

# NASA'S EXO-PLANET DATABASE ANALYSIS

---

By Christopher Figueroa

# INTRODUCTION

---

- Earth Similarity Index (ESI) – measures the similarity of exo-planets to Earth.
- 5,220 confirmed planets, 9,151 candidates
- NASA Technical Reports Server (NTRS) stores the main exo-planet data
- The Deep Space Network (DSN) stores the data collected from the space probes
- Stored in a relational database model

## THE 4 ESI VARIANTS

---

- NASA's Standard ESI
- NASA's Weighted ESI
- Derived Custom ESI
- Derived Revised ESI

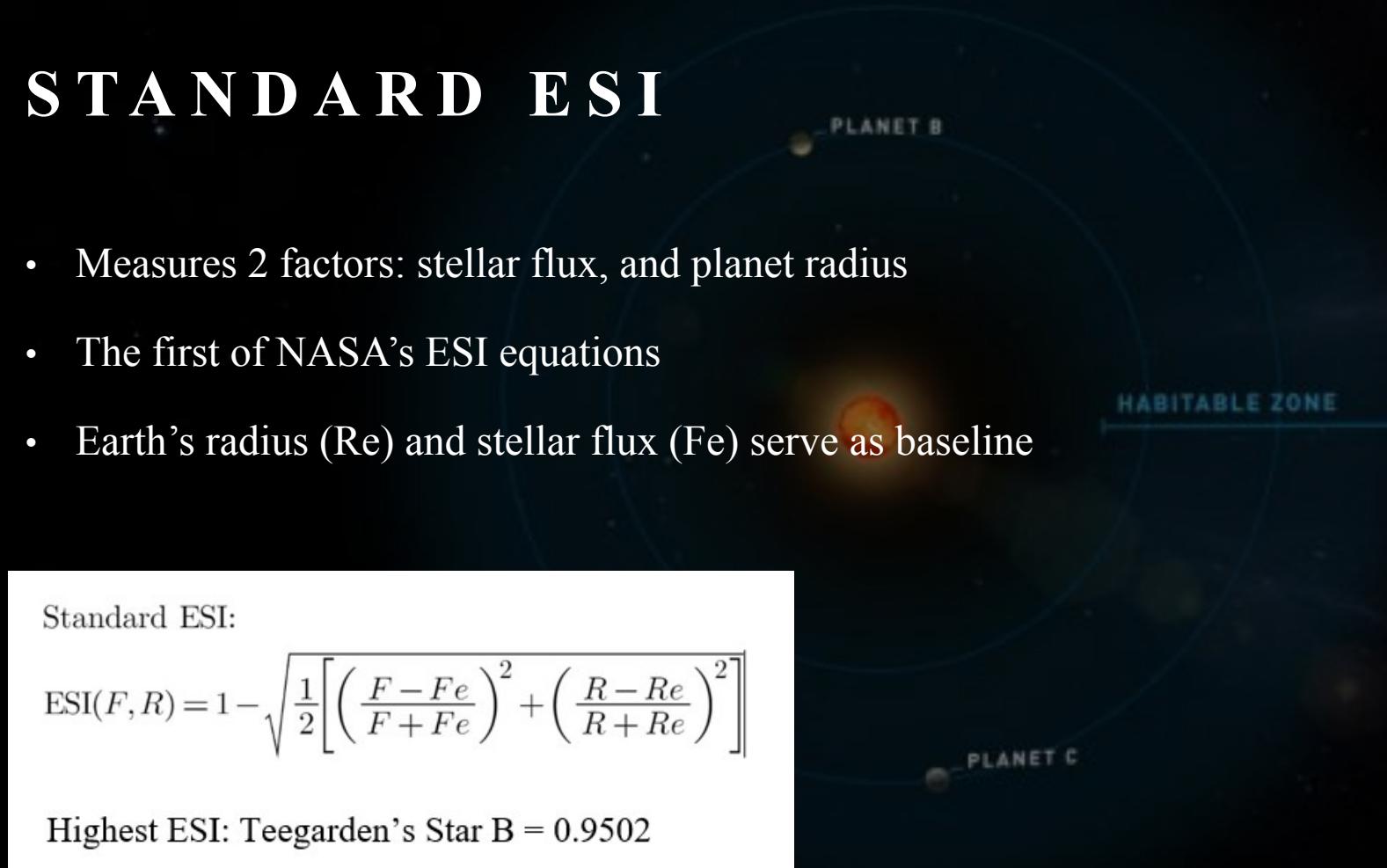
# STANDARD ESI

- Measures 2 factors: stellar flux, and planet radius
- The first of NASA's ESI equations
- Earth's radius ( $R_e$ ) and stellar flux ( $F_e$ ) serve as baseline

