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Program Structures & Algorithms

Fall 2021

Assignment No. 3

- Task (List down the tasks performed in the Assignment)

WQUPC

- Relationship Conclusion:

$M=N-1$

- Evidence to support the conclusion:

The screenshot shows an IDE with a project named 'Assignment3'. The code editor displays the following Java code:

```
public static void main(String[] args) {  
    for (int i = 1; i < 100; i++) {  
        UF_WQUPC uh = new UF_WQUPC(i, pathCompression: false);  
        System.out.println("n="+i+", number of connection is:"+ uh.count(i));  
    }  
}
```

The Run console shows the output of the program, listing the number of connections for each value of i from 1 to 38:

```
n=1, number of connection is:1  
n=2, number of connection is:1  
n=3, number of connection is:2  
n=4, number of connection is:1  
n=5, number of connection is:2  
n=6, number of connection is:2  
n=7, number of connection is:3  
n=8, number of connection is:2  
n=9, number of connection is:3  
n=10, number of connection is:3  
n=11, number of connection is:4  
n=12, number of connection is:3  
n=13, number of connection is:4  
n=14, number of connection is:4  
n=15, number of connection is:5  
n=16, number of connection is:4  
n=17, number of connection is:5  
n=18, number of connection is:5  
n=19, number of connection is:6  
n=20, number of connection is:5  
n=21, number of connection is:6  
n=22, number of connection is:6  
n=23, number of connection is:7  
n=24, number of connection is:6  
n=25, number of connection is:7  
n=26, number of connection is:7  
n=27, number of connection is:8  
n=28, number of connection is:7  
n=29, number of connection is:8  
n=30, number of connection is:8  
n=31, number of connection is:9  
n=32, number of connection is:8  
n=33, number of connection is:9  
n=34, number of connection is:9  
n=35, number of connection is:10  
n=36, number of connection is:9  
n=37, number of connection is:10  
n=38, number of connection is:10
```

The status bar at the bottom indicates 'Build completed successfully in 2.71 ms (a minute ago)'.

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

The screenshot displays an IDE window for a project named 'Assignment3'. The main editor shows the source code for 'UF_HWQUPC.java', which includes methods for finding components, finding a root, and checking if two sites are connected. The bottom panel shows the 'Run' output, indicating that all 13 tests passed successfully.

```
68 public int components() { return count; }
69
70 /**
71  * Returns the component identifier for the component containing site {@code p}.
72  *
73  * @param p the integer representing one site
74  * @return the component identifier for the component containing site {@code p}
75  * @throws IllegalArgumentException unless  $0 \leq p < n$ 
76  */
77 public int find(int p) {
78     validate(p);
79     int root = p;
80     while (root != parent[root]) {
81         if (pathCompression == true) {
82             doPathCompression(root);
83         }
84         root = parent[root];
85     }
86     return root;
87 }
88
89 /**
90  * Returns true if the two sites are in the same component.
91  *
92  * @param p the integer representing one site
93  * @param q the integer representing the other site
94  * @return  $\text{@code true}$  if the two sites  $\text{@code p}$  and  $\text{@code q}$  are in the same component;
95  *          $\text{@code false}$  otherwise
96  * @throws IllegalArgumentException unless both  $\text{@code 0} \leq p < n$  and  $\text{@code 0} \leq q < n$ 
97  */
98 public boolean connected(int p, int q) { return find(p) == find(q); }
99
100 /**
```

Run: UF_HWQUPC_Test

Tests passed: 13 of 13 tests - 11ms

Process finished with exit code 0

| Test Name | Duration |
|-------------------|----------|
| testIsConnected01 | 0ms |
| testIsConnected02 | 0ms |
| testIsConnected03 | 4ms |
| testFind0 | 0ms |
| testFind1 | 0ms |
| testFind2 | 0ms |
| testFind3 | 1ms |
| testFind4 | 0ms |
| testFind5 | 0ms |
| testToBring | 0ms |
| testConnect01 | 0ms |
| testConnect02 | 0ms |
| testConnect03 | 0ms |