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Program Structures & Algorithms
Fall 2021
Assignment 3
Weighted Quick Union with Path Compression (WQUPC).

- **Task**
  1. Implemented method doPathCompression by changing the parent of the node by its parent's parent.
  2. Implemented method mergeComponents by first checking if they are not connected and if they aren't then comparing their parent's height and assigning the smaller height value one to the new parent of the bigger one also updating their height as well and vice versa.
  3. Implemented method find which finds the parent of any given node.

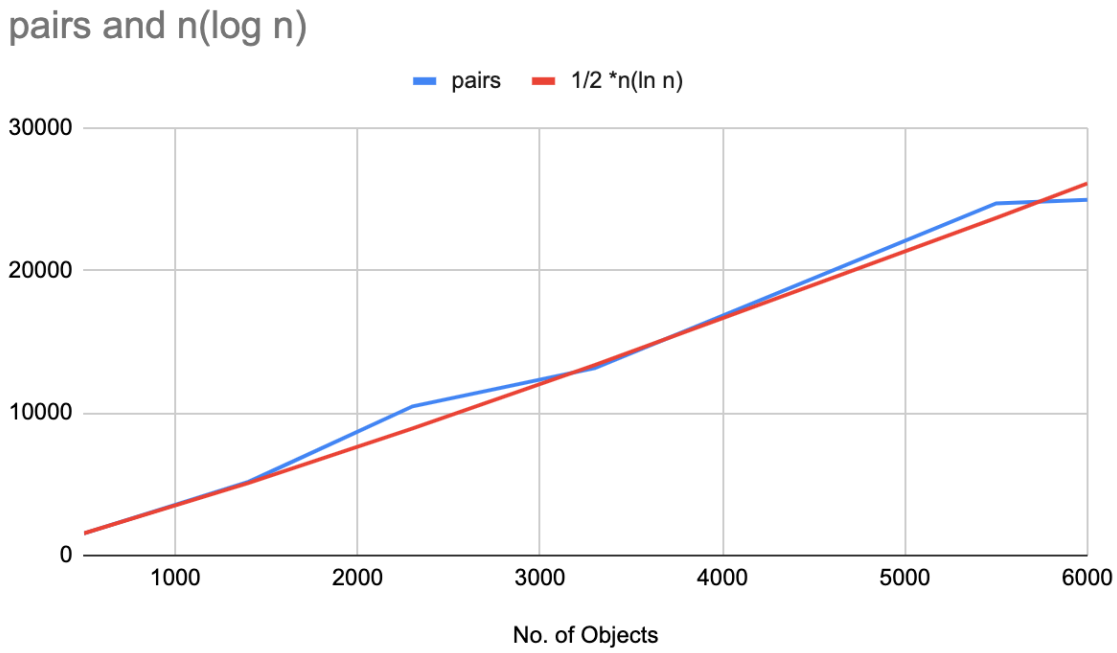
- **Relationship Conclusion**

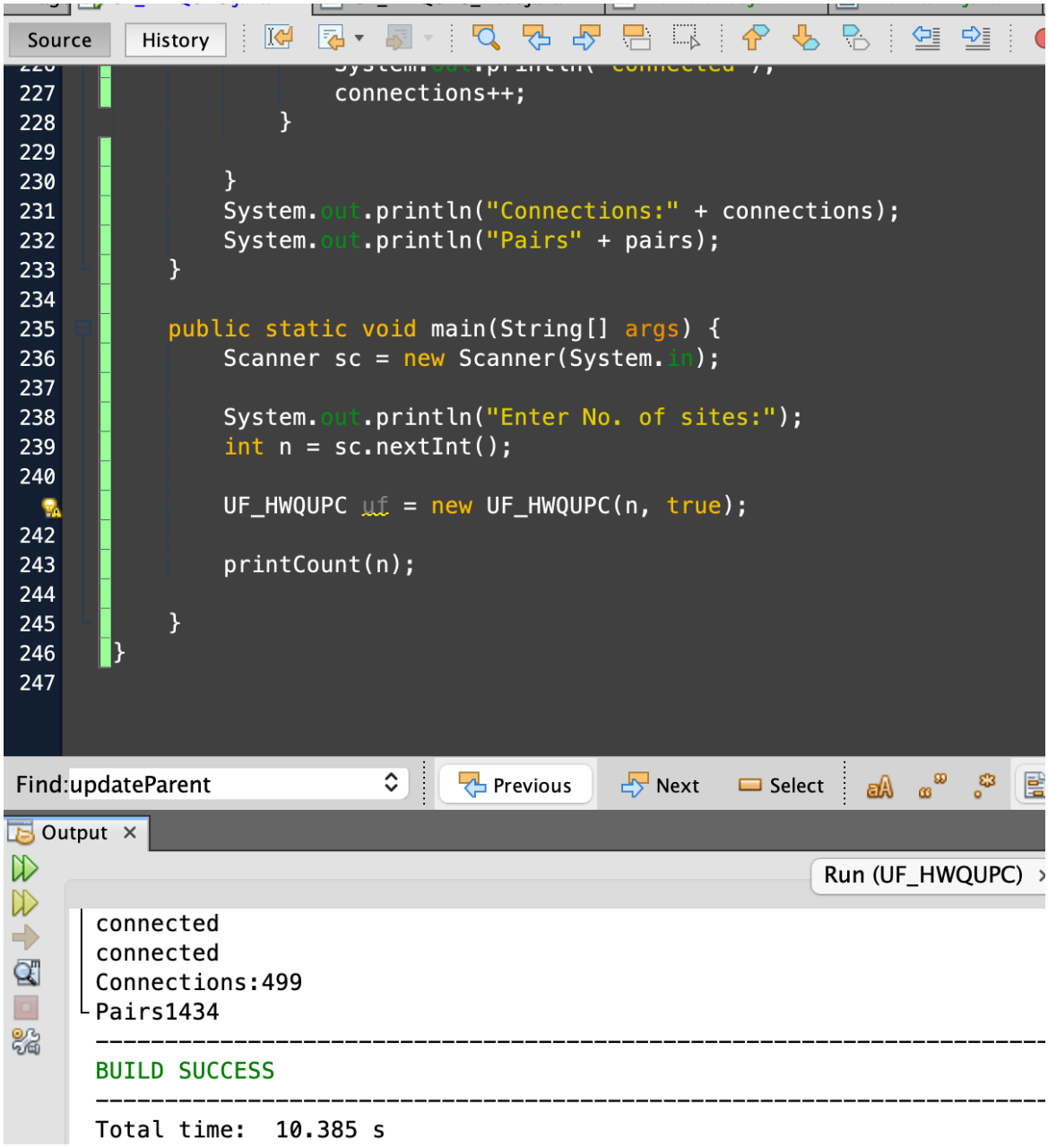
  While running the program for various values of no of samples we form the following observation on the number of objects(N) and number of pairs(M).