Standard ESI:

$$\text{ESI}(F, R) = 1 - \sqrt{\frac{1}{2} \left[ \left( \frac{F - F_e}{F + F_e} \right)^2 + \left( \frac{R - R_e}{R + R_e} \right)^2 \right]}$$

Highest ESI: Teegarden's Star B = 0.9502



# W E I G H T E D   E S I

- 5 variables: stellar flux, radius, density, escape velocity, and temperature
- Each variable has weights
- More accurate than Standard ESI

Weighted ESI variables:

Variables	Weights
Flux	1
Radius	0.57
Density	1.07
Escape Velocity	0.70
Temperature	5.58

Weighted ESI:

$$\text{ESI}(F, R, D, E, T) = 1 - \sqrt{\frac{1}{5} \left[ \left( \frac{F - F_e}{F + F_e} \right)^2 + (0.57) \left( \frac{R - R_e}{R + R_e} \right)^2 + (1.07) \left( \frac{D - D_e}{D + D_e} \right)^2 + (0.70) \left( \frac{E - E_e}{E + E_e} \right)^2 + (5.58) \left( \frac{T - T_e}{T + T_e} \right)^2 \right]}$$

Highest ESI: Teegarden's Star B = 0.9636

# C U S T O M   E S I

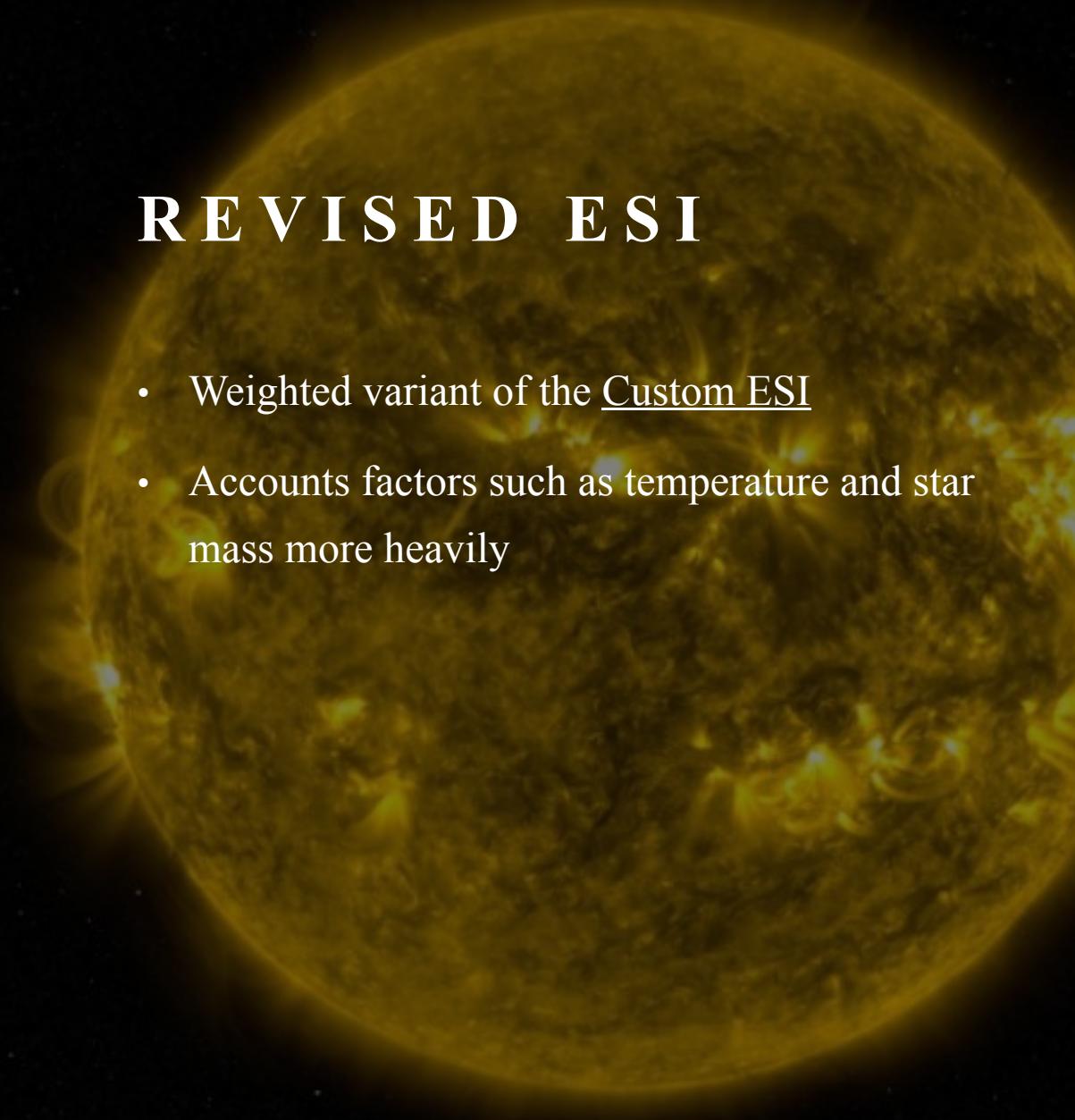
- First of my own derived test ESI equations
- 9 variables in total, unweighted

Variables: Flux, Radius, Gravity, Planet Mass, Temperature, Star Temperature, Star Mass, Orbital Period, Density.

