

Project1 Info

Linux compilation command:

```
javac hash341/City.java hash341/Pair.java hash341/CityTable.java hash341/Hash24.java  
driver/First.java driver/Second.java driver/Tester.java driver/Proj4Test.java
```

Linux execution command:

```
java SpecifiedClass
```

Windows Compilation Command:

```
javac hash341\City.java hash341\Pair.java hash341\CityTable.java hash341\Hash24.java  
driver\First.java driver\Second.java driver\Tester.java driver\Proj4Test.java
```

Windows execution command:

```
java package.SpecifiedClass
```

Note to run on eclipse:

The file structure is different for eclipse so within my submission folder is another folder called Project1Eclipse that is modified so that the project can be run on Eclipse.

src.hash341 package

- City.java stores city information - name, longitude, latitude, etc.

- CityTable.java stores city information - implements perfect hashing scheme.

- Pair.java - additional class for CityTable.

- Hash24.java - given code for Hash Functions.

src.driver package

- First.java - First program as stated in instructions

 - The first program implemented reads in the text file US_Cities_LL.txt, constructs a hash table using perfect hashing, prints out the statistics described above and writes out the hash table to a file named US_Cities_LL.ser.

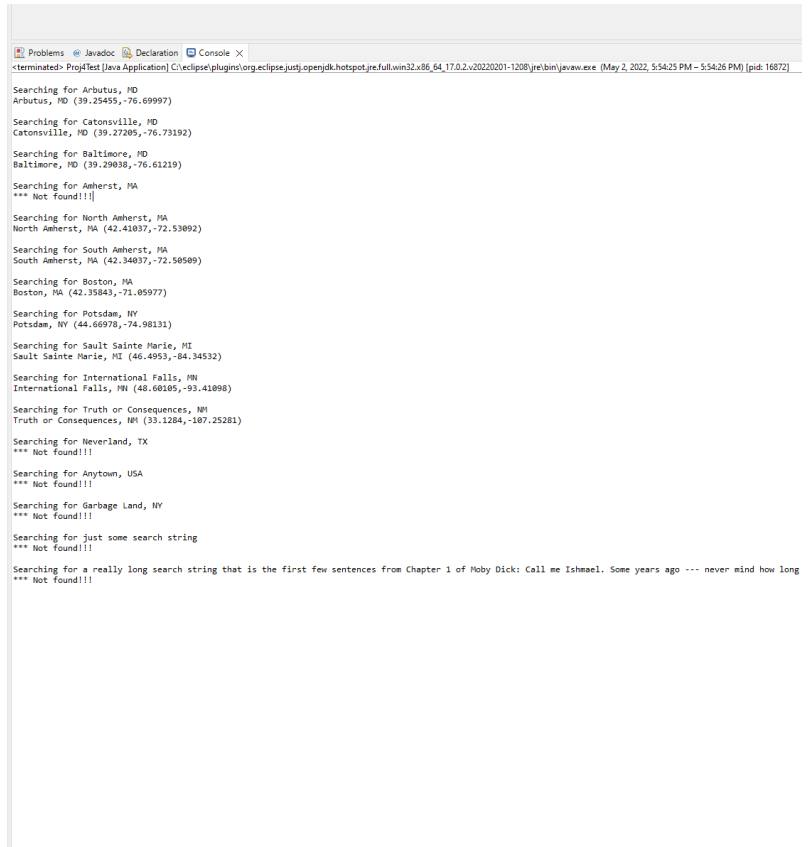
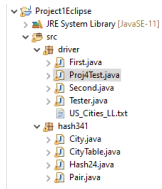
- Second.java - Second program as stated in instructions

 - The second program implemented reads in the hash table from the file named US_Cities_LL.ser and prompts the user to type in a city name (including the state). If the city is in the hash table, your program prints out the city's name and coordinates and also a URL that can be cut-and-pasted into a web browser.