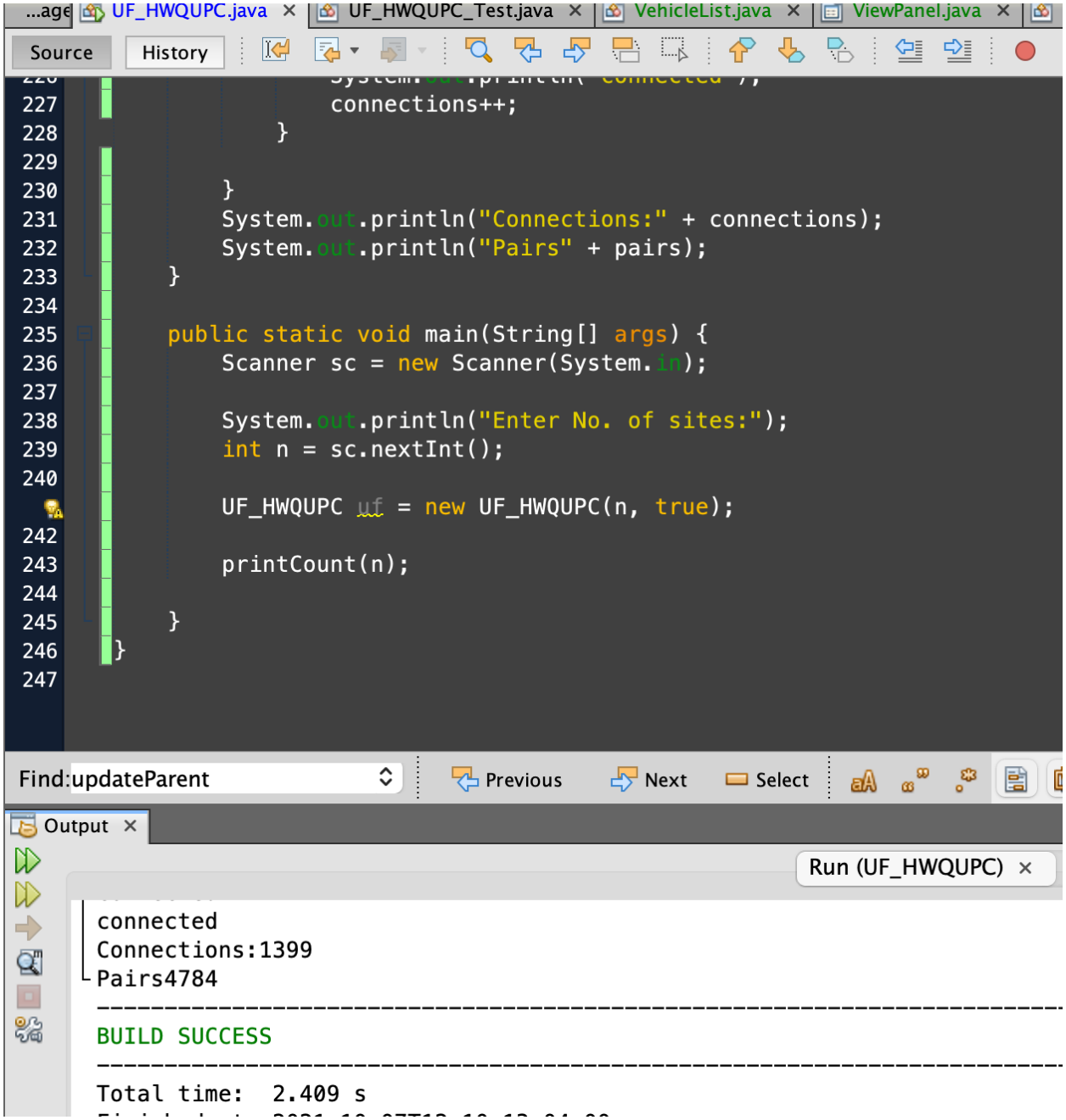
  M = 1/2 * N (Ln N)

