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## **Program Structures & Algorithms**

**Fall 2021**

### **Assignment No. 3**

◉ **Task (List down the tasks performed in the Assignment)**

1. Implement height-weighted Quick Union with Path Compression.
2. Using your implementation of UF\_HWQUPC, develop a UF ("union-find") client that takes an integer value  $n$  from the command line to determine the number of "sites."
3. Determine the relationship between the number of objects ( $n$ ) and the number of pairs ( $m$ ) generated to accomplish this

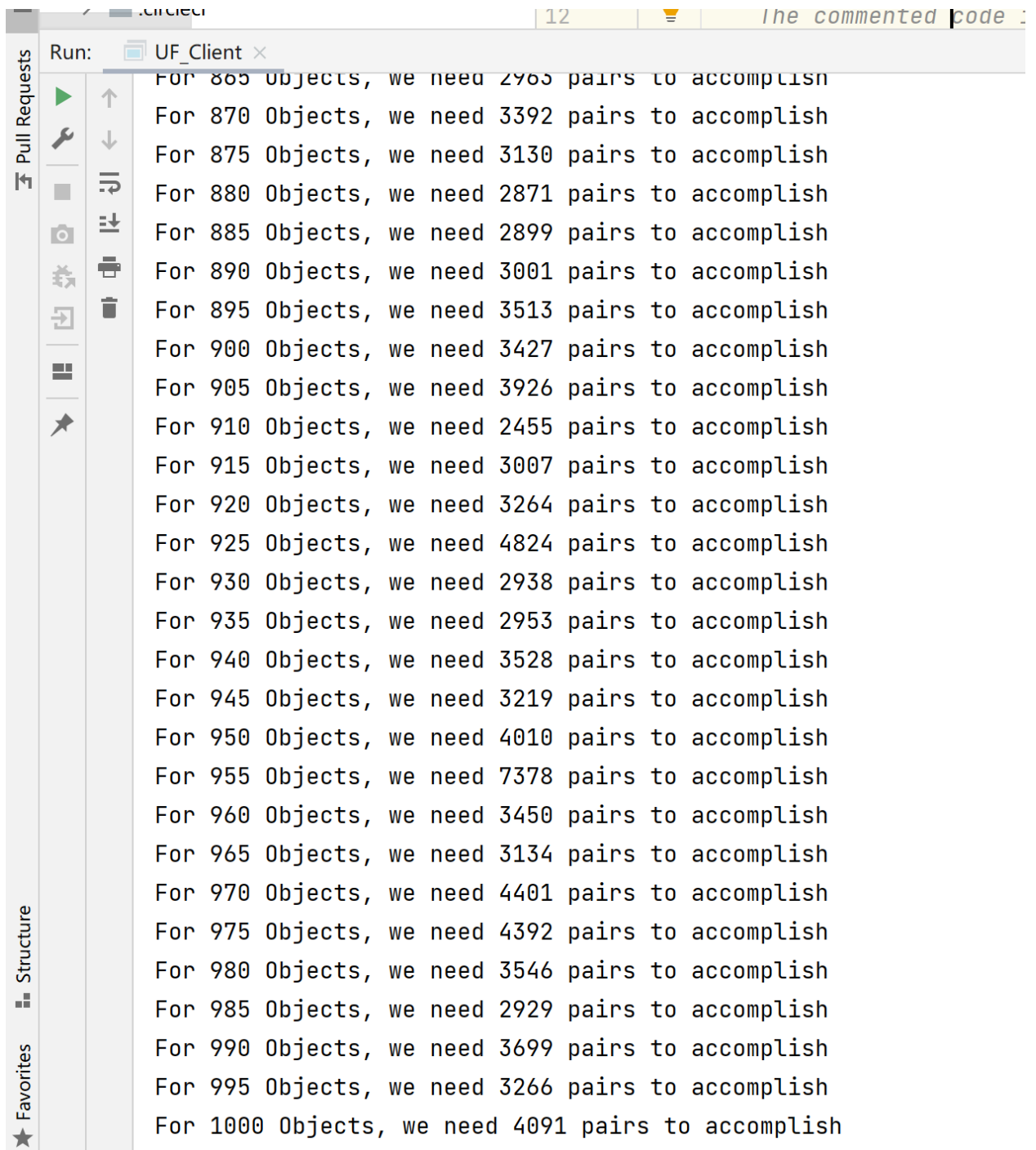
◉ **Relationship Conclusion: (For ex :  $z = a * b$ )**