Custom ESI:

$$\text{ESI}(F, R, G, M, T, K, S, O, D) = \prod_{i=1}^9 \left( 1 - \left| \frac{x_i - x_{io}}{x_i + x_{io}} \right| \right)$$

Highest ESI: Venus = 0.7996



# REVISED ESI

- Weighted variant of the Custom ESI
- Accounts factors such as temperature and star mass more heavily

Revised ESI variables:

Variables	Weights
Flux	3.2
Radius	0.57
Gravity	4.75
Planet Mass	0.4
Temperature	10.58
Star Temperature	1
Star Mass	1
Orbital Period	1
Density	2.8

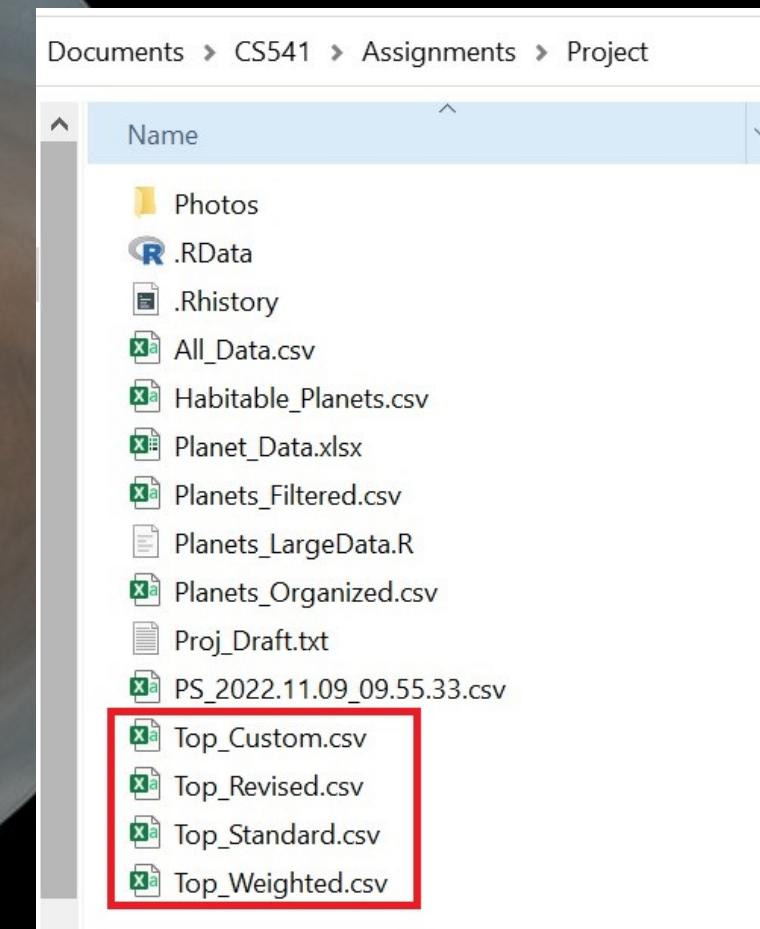
Revised ESI:

$$\text{ESI}(F, R, G, M, T, K, S, O, D) = \prod_{i=1}^9 \left( 1 - \left| \frac{x_i - x_{io}}{x_i + x_{io}} \right| \right)^{\frac{wi}{9}}$$