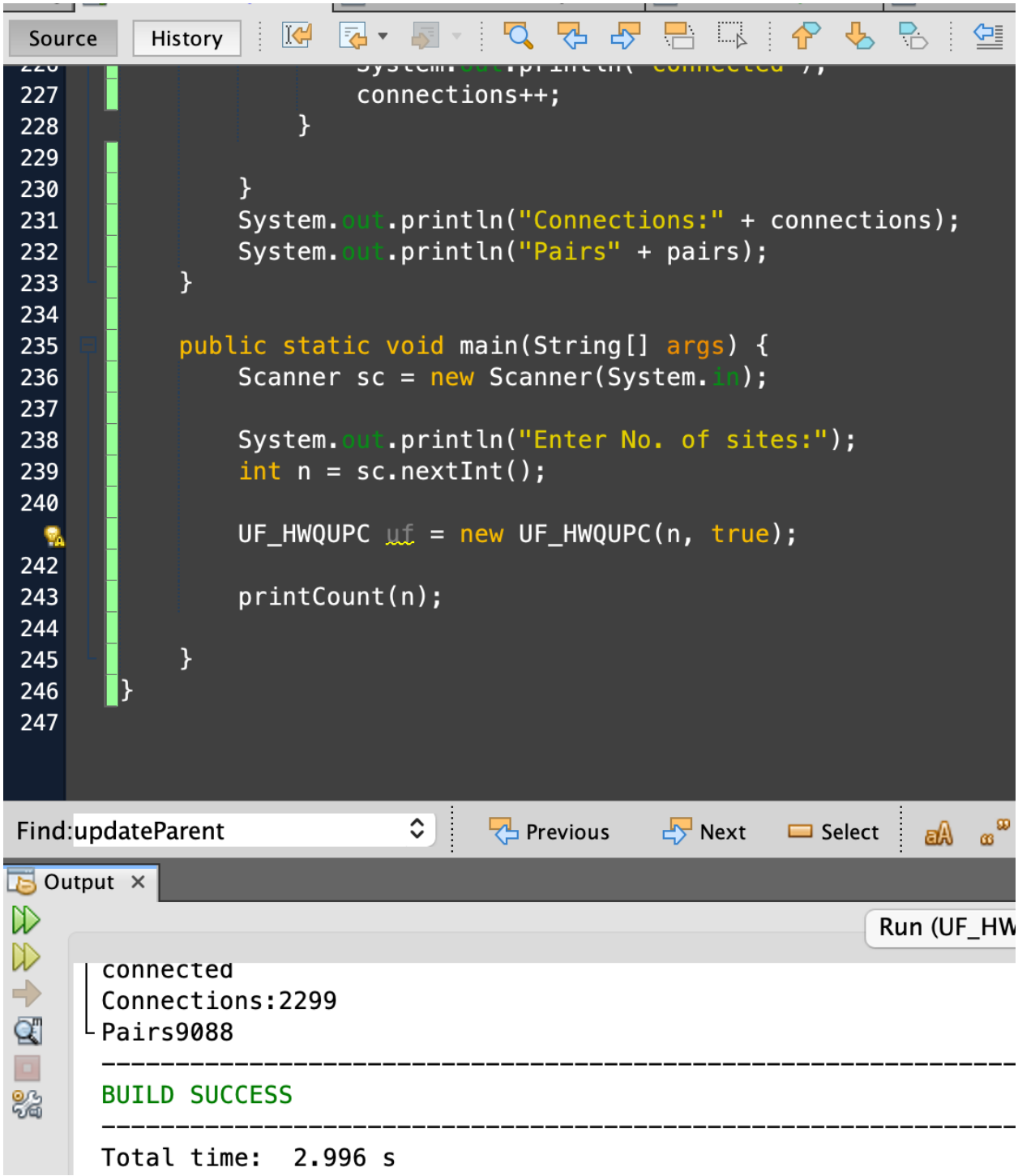
  Following graph helps in supporting the relation