- Tester.java - my own test program to test if all cities are in hash table

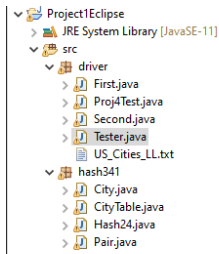
- Proj4Test.java - provided test program

Proj4Test.java - output:



Tester.java - output:

Tester checks if all cities are in the Hash Table



```
<terminated> Tester [Java Application] C:\eclipse\plugins\org.eclipse.justi.openjdk.hotspot.jre.full.win32.x86_64.17.0.2.v20220201-1208\jre\bin\javaw.exe (May 2, 2022, 5:57:43 PM -
Primary hash table hash function:
*** Hash24 dump ***
prime1 = 16890581
prime2 = 17027399
random_a = 13966628
random_b = 1754142
random_c = 6860665

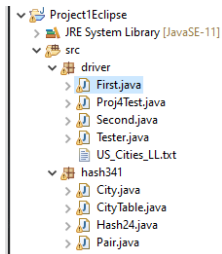
Primary hash table statistics:
Number of cities: 15937
Table size: 16000
Max collisions = 6
# of primary slots with 0 cities = 5879
# of primary slots with 1 cities = 5961
# of primary slots with 2 cities = 2880
# of primary slots with 3 cities = 967
# of primary slots with 4 cities = 255
# of primary slots with 5 cities = 53
# of primary slots with 6 cities = 5
# of primary slots with 7 cities = 0
# of primary slots with 8 cities = 0
# of primary slots with 9 cities = 0
# of primary slots with 10 cities = 0
# of primary slots with 11 cities = 0
# of primary slots with 12 cities = 0
# of primary slots with 13 cities = 0
# of primary slots with 14 cities = 0
# of primary slots with 15 cities = 0
# of primary slots with 16 cities = 0
# of primary slots with 17 cities = 0
# of primary slots with 18 cities = 0
# of primary slots with 19 cities = 0
# of primary slots with 20 cities = 0
# of primary slots with 21 cities = 0
# of primary slots with 22 cities = 0
# of primary slots with 23 cities = 0
# of primary slots with 24 cities = 0

*** Cities in the slot with most collisions ***
Dundee, FL (28.02252,-81.61924)
Danville, VA (36.58597,-79.39502)
Southport, NC (33.92156,-78.02027)
Winton, CA (37.38938,-120.61325)
Elma, WA (47.00343,-123.40877)
Capitol Heights, MD (38.88511,-76.91581)

Secondary hash table statistics:
# of secondary hash tables trying 1 hash functions = 3032
# of secondary hash tables trying 2 hash functions = 836
# of secondary hash tables trying 3 hash functions = 219
# of secondary hash tables trying 4 hash functions = 46
# of secondary hash tables trying 5 hash functions = 19
# of secondary hash tables trying 6 hash functions = 6
# of secondary hash tables trying 7 hash functions = 1
# of secondary hash tables trying 8 hash functions = 1
# of secondary hash tables trying 9 hash functions = 0
# of secondary hash tables trying 10 hash functions = 0
# of secondary hash tables trying 11 hash functions = 0
# of secondary hash tables trying 12 hash functions = 0
# of secondary hash tables trying 13 hash functions = 0
# of secondary hash tables trying 14 hash functions = 0
# of secondary hash tables trying 15 hash functions = 0
# of secondary hash tables trying 16 hash functions = 0
# of secondary hash tables trying 17 hash functions = 0
# of secondary hash tables trying 18 hash functions = 0
# of secondary hash tables trying 19 hash functions = 0
# of secondary hash tables trying 20 hash functions = 0

Number of secondary hash tables with more than 1 item = 4160
Average # of hash functions tried = 1.3680289
All cities found !!!!!!!!!!!!!!!
```

