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INFO 6205

Program Structure & Algorithms

Spring 2021

Assignment3

Task: Implement height-weighted Quick Union with Path Compression.

UF_HWQUPC classs:

```
 */
public int find(int p) {
    validate(p);
    int root = p;
    while (root != parent[root]) {
        if(pathCompression)
            doPathCompression(root);
        root = parent[root];
    }
    // TO BE IMPLEMENTED
    return root;
}
```

```
private void mergeComponents(int i, int j) {
    // TO BE IMPLEMENTED make shorter root point to taller one
    int iRoot = find(i);
    int jRoot= find(j);
    if (iRoot == jRoot) {
        return;
    }
    if (height[iRoot] < height[jRoot]) {
        updateParent(iRoot, jRoot);
        updateHeight(jRoot, iRoot);
    }
    else  {
        updateParent(jRoot, iRoot);
        updateHeight(iRoot, jRoot);
    }
}
```

```
private void doPathCompression(int i) {
    // TO BE IMPLEMENTED update parent to value of grandparent
    parent[i] = parent[parent[i]];

}
```

```
    public static int count(int n) {
        UF_HWQUPC cal = new UF_HWQUPC(n);
        int conNumber =0;
        Random ran= new Random();
        while(cal.count != 1) {
            int p=ran.nextInt(n);
            int q=ran.nextInt(n);
            cal.union(p, q);
            conNumber++;
        }
        return conNumber;
    }
    public static void main(String[] args) {
        int n=100;
        int times=100;
        for(int i=0; i<50; i++) {
            int sum =0;
            for(int j=0; j<times; j++){
                sum +=count(n);
            }
            sum =sum/times;
            System.out.println(sum+ ","+ n);
            n+=100;

        }
    }
}
```

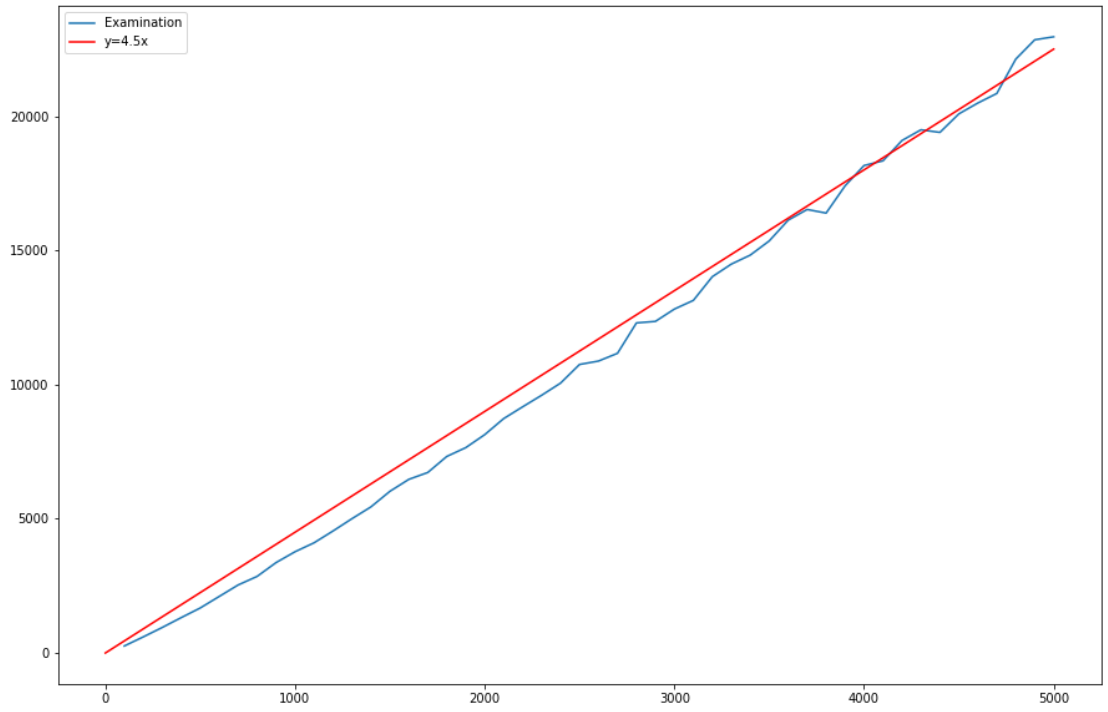
Output:

	A	B	C
37	16126	3600	
38	16524	3700	
39	16390	3800	
40	17405	3900	
41	18162	4000	
42	18337	4100	
43	19094	4200	
44	19493	4300	
45	19396	4400	
46	20087	4500	
47	20490	4600	
48	20847	4700	
49	22127	4800	
50	22846	4900	
51	22958	5000	

Relationship Conclusion:

pairs=4.5*objects

Graphical representation:



Unit tests result:

UF_HWQUPC_test