Program Structures and Algorithms

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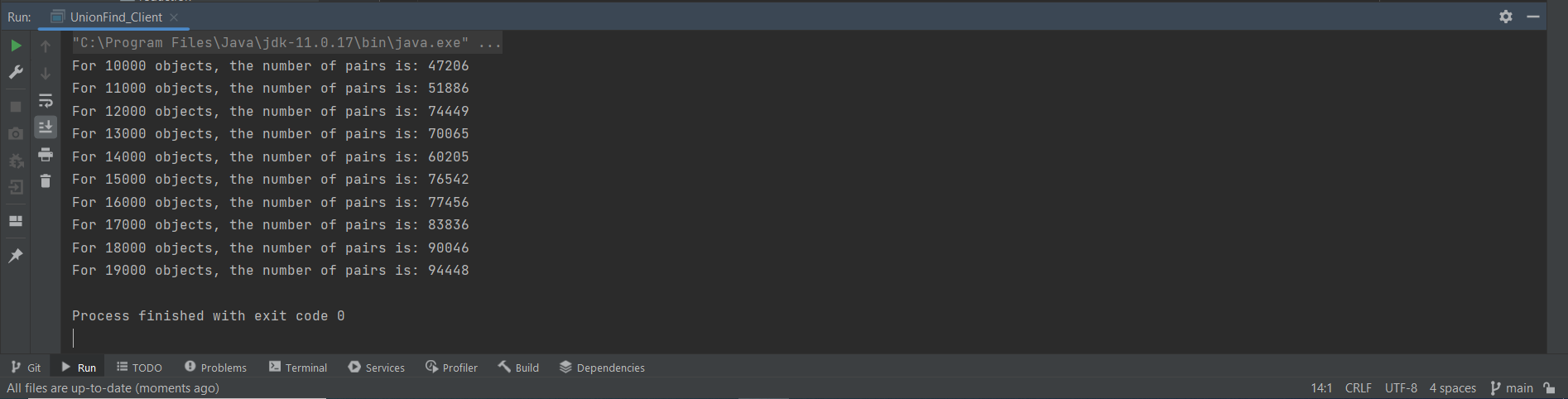
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**Task:** To find the relationship between the number of objects (n) and the number of pairs (m) generated in a Union Find Algorithm.

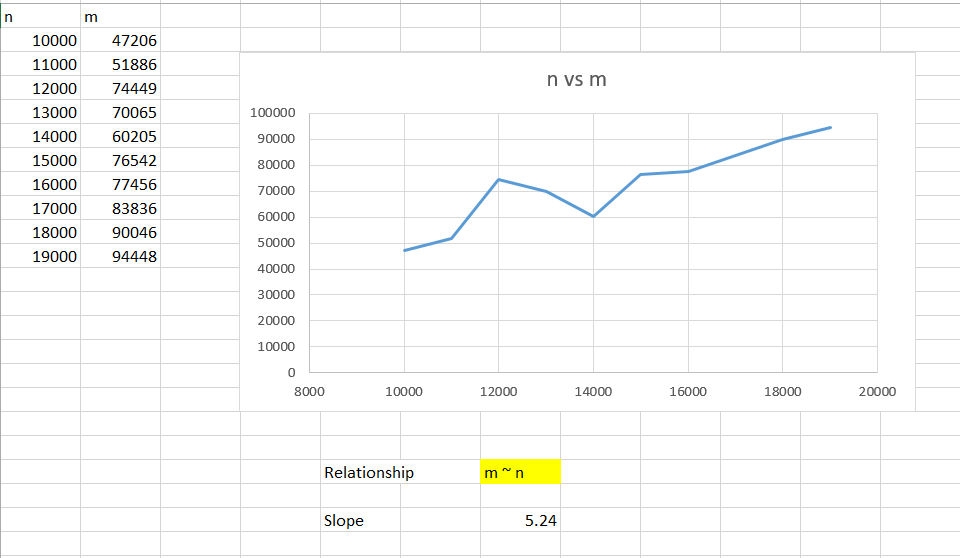
**Relationship Conclusion:** For (n) objects in a Union Find Algorithm, the number of pairs generated is proportional to n.

m ~ k \* n, where k is any constant

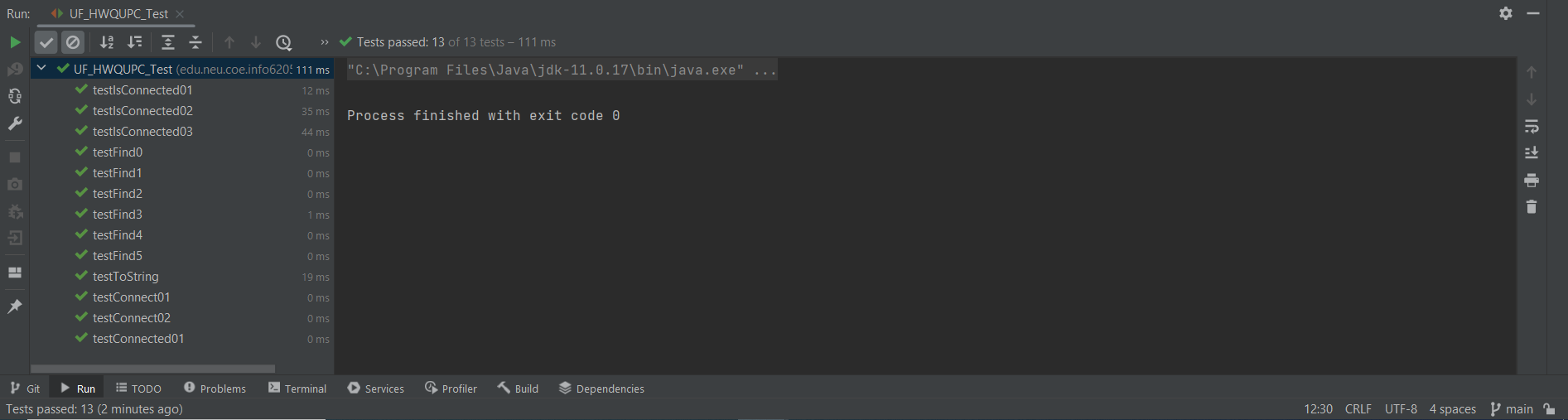
**Evidence to support that conclusion:**



**Graphical Representation:** From the graph, we can infer that the slop is approximately equal to 5 and thus the relationship between (m) and (n) is m ~ 5 \* n.

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**Unit Test Screenshots:**



**Working of Union Find:** The Union Find Algorithm aims to connect multiple disjointed nodes into a single component graph. For n separate components to be combined into one single component, there needs to be n-1 connections made. At the beginning of the Algorithm, each node is separate and each time we connect two sets of nodes randomly, the total number of nodes reduces by 1 and the connection count increases by 1. Ultimately as the number of nodes become 1, the connection count would have summed up to n-1. Thus for n objects, the number of connections are always n-1. But the random number generation in java would take more than the expected number as it can choose the same pair of nodes multiple times and thus the number of pairs generated (m) would always be proportional to the value of n.