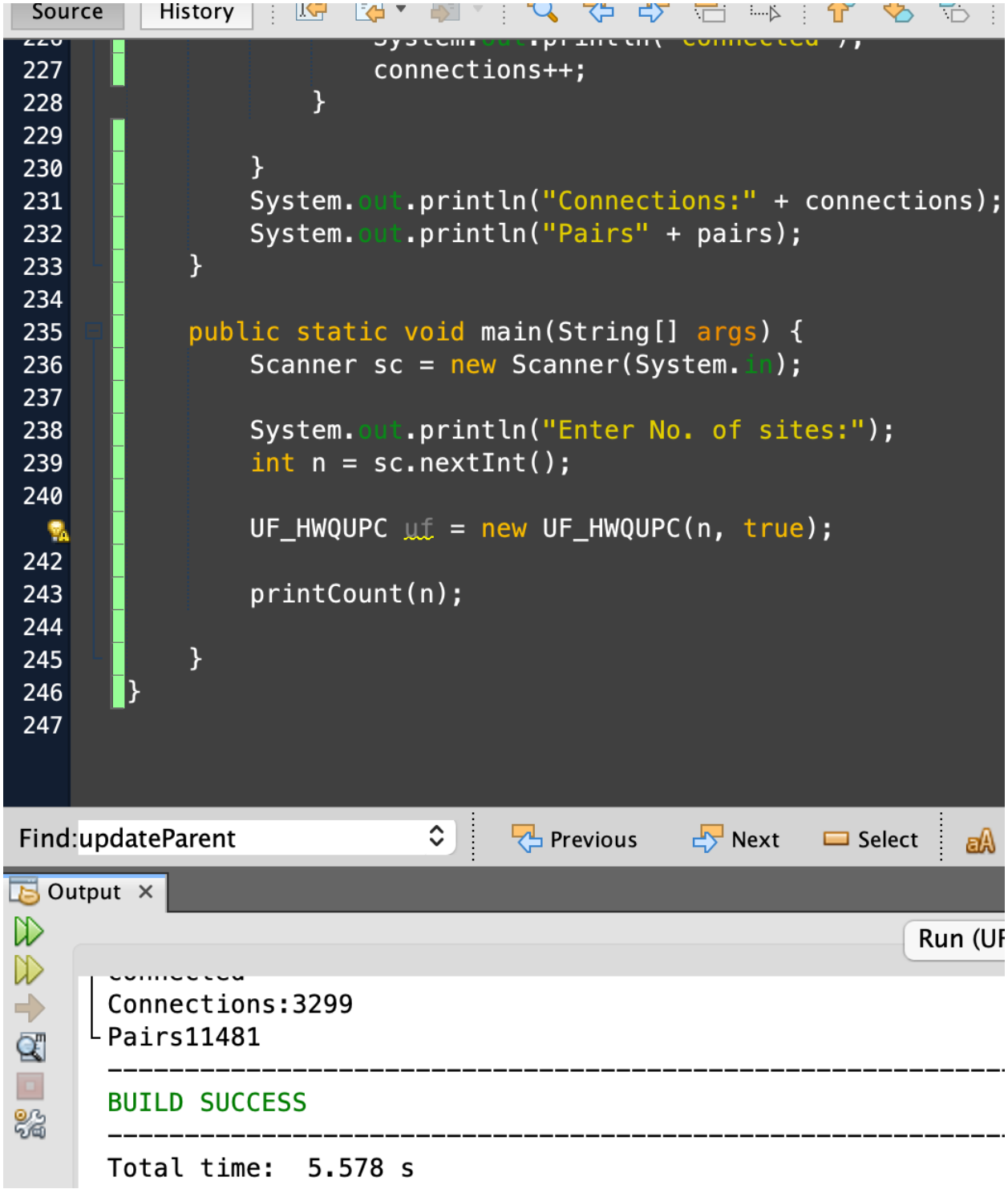
No. of Objects	pairs	1/2 *n(ln n)
500	1547	1,554
1400	5150	5,071
2300	10459	8,902
3300	13140	13,368
5500	24695	23,684
6000	24953	26,099