First.java - output:



```
// TDDO Auto-generated method stub

<terminated> First [Java Application] C:\eclipse\plugins\org.eclipse.justi.openjdk.hotspot.jre.full.win32.x86_64_17.0.2.v20220201-1208\jre\bin\javaw.exe (May 2, 2022, 5:58:45 PM - 5:58:45 PM)

Primary hash table hash function:
*** Hash24 dump ***
prime1 = 16890561
prime2 = 17027399
random_a = 16566110
random_b = 13975772
random_c = 142217

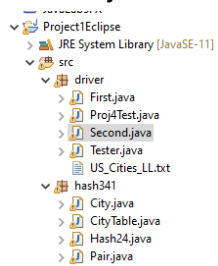
Primary hash table statistics:
Number of cities: 15937
Table size: 16000
Max collisions = 6
# of primary slots with 0 cities = 5910
# of primary slots with 1 cities = 5887
# of primary slots with 2 cities = 2924
# of primary slots with 3 cities = 983
# of primary slots with 4 cities = 236
# of primary slots with 5 cities = 51
# of primary slots with 6 cities = 9
# of primary slots with 7 cities = 0
# of primary slots with 8 cities = 0
# of primary slots with 9 cities = 0
# of primary slots with 10 cities = 0
# of primary slots with 11 cities = 0
# of primary slots with 12 cities = 0
# of primary slots with 13 cities = 0
# of primary slots with 14 cities = 0
# of primary slots with 15 cities = 0
# of primary slots with 16 cities = 0
# of primary slots with 17 cities = 0
# of primary slots with 18 cities = 0
# of primary slots with 19 cities = 0
# of primary slots with 20 cities = 0
# of primary slots with 21 cities = 0
# of primary slots with 22 cities = 0
# of primary slots with 23 cities = 0
# of primary slots with 24 cities = 0

*** Cities in the slot with most collisions ***
Elkin, NC (36.2443,-80.8484)
Janesville, WI (42.68279,-89.01872)
Modesto, CA (37.6391,-120.99688)
Fairfax, MN (44.52913,-94.72082)
Ham Lake, MN (45.25024,-93.24995)
Wolfhurs, OH (40.06924,-80.7837)

Secondary hash table statistics:
# of secondary hash tables trying 1 hash functions = 3098
# of secondary hash tables trying 2 hash functions = 795
# of secondary hash tables trying 3 hash functions = 222
# of secondary hash tables trying 4 hash functions = 63
# of secondary hash tables trying 5 hash functions = 16
# of secondary hash tables trying 6 hash functions = 9
# of secondary hash tables trying 7 hash functions = 0
# of secondary hash tables trying 8 hash functions = 0
# of secondary hash tables trying 9 hash functions = 0
# of secondary hash tables trying 10 hash functions = 0
# of secondary hash tables trying 11 hash functions = 0
# of secondary hash tables trying 12 hash functions = 0
# of secondary hash tables trying 13 hash functions = 0
# of secondary hash tables trying 14 hash functions = 0
# of secondary hash tables trying 15 hash functions = 0
# of secondary hash tables trying 16 hash functions = 0
# of secondary hash tables trying 17 hash functions = 0
# of secondary hash tables trying 18 hash functions = 0
# of secondary hash tables trying 19 hash functions = 0
# of secondary hash tables trying 20 hash functions = 0

Number of secondary hash tables with more than 1 item = 4203
Average # of hash functions tried = 1.3656912
```

Second.java - output:



```
// TDDO Auto-generated method stub

<terminated> Second [Java Application] C:\eclipse\plugins\org.eclipse.justi.openjdk.hotspot.jre.full.win32.x86_64_17.0.2.v20220201-1208\jre\bin\javaw.exe (May 2, 2022, 5:59:22 PM - 5:59:22 PM)

Enter City, State (or 'quit'): Bastrop, TX
Found Bastrop, TX (30.11049,-97.31527)
http://www.google.com/maps?z=10&q=30.11049,-97.31527
Enter City, State (or 'quit'): Baltimore, MD
Found Baltimore, MD (39.29038,-76.61219)
http://www.google.com/maps?z=10&q=39.29038,-76.61219
Enter City, State (or 'quit'): Brooklyn, NY
Found Brooklyn, NY (40.6501,-73.94958)
http://www.google.com/maps?z=10&q=40.6501,-73.94958
Enter City, State (or 'quit'): Neverland, TX
Could not find 'Neverland, TX'
Enter City, State (or 'quit'): quit
```

