CSCI 3415 – Principles of Programming Languages
Fall 2018 – Dr. Doug Williams
Program 3b – Racket
Due December 12, 2018

From Wikipedia:

> Racket (formerly PLT Scheme) is a general purpose, multi-paradigm programming language in the Lisp-Scheme family. One of its design goals is to serve as a platform for language creation, design, and implementation. The language is used in a variety of contexts such as scripting, general-purpose programming, computer science education, and research.

Additional information can be found on the Racket web site at https://racket-lang.org/.

In this program you will implement a program to analyze meteorite data from the Kaggle web site https://www.kaggle.com/. The simple-meteorite.rkt program is provided on Canvas and produces the following map of meteorite landings.

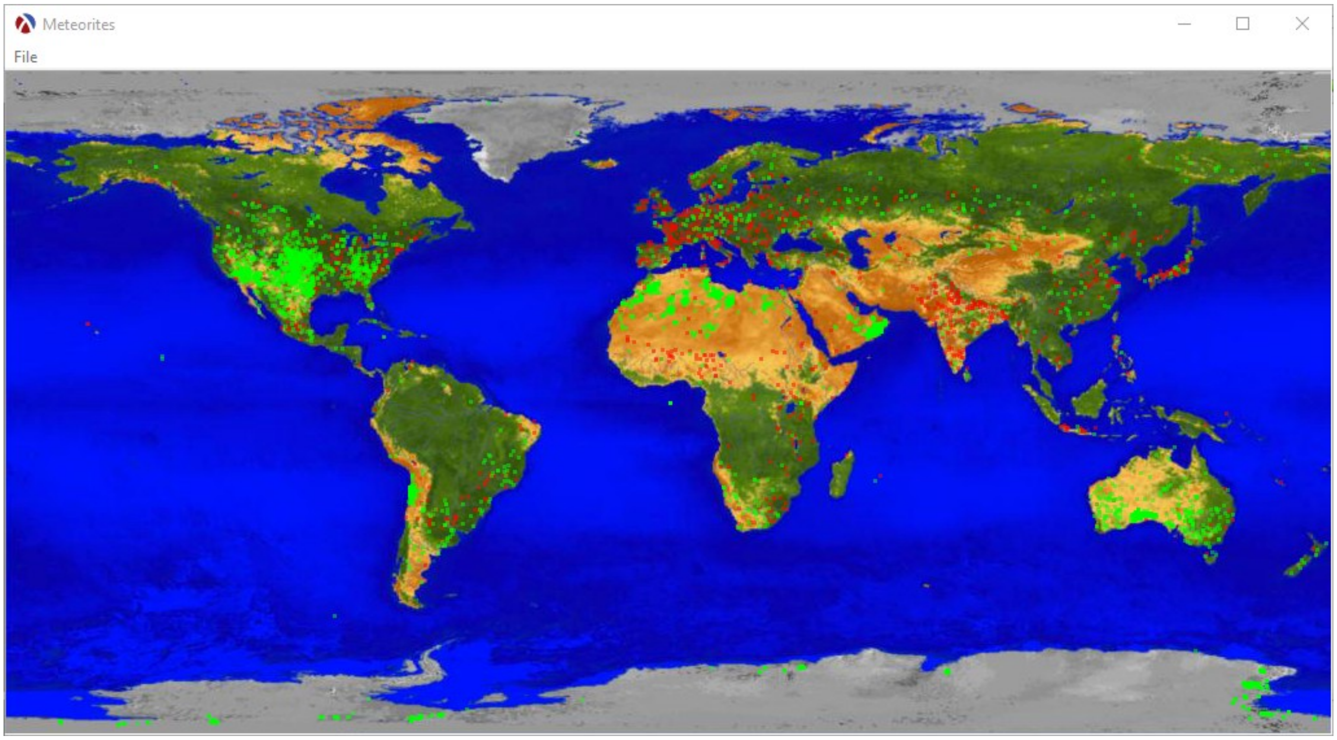


Illustration 1: Simple Meteorite Program (simple-meteorite.rkt)

Part 1 – Download Racket

From the home page of the Racket web site, select the Download button on the top, right side of the page. This takes you to a web page that allows you to download Racket for the various platforms – Windows, Mac OS X, or Linux. Install the downloaded file for your platform.