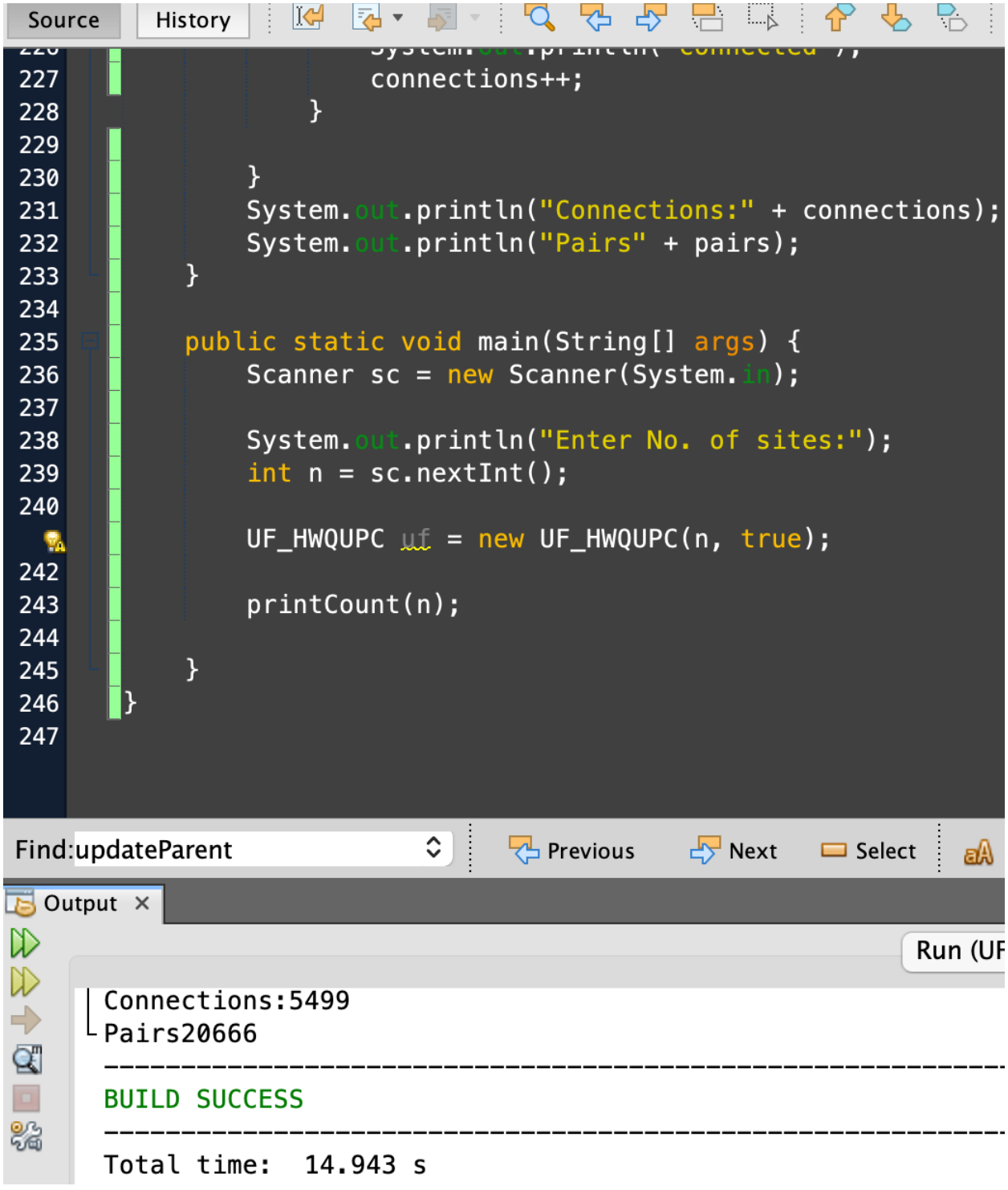

pairs and n(log n)
pairs
1/2 *n(ln n)
30000
20000
10000
0
1000
2000
3000
4000
5000
6000
No. of Objects


Source
History
connections++;
}
}
System.out.println("Connections:" + connections);
System.out.println("Pairs" + pairs);
}
public static void main(String[] args) {
Scanner sc = new Scanner(System.in);
System.out.println("Enter No. of sites:");
int n = sc.nextInt();
UF_HWQUPC uf = new UF_HWQUPC(n, true);
printCount(n);
}
}
Find:updateParent
Previous
Next
Select
Output
Run (UF_HWQUPC)
connected
connected
Connections:499
Pairs1434
BUILD SUCCESS
Total time: 10.385 s


UF_HWQUPC.java
UF_HWQUPC_Test.java
VehicleList.java
ViewPanel.java
Source
History
connections++;
}
}
System.out.println("Connections:" + connections);
System.out.println("Pairs" + pairs);
}
public static void main(String[] args) {
Scanner sc = new Scanner(System.in);
System.out.println("Enter No. of sites:");
int n = sc.nextInt();
UF_HWQUPC uf = new UF_HWQUPC(n, true);
printCount(n);
}
}
Find:updateParent
Previous
Next
Select
Output
Run (UF_HWQUPC)
connected
Connections:1399
Pairs4784
BUILD SUCCESS
Total time: 2.409 s


Source
History
connections++;
}
}
System.out.println("Connections:" + connections);
System.out.println("Pairs" + pairs);
}
public static void main(String[] args) {
Scanner sc = new Scanner(System.in);
System.out.println("Enter No. of sites:");
int n = sc.nextInt();
UF_HWQUPC uf = new UF_HWQUPC(n, true);
printCount(n);
}
}
Find:updateParent
Previous
Next
Select
Output
Run (UF_HW
connected
Connections:2299
Pairs9088
BUILD SUCCESS
Total time: 2.996 s


Source
History
connections++;
}
}
System.out.println("Connections:" + connections);