Highest ESI: Kepler-452 B = 0.8478

# C O D I N G   S E T U P

- Downloaded NASA's exoplanet catalog as a .csv file
- Installed R language and R studio to process database
- Filtered out unnecessary columns, 92 was the initial amount
- Filtered out blank data to make ESI calculations possible





```
Plants_LargeData.R x topstandard x topweighted x topcustom x toprevised x revised x
Go to file/function Addins

1 #installs the necessary packages to read .csv files
2 #install.packages("tidyverse")
3 library(tidyverse)
4
5 #creates a planets variable to read the .csv file into a large data table
6 planets <- read.csv(file="PS_2022.11.09_09.55.33.csv", skip=96, sep=",")
7
8 #creates a filtered variant of table above, -c skips over certain columns
9 filtered <- read.csv(file="PS_2022.11.09_09.55.33.csv", skip=96, sep=",")[-c(2:11,13:19,21:27,29:40,42:44,46:51,53:55,56:59,61:63)]
10
11 #generates a .csv file from the filtered data
12 write.csv(filtered, "Planets_Filtered.csv", row.names=FALSE)
13 #reads the .csv file of filtered data
14 averages <- read.csv(file="Planets_Filtered.csv", sep=",")
15
16 #filters out any nulls or zeros one column at a time
17 library(dplyr)
18 orbit <- subset(averages, !is.na(pl_orbper))
19 radius <- subset(orbit, !is.na(pl_rade))
20 mass <- subset(radius, !is.na(pl_bmasse))
21 flux <- subset(mass, !is.na(pl_insol))
22 temperature <- subset(flux, !is.na(pl_eqt))
23 startemp <- subset(temperature, !is.na(st_teff))
24 starmass <- subset(startemp, !is.na(st_mass))
25
26 #imports smaller .csv file with habitable planets
27 habitable <- read.csv(file="Habitable_Plansets.csv", sep=",")
28 #appends habitable graph to star mass graph
29 organized <- rbind(habitable, starmass)
30
31 #exports organized .csv data
32
33
```

19:41 (Top Level) ↴

Console Terminal × Background Jobs ×

R 4.2.2 · C:/Users/Administrator/Desktop/Documents/CS541/Assignments/Project/ ↴

Platform: x86\_64-w64-mingw32/x64 (64-bit)

R is free software and comes with ABSOLUTELY NO WARRANTY.  
You are welcome to redistribute it under certain conditions.  
Type 'license()' or 'licence()' for distribution details.

R is a collaborative project with many contributors.  
Type 'contributors()' for more information and  
'citation()' on how to cite R or R packages in publications.

Type 'demo()' for some demos, 'help()' for on-line help, or  
'help.start()' for an HTML browser interface to help.  
Type 'q()' to quit R.

[workspace loaded from c:/users/Administrator/Desktop/Documents/cs541/Assignments/Project/.RData]

> |

Project: (None)

Environment History Connections Tutorial

R Global Environment

Data

Name	Size
averages	33719 obs. of 8 variables
custom	313 obs. of 14 variables
escape	313 obs. of 10 variables
filtered	33719 obs. of 8 variables
flux	307 obs. of 8 variables
gravity	313 obs. of 11 variables
habitable	63 obs. of 8 variables
mass	2210 obs. of 8 variables
nodups	313 obs. of 8 variables
orbit	30874 obs. of 8 variables
organized	331 obs. of 8 variables
planetden...	313 obs. of 9 variables
planets	33719 obs. of 92 variables
radius	21041 obs. of 8 variables
renamed	331 obs. of 8 variables
revised	313 obs. of 15 variables
standard	313 obs. of 12 variables
starmass	268 obs. of 8 variables
startemp	268 obs. of 8 variables
temperatu...	268 obs. of 8 variables

Files Plots Packages Help Viewer Present

Desktop > Documents > CS541 > Assignments > Project

▲ Name Size

Name	Size
.RData	4.3 MB
.Rhistory	26.6 KB
~\$Planet_Data.xlsx	165 B
All_Data.csv	54.5 KB
Habitable_Plansets.csv	2.9 KB
Photos	
Planet_Data.xlsx	21.4 KB
Planets_Filtered.csv	1.6 MB
Planets_LargeData.R	4.5 KB
Planets_Organized.csv	17.4 KB
Proj Draft.txt	6.6 KB

