expression holds mostly good with all the experiments provided the given constraints remaining the same.

- **Evidence to support the conclusion:**

1. **Unit tests (Snapshot of Code output in the terminal)**



2. Test UF_HWQUPC_TestRandomPair to find number of sites and the number of connections



3 .Graphical Representation(Observations from experiments should be tabulated and analyzed by plotting graphs(usually in excel) to arrive on the relationship conclusion)

no of sites	no of connection	NLOGN/2
1	0	0
3	3	2.377443751
7	19	9.825742227
15	29	29.30167947
31	42	76.79004281
63	153	188.2843176
127	453	443.7814776
255	833	1019.280063
511	1918	2298.779357
1023	3641	5114.279005
2047	10396	11257.77883
4095	25109	24569.27874
8191	43740	53240.7787