System.out.println("Pairs" + pairs);
}
public static void main(String[] args) {
Scanner sc = new Scanner(System.in);
System.out.println("Enter No. of sites:");
int n = sc.nextInt();
UF_HWQUPC uf = new UF_HWQUPC(n, true);
printCount(n);
}
}
Find:updateParent
Previous
Next
Select
Output
Run (UF
Connections:3299
Pairs11481
BUILD SUCCESS
Total time: 5.578 s


Source
History
connections++;
}
}
System.out.println("Connections:" + connections);
System.out.println("Pairs" + pairs);
}
public static void main(String[] args) {
Scanner sc = new Scanner(System.in);
System.out.println("Enter No. of sites:");
int n = sc.nextInt();
UF_HWQUPC uf = new UF_HWQUPC(n, true);
printCount(n);
}
}
Find:updateParent
Previous
Next
Select
Output
Run (UF
Connections:5499
Pairs20666
BUILD SUCCESS
Total time: 14.943 s

```
227                     connections++;
228                 }
229
230             }
231             System.out.println("Connections:" + connections);
232             System.out.println("Pairs" + pairs);
233         }
234
235         public static void main(String[] args) {
236             Scanner sc = new Scanner(System.in);
237
238             System.out.println("Enter No. of sites:");
239             int n = sc.nextInt();
240
                UF_HWQUPC uf = new UF_HWQUPC(n, true);
242
243             printCount(n);
244
245         }
246     }
247
```

Find: updateParent Previous Next Select

Output

Run (UF_HWQUPC)

```
971
connected
Connections:5999
Pairs24953
------------------------------------------------------------------------
BUILD SUCCESS
------------------------------------------------------------------------
Total time:  4.776 s
```

- **Unit tests result**