Go to file/function

Addins

Project: (None)

```
31 #exports organized .csv data
32 write.csv(organized, "Planets_Organized.csv", row.names=FALSE)
33
34 #creates renamed table
35 oldnames = c("pl_name", "pl_orbper", "pl_rade", "pl_bmasse", "pl_insol", "pl_eqt", "st_teff", "st_mass")
36 newnames = c("Planet_Name", "Orbit_Period", "Planet_Radius", "Planet_Mass", "Stellar_Flux", "Temperature", "Star_Temperature", "Radius")
37 renamed <- organized %>% rename_at(vars(oldnames), ~ newnames)
38 #removes duplicates
39 nodups <- renamed %>% distinct(Planet_Name, .keep_all=TRUE)
40
41 #adds columns based on calculations
42 planetdensity <- nodups %>% mutate(Planet_Density=(5.51*(4.19*(Planet_Mass/((4/3)*(22/7)*(Planet_Radius^3))))))
43 escape <- planetdensity %>% mutate(Escape_Velocity=(11.186*(0.7072*sqrt((Planet_Mass^2)/Planet_Radius))))
44 gravity <- escape %>% mutate(Gravity=(9.82*(Planet_Mass/(Planet_Radius)^2)))
45
46 #ESI variants analysis
47 #ESI Standard
48 standard <- gravity %>% mutate(ESI_Standard=
49 (1-sqrt((1/2)*(((Stellar_Flux-1)/(Stellar_Flux+1))^2+
50 ((Planet_Radius-1)/(Planet_Radius+1))^2)))
51 #ESI weighted
52 weighted <- standard %>% mutate(ESI_Weighted=
53 (1-sqrt((1/3)*(((Stellar_Flux-1)/(Stellar_Flux+1))^2+
54 (0.57*((Planet_Radius-1)/(Planet_Radius+1))^2)+ 
55 (1.07*((Planet_Density-5.51)/(Planet_Density+5.51))^2)+ 
56 (0.7*((Escape_Velocity-11.186)/(Escape_Velocity+11.186))^2)+ 
57 (5.58*((Temperature-288)/(Temperature+288))^2)))
58 #ESI custom
59 custom <- weighted %>% mutate(ESI_Custom=
60 (1-sqrt((1/9)*(((Stellar_Flux-1)/(Stellar_Flux+1))^2+
61 ((Planet_Radius-1)/(Planet_Radius+1))^2)))
62
63
```

90:35 [Top Level]

Console Terminal Background Jobs

R 4.2.2 · C:/Users/Administrator/Desktop/Documents/CS541/Assignments/Project/

Platform: x86\_64-w64-mingw32/x64 (64-bit)

R is free software and comes with ABSOLUTELY NO WARRANTY.  
You are welcome to redistribute it under certain conditions.  
Type 'license()' or 'licence()' for distribution details.

R is a collaborative project with many contributors.  
Type 'contributors()' for more information and  
'citation()' on how to cite R or R packages in publications.

Type 'demo()' for some demos, 'help()' for on-line help, or  
'help.start()' for an HTML browser interface to help.  
Type 'q()' to quit R.

[workspace loaded from C:/Users/Administrator/Desktop/Documents/CS541/Assignments/Project/.RData]

&gt; |

Environment History Connections Tutorial

R Global Environment

averages	33719 obs. of 8 variables
custom	313 obs. of 14 variables
escape	313 obs. of 10 variables
filtered	33719 obs. of 8 variables
flux	307 obs. of 8 variables
gravity	313 obs. of 11 variables
habitable	63 obs. of 8 variables
mass	2210 obs. of 8 variables
nodups	313 obs. of 8 variables
orbit	30874 obs. of 8 variables
organized	331 obs. of 8 variables
planetden...	313 obs. of 9 variables
planets	33719 obs. of 92 variables
radius	21041 obs. of 8 variables
renamed	331 obs. of 8 variables
revised	313 obs. of 15 variables
standard	313 obs. of 12 variables
starmass	268 obs. of 8 variables
startemp	268 obs. of 8 variables
temperatu...	268 obs. of 8 variables

Files Plots Packages Help Viewer Present

Desktop Documents CS541 Assignments Project

Name	Size
..	
.RData	4.3 MB
.Rhistory	26.6 KB
~\$Planet_Data.xlsx	165 B
All_Data.csv	54.5 KB
Habitable_Planets.csv	2.9 KB
Photos	
Planet_Data.xlsx	21.4 KB
Planets_Filtered.csv	1.6 MB
Planets_LargeData.R	4.5 KB
Planets_Organized.csv	17.4 KB
Proj_Draft.txt	6.6 KB

Plants\_LargeData.R x topstandard x topweighted x topcustom x toprevised x revised x

```

66             ((Star_Mass-1)/(Star_Mass+1))^2+
67             ((Orbit_Period-365)/(Orbit_Period+365))^2+
68             ((Planet_Density-5.51)/(Planet_Density+5.51))^2)))
69 #ESI Revised
70 revised <- custom %>% mutate(ESI_Revised=
71 (1-sqrt((1/9)*((3.2*((Stellar_Flux-1)/(Stellar_Flux+1))^2)+(
72 (0.57*((Planet_Radius-1)/(Planet_Radius+1))^2)+(
73 (4.75*((Gravity-9.82)/(Gravity+9.82))^2)+(
74 (0.2*((Planet_Mass-1)/(Planet_Mass+1))^2)+(
75 (10.58*((Temperature-288)/(Temperature+288))^2)+(
76 ((Star_Temperature-5778)/(Star_Temperature+5778))^2+
77 ((Star_Mass-1)/(Star_Mass+1))^2+
78 ((Orbit_Period-365)/(Orbit_Period+365))^2+
79 (2.8*((Planet_Density-5.51)/(Planet_Density+5.51))^2))))
80
81 #exports all usable .csv data
82 write.csv(revised, "All_Data.csv", row.names=FALSE)
83
84 #gets top 10 from each analysis
85 topstandard <- revised[-c(13:15)] %>% arrange(desc(ESI_Standard)) %>% slice(1:11)
86 topweighted <- revised[-c(12,14:15)] %>% arrange(desc(ESI_Weighted)) %>% slice(1:11)
87 topcustom <- revised[-c(12:13,15)] %>% arrange(desc(ESI_Custom)) %>% slice(1:11)
88 toprevised <- revised[-c(12:14)] %>% arrange(desc(ESI_Revised)) %>% slice(1:11)
89
90 #generates .csv files from top 10s
91 write.csv(topstandard, "Top_Standard.csv", row.names=FALSE)
92 write.csv(topweighted, "Top_Weighted.csv", row.names=FALSE)
93 write.csv(topcustom, "Top_Custom.csv", row.names=FALSE)
94 write.csv(tobrevised, "Top_Revised.csv", row.names=FALSE)
95
96 #rm (remained) #removes any unneeded table