Putty Output:

```
[ivanattexas]@compute ~/Project1Submission> (22:33:26 05/02/22)
:: javac hash341/City.java hash341/Pair.java hash341/CityTable.java hash341/Hash
24.java driver/First.java driver/Second.java driver/Tester.java driver/Proj4Test
.java
[ivanattexas]@compute ~/Project1Submission> (22:33:33 05/02/22)
```

```
[ivanattexas]@compute ~/Project1Submission> (22:33:33 05/02/22)
```

```
:: java driver/First
```

```
Primary hash table hash function:
```

```
*** Hash24 dump ***
```

```
prime1 = 16890581
```

```
prime2 = 17027399
```

```
random_a = 14595306
```

```
random_b = 5391300
```

```
random_c = 12057704
```

```
Primary hash table statistics:
```

```
Number of cities: 15937
```

```
Table size: 16000
```

```
Max collisions = 8
```

```
# of primary slots with 0 cities = 5886
# of primary slots with 1 cities = 5947
# of primary slots with 2 cities = 2898
# of primary slots with 3 cities = 962
# of primary slots with 4 cities = 241
# of primary slots with 5 cities = 55
# of primary slots with 6 cities = 9
# of primary slots with 7 cities = 1
# of primary slots with 8 cities = 1
# of primary slots with 9 cities = 0
# of primary slots with 10 cities = 0
# of primary slots with 11 cities = 0
# of primary slots with 12 cities = 0
# of primary slots with 13 cities = 0
# of primary slots with 14 cities = 0
# of primary slots with 15 cities = 0
# of primary slots with 16 cities = 0
# of primary slots with 17 cities = 0
# of primary slots with 18 cities = 0
# of primary slots with 19 cities = 0
# of primary slots with 20 cities = 0
# of primary slots with 21 cities = 0
# of primary slots with 22 cities = 0
# of primary slots with 23 cities = 0
# of primary slots with 24 cities = 0
```

```
*** Cities in the slot with most collisions ***
```

```
Muskegon Heights, MI (43.20113,-86.23895)
```

```
Greeley, NE (41.54862,-98.53118)
```

```
Saint Leo, FL (28.33723,-82.25842)
```

```
Lenexa, KS (38.95362,-94.73357)
```

```
Lansing, MI (42.73254,-84.55553)
```

```
Whitesboro, NY (43.12201,-75.29156)
```

```
King William, VA (37.68736,-77.01358)
```

```
Logansport, LA (31.97544,-93.99797)
```

```
Secondary hash table statistics:
```

```
# of secondary hash tables trying 1 hash functions = 3079
# of secondary hash tables trying 2 hash functions = 781
# of secondary hash tables trying 3 hash functions = 215
# of secondary hash tables trying 4 hash functions = 68
# of secondary hash tables trying 5 hash functions = 16
# of secondary hash tables trying 6 hash functions = 5
# of secondary hash tables trying 7 hash functions = 3
# of secondary hash tables trying 8 hash functions = 0
# of secondary hash tables trying 9 hash functions = 0
# of secondary hash tables trying 10 hash functions = 0
# of secondary hash tables trying 11 hash functions = 0
# of secondary hash tables trying 12 hash functions = 0
# of secondary hash tables trying 13 hash functions = 0
# of secondary hash tables trying 14 hash functions = 0
# of secondary hash tables trying 15 hash functions = 0
# of secondary hash tables trying 16 hash functions = 0
# of secondary hash tables trying 17 hash functions = 0
# of secondary hash tables trying 18 hash functions = 0
# of secondary hash tables trying 19 hash functions = 0
# of secondary hash tables trying 20 hash functions = 0
```

```
Number of secondary hash tables with more than 1 item = 4167
```

```
Average # of hash functions tried = 1.3652508
```

```
[ivanattexas]@compute ~/Project1Submission> (22:34:33 05/02/22)
:: java driver/Second
Enter City, State (or 'quit'): Bastrop, TX
Found Bastrop, TX (30.11049,-97.31527)
http://www.google.com/maps?z=10&q=30.11049,-97.31527
Enter City, State (or 'quit'): Neverland, TX
Could not find 'Neverland, TX'
Enter City, State (or 'quit'): quit
```

```

[ivanattexas]@compute ~/Project1Submission> (22:35:14 05/02/22)
:: java driver/Tester
Primary hash table hash function:
*** Hash24 dump ***
prime1 = 16890581
prime2 = 17027399
random_a = 442617
random_b = 10403432
random_c = 3403079

Primary hash table statistics:
  Number of cities: 15937
  Table size: 16000
  Max collisions = 7
    # of primary slots with 0 cities = 5969
    # of primary slots with 1 cities = 5784
    # of primary slots with 2 cities = 2938
    # of primary slots with 3 cities = 1020
    # of primary slots with 4 cities = 237
    # of primary slots with 5 cities = 44
    # of primary slots with 6 cities = 7
    # of primary slots with 7 cities = 1
    # of primary slots with 8 cities = 0
    # of primary slots with 9 cities = 0
    # of primary slots with 10 cities = 0
    # of primary slots with 11 cities = 0
    # of primary slots with 12 cities = 0
    # of primary slots with 13 cities = 0
    # of primary slots with 14 cities = 0
    # of primary slots with 15 cities = 0
    # of primary slots with 16 cities = 0
    # of primary slots with 17 cities = 0
    # of primary slots with 18 cities = 0
    # of primary slots with 19 cities = 0
    # of primary slots with 20 cities = 0
    # of primary slots with 21 cities = 0
    # of primary slots with 22 cities = 0
    # of primary slots with 23 cities = 0
    # of primary slots with 24 cities = 0

*** Cities in the slot with most collisions ***
  Sneads, FL (30.70769,-84.92437)
  Cherryville, PA (40.75398,-75.53852)
  Staunton, IL (39.01227,-89.79121)
  Evans City, PA (40.76923,-80.06284)
  Myrtle Grove, NC (34.13462,-77.88165)
  Humansville, MO (37.79448,-93.57798)
  Peaceful Valley, WA (48.93815,-122.14734)

Secondary hash table statistics:
  # of secondary hash tables trying 1 hash functions = 3102
  # of secondary hash tables trying 2 hash functions = 839
  # of secondary hash tables trying 3 hash functions = 227
  # of secondary hash tables trying 4 hash functions = 59
  # of secondary hash tables trying 5 hash functions = 14
  # of secondary hash tables trying 6 hash functions = 3
  # of secondary hash tables trying 7 hash functions = 0
  # of secondary hash tables trying 8 hash functions = 2
  # of secondary hash tables trying 9 hash functions = 1
  # of secondary hash tables trying 10 hash functions = 0
  # of secondary hash tables trying 11 hash functions = 0
  # of secondary hash tables trying 12 hash functions = 0
  # of secondary hash tables trying 13 hash functions = 0
  # of secondary hash tables trying 14 hash functions = 0
  # of secondary hash tables trying 15 hash functions = 0
  # of secondary hash tables trying 16 hash functions = 0
  # of secondary hash tables trying 17 hash functions = 0
  # of secondary hash tables trying 18 hash functions = 0
  # of secondary hash tables trying 19 hash functions = 0
  # of secondary hash tables trying 20 hash functions = 0

Number of secondary hash tables with more than 1 item = 4247
Average # of hash functions tried = 1.3680245
All cities found !!!!!!!!!!!!!!!