The distribution includes complete documentation, which is also available on the Racket web site.

Part II – Meteorite Data

The meteorite data contains identification, description, mass, and location data for 45,000+ meteorites that have fallen (and in most cases recovered) on Earth. This data is in the file meteorite-landings.csv on the Canvas site.

The data contains the following variables:

- name: the name of the meteorite (typically a location, often modified with a number, year, composition, etc)
- id: a unique identifier for the meteorite
- nametype: one of:
    - valid: a typical meteorite
    - relict: a meteorite that has been highly degraded by weather on Earth
- recclass: the class of the meteorite; one of a large number of classes based on physical, chemical, and other characteristics (see the Wikipedia article on meteorite classification for a primer)
- mass: the mass of the meteorite, in grams
- fall: whether the meteorite was seen falling, or was discovered after its impact; one of:
    - Fell: the meteorite's fall was observed
    - Found: the meteorite's fall was not observed
- year: the year the meteorite fell, or the year it was found (depending on the value of fell)
- reclat: the latitude of the meteorite's landing
- reclong: the longitude of the meteorite's landing
- GeoLocation: a parentheses-enclose, comma-separated tuple that combines reclat and reclong

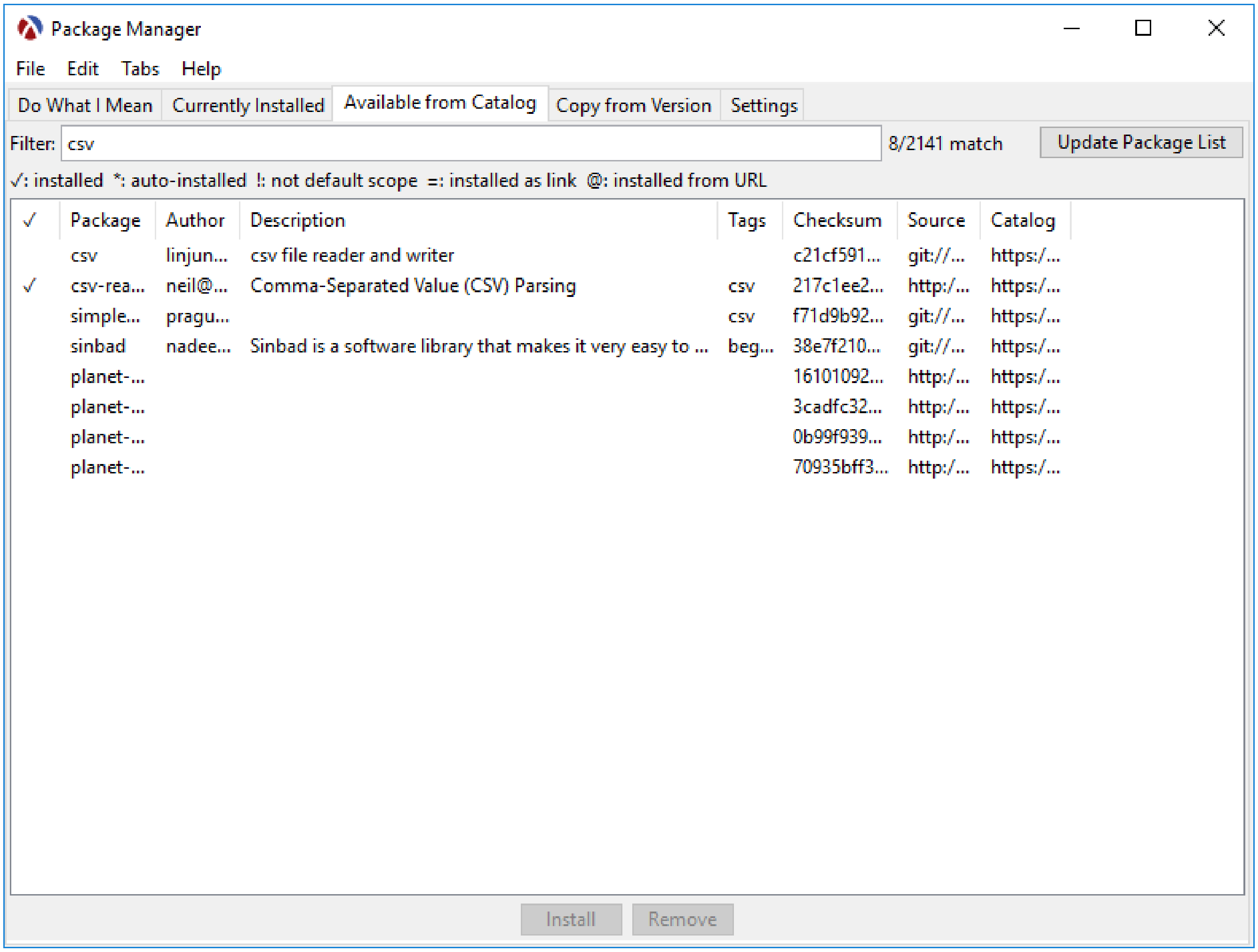
Here are the first ten (10) lines of the meteorite landings data.

```
name,id,nametype,recclass,mass,fall,year,reclat,reclong,GeoLocation
Aachen,1,Valid,L5,21,Fell,1880,50.775000,6.083330,"(50.775000, 6.083330)"
Aarhus,2,Valid,H6,720,Fell,1951,56.183330,10.233330,"(56.183330, 10.233330)"
Abee,6,Valid,EH4,107000,Fell,1952,54.216670,-113.000000,"(54.216670, -113.000000)"
Acapulco,10,Valid,Acapulcoite,1914,Fell,1976,16.883330,-99.900000,"(16.883330, -99.900000)"
Achiras,370,Valid,L6,780,Fell,1902,-33.166670,-64.950000,"(-33.166670, -64.950000)"
Adhi Kot,379,Valid,EH4,4239,Fell,1919,32.100000,71.800000,"(32.100000, 71.800000)"
Adzhi-Bogdo (stone),390,Valid,LL3-6,910,Fell,1949,44.833330,95.166670,"(44.833330, 95.166670)"
Agen,392,Valid,H5,30000,Fell,1814,44.216670,0.616670,"(44.216670, 0.616670)"
Aguada,398,Valid,L6,1620,Fell,1930,-31.600000,-65.233330,"(-31.600000, -65.233330)"
```