```

90:35 (Top Level) ↴

Console Terminal x Background Jobs x

R 4.2.2 · C:/Users/Administrator/Desktop/Documents/CS541/Assignments/Project/ ↗  
 Platform: x86\_64-w64-mingw32/x64 (64-bit)

R is free software and comes with ABSOLUTELY NO WARRANTY.  
 You are welcome to redistribute it under certain conditions.  
 Type 'license()' or 'licence()' for distribution details.

R is a collaborative project with many contributors.  
 Type 'contributors()' for more information and  
 'citation()' on how to cite R or R packages in publications.

Type 'demo()' for some demos, 'help()' for on-line help, or  
 'help.start()' for an HTML browser interface to help.  
 Type 'q()' to quit R.

[workspace loaded from C:/Users/Administrator/Desktop/Documents/CS541/Assignments/Project/.RData]

&gt; |

Project: (None)

Environment History Connections Tutorial

R Global Environment

averages	33719 obs. of 8 variables
custom	313 obs. of 14 variables
escape	313 obs. of 10 variables
filtered	33719 obs. of 8 variables
flux	307 obs. of 8 variables
gravity	313 obs. of 11 variables
habitable	63 obs. of 8 variables
mass	2210 obs. of 8 variables
nodups	313 obs. of 8 variables
orbit	30874 obs. of 8 variables
organized	331 obs. of 8 variables
planetden...	313 obs. of 9 variables
planets	33719 obs. of 92 variables
radius	21041 obs. of 8 variables
renamed	331 obs. of 8 variables
revised	313 obs. of 15 variables
standard	313 obs. of 12 variables
starmass	268 obs. of 8 variables
startemp	268 obs. of 8 variables
temperatu...	268 obs. of 8 variables

Files Plots Packages Help Viewer Present

Desktop Documents CS541 Assignments Project

Name	Size
..	
.RData	4.3 MB
.Rhistory	26.6 KB
~\$Planet_Data.xlsx	165 B
All_Data.csv	54.5 KB
Habitable_Planets.csv	2.9 KB
Photos	
Planet_Data.xlsx	21.4 KB
Planets_Filtered.csv	1.6 MB
Planets_LargeData.R	4.5 KB
Planets_Organized.csv	17.4 KB
Proj_Draft.txt	6.6 KB