Linear relationship

$$m(\text{pairs}) = C * n(\text{objects})$$

◉ **Evidence to support the conclusion:**

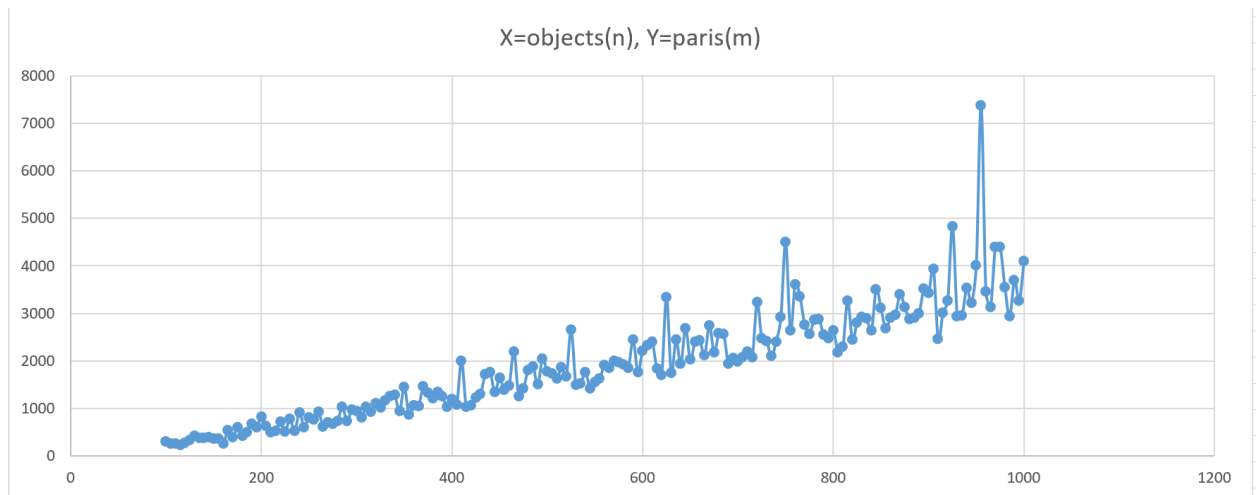
1. **Output (Snapshot of Code output in the terminal)**



The screenshot shows a code editor window with a file named 'UF\_Client'. The code consists of a single line repeated 20 times, each line representing a different number of objects and the corresponding number of pairs needed. The left sidebar shows a 'Pull Requests' panel and a 'Structure' panel. The top of the editor shows a 'Run' button and a 'UF\_Client' tab.

```
For 865 Objects, we need 2965 pairs to accomplish  
For 870 Objects, we need 3392 pairs to accomplish  
For 875 Objects, we need 3130 pairs to accomplish  
For 880 Objects, we need 2871 pairs to accomplish  
For 885 Objects, we need 2899 pairs to accomplish  
For 890 Objects, we need 3001 pairs to accomplish  
For 895 Objects, we need 3513 pairs to accomplish  
For 900 Objects, we need 3427 pairs to accomplish  
For 905 Objects, we need 3926 pairs to accomplish  
For 910 Objects, we need 2455 pairs to accomplish  
For 915 Objects, we need 3007 pairs to accomplish  
For 920 Objects, we need 3264 pairs to accomplish  
For 925 Objects, we need 4824 pairs to accomplish  
For 930 Objects, we need 2938 pairs to accomplish  
For 935 Objects, we need 2953 pairs to accomplish  
For 940 Objects, we need 3528 pairs to accomplish  
For 945 Objects, we need 3219 pairs to accomplish  
For 950 Objects, we need 4010 pairs to accomplish  
For 955 Objects, we need 7378 pairs to accomplish  
For 960 Objects, we need 3450 pairs to accomplish  
For 965 Objects, we need 3134 pairs to accomplish  
For 970 Objects, we need 4401 pairs to accomplish  
For 975 Objects, we need 4392 pairs to accomplish  
For 980 Objects, we need 3546 pairs to accomplish  
For 985 Objects, we need 2929 pairs to accomplish  
For 990 Objects, we need 3699 pairs to accomplish  
For 995 Objects, we need 3266 pairs to accomplish  
For 1000 Objects, we need 4091 pairs to accomplish
```

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



From the graph I generated in Excel, we can tell that even though the fluctuation grows more and more unstable, the relationship between  $n(\text{objects})$  and  $m(\text{pairs})$  are still linear.

#### ◉ Unit tests result:(Snapshot of successful unit test run)