Part III – CSV Parsing

Because the meteorite landing CSV file includes quoted text fields (that include embedded commas), it is better to use an existing CSV parsing package rather than doing it yourself. I used the csv-reading package to do this in the simple-meteorite.rkt program.

To load this package, use the Racket package manager, which is available from the Racket IDE(DrRacket) using the Package Manager… menu item under the File menu. Use the Available from Catalog tab to search for and install the csv-reading package as shown below.



Filter: csv

8/2141 match

✓: installed *: auto-installed !: not default scope =: installed as link @: installed from URL

✓	Package	Author	Description	Tags	Checksum	Source	Catalog
	csv	linjun...	csv file reader and writer		c21cf591...	git://...	https:/...
✓	csv-rea...	neil@...	Comma-Separated Value (CSV) Parsing	csv	217c1ee2...	http:/...	https:/...
	simple...	pragu...		csv	f71d9b92...	git://...	https:/...
	sinbad	nadee...	Sinbad is a software library that makes it very easy to ...	beg...	38e7f210...	git://...	https:/...
	planet-...				16101092...	http:/...	https:/...
	planet-...				3cadfc32...	http:/...	https:/...
	planet-...				0b99f939...	http:/...	https:/...
	planet-...				70935bff3...	http:/...	https:/...

Illustration 2: Using the Package Manager to Install the csv-reading Package

Once the csv-reading package has been installed, it is available for use in Racket.

Part IV – Specifics

Download the Program 5 file for the course's Canvas web site into a suitable location on your computer. If Racket and the csv-reading reading package have been installed, the simple-meteorite.rkt program should run on your machine.

For this assignment, you will make additions to this program.

Each student will extend the simple-meteorites.rkt Racket program as follows:

- For a C-level grade, you must get the simple-meteorites.rkt Racket program as written running.
- For a B-level grade, you must add a latitude and longitude grid to the output. Specifically, draw a light grid for every 10 degrees of latitude and longitude. Then, draw heavier lines for the equator (i.e., latitude 0) and the prime meridian (i.e., longitude 0). Also, don't plot those meteorites with lat and long values of 0.
- For an A-level grade, you must draw the meteorite size proportional to the mass of the meteorite, using a logarithmic scale.