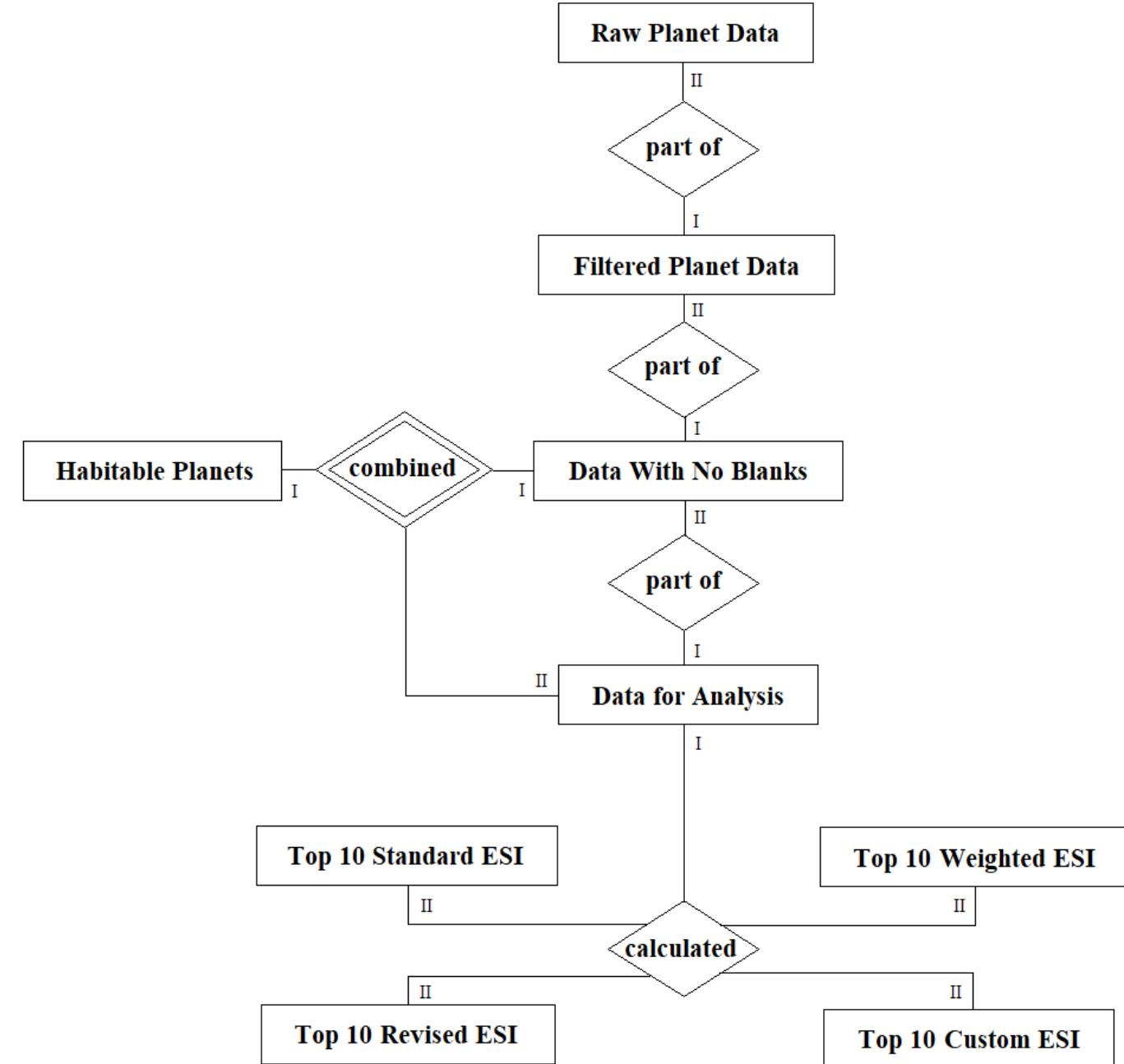
# EXPORT INTO GABEN

---

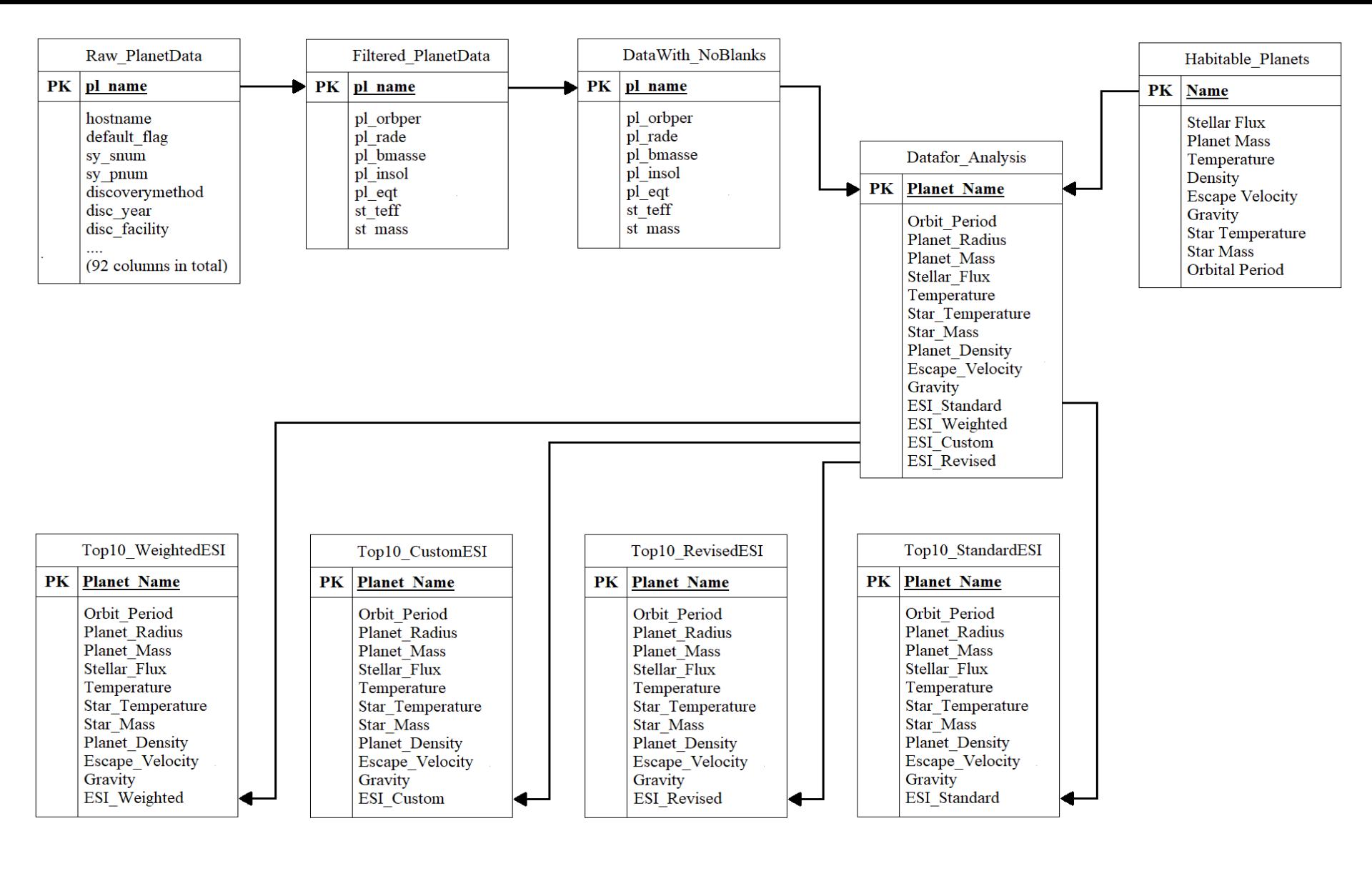
- ESI equations used to create 4 sub tables from the main filtered table
- The main table and the 4 ESI tables were exported as .csv files
- The .csv files were transferred over to the "CS541" folder in the Gaben server
- Made backup of data in hard drive due to possible SQL data corruption

# RELATIONAL DIAGRAM

- The original raw .csv file is the source of all the data
- “Habitable Planets” contains supplemental habitable exo-planet data
- Column names differ between “Habitable Planets” and the filtered “Data with No Blanks”
- Identifying relationship because of difference between those two tables



# TABLE LAYOUT



# INSERTION INTO SQL

```
CREATE TABLE `alldata` (
  `pname` varchar(20) NOT NULL,
  `operiod` real DEFAULT NULL,
  `radius` real DEFAULT NULL,
  `pmass` real DEFAULT NULL,
  `flux` real DEFAULT NULL,
  `temp` real DEFAULT NULL,
  `sttemp` real DEFAULT NULL,
  `stmass` real DEFAULT NULL,
  `density` real DEFAULT NULL,
  `velocity` real DEFAULT NULL,
  `gravity` real DEFAULT NULL,
  `standard` real DEFAULT NULL,
  `weighted` real DEFAULT NULL,
  `custom` real DEFAULT NULL,
  `revised` real DEFAULT NULL,
  PRIMARY KEY (`pname`)
) ENGINE=MyISAM DEFAULT CHARSET=utf8;
```

```
BULK INSERT alldata
from 'All_Data.csv'
with (firstrow = 2,
      fieldterminator = ',',
      rowterminator='\'\n\'',
      batchsize=313,
      maxerrors=10);
```

```
[mysql] describe alldata;
```

Field	Type	Null	Key	Default	Extra
pname	varchar(20)	NO	PRI	NULL	
operiod	double	YES		NULL	
radius	double	YES		NULL	
pmass	double	YES		NULL	
flux	double	YES		NULL	
temp	double	YES		NULL	
sttemp	double	YES		NULL	
stmass	double	YES		NULL	
density	double	YES		NULL	
velocity	double	YES		NULL	
gravity	double	YES		NULL	
standard	double	YES		NULL	
weighted	double	YES		NULL	
custom	double	YES		NULL	
revised	double	YES		NULL	

15 rows in set (0.02 sec)

Scre

Screenshot

# ESI SQL QUERIES

- Added columns to the main Data for Analysis table
- SQL query uses planet name for the “group by” function
- Example below uses Standard ESI equation to create “esistandard” column

Standard ESI:

$$\text{ESI}(F, R) = 1 - \sqrt{\frac{1}{2} \left[ \left( \frac{F - F_e}{F + F_e} \right)^2 + \left( \frac{R - R_e}{R + R_e} \right)^2 \right]}$$

```
SELECT pname, (1-SQRT((1/2)*(POWER((flux-1)/(flux+1),2)+  
POWER((radius-1)/(radius+1),2))))  
as esistandard  
FROM alldata  
Group by pname;
```

# R AND SQL COMPARISON

```

SELECT pname, (1-SQRT((1/2)*