```



```
[ivanattexas]@compute ~/Project1Submission> (22:35:30 05/02/22)
:: java driver/Proj4Test
```

```
Searching for Arbutus, MD
Arbutus, MD (39.25455,-76.69997)
```

```
Searching for Catonsville, MD
Catonsville, MD (39.27205,-76.73192)
```

```
Searching for Baltimore, MD
Baltimore, MD (39.29038,-76.61219)
```

```
Searching for Amherst, MA
*** Not found!!!
```

```
Searching for North Amherst, MA
North Amherst, MA (42.41037,-72.53092)
```

```
Searching for South Amherst, MA
South Amherst, MA (42.34037,-72.50509)
```

```
Searching for Boston, MA
Boston, MA (42.35843,-71.05977)
```

```
Searching for Potsdam, NY
Potsdam, NY (44.66978,-74.98131)
```

```
Searching for Sault Sainte Marie, MI
Sault Sainte Marie, MI (46.4953,-84.34532)
```

```
Searching for International Falls, MN
International Falls, MN (48.60105,-93.41098)
```

```
Searching for Truth or Consequences, NM
Truth or Consequences, NM (33.1284,-107.25281)
```

```
Searching for Neverland, TX
*** Not found!!!
```

```
Searching for Anytown, USA
*** Not found!!!
```

```
Searching for Garbage Land, NY
*** Not found!!!
```

```
Searching for just some search string
*** Not found!!!
```

```
Searching for a really long search string that is the first few sentences
part of the world. It is a way I have of driving off the spleen and re-
ect; and especially whenever my hypos get such an upper hand of me, tli-
ll. With a philosophical flourish Cato throws himself upon his sword;
*** Not found!!!
```