The figure below shows a sample A-level program output.

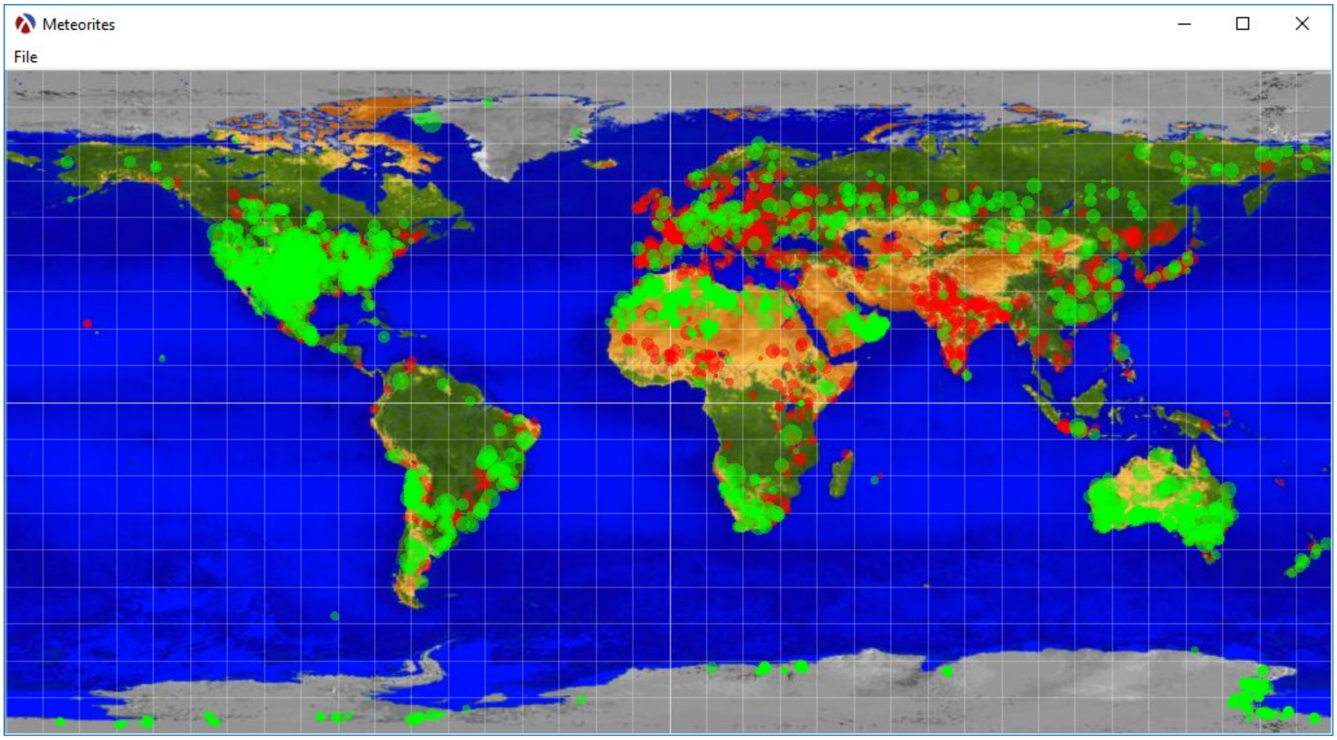


Illustration 3: Output with grid and meteorite sizes proportional to the log of the mass.

Notes:

1. There are several map graphics provided that can be used as the background map. Feel free to use a different one. But, you may want to change color schemes in your program to increase visibility.
2. You need to be careful when processing the mass data. It may be missing in some cases or may be encoded as 0 in others. You may either ignore these meteorites or assign them a nominal mass value (e.g., 1).
3. Also, you will want to use some minimum size for the meteorites since log will produce very small values for small masses – too small to be seen. I used a minimum pen width of 3 to draw the example above.
4. Using something like

   ```
   (for ((lat (in-range -90.0 90.0 10.0)))
     …)
   ```

   to draw the latitude lines is the easiest was to do the iteration.

As usual, a report on the problem, your program, and the results must be submitted to canvas. On Windows, the Snipping Tool is the easiest way to capture the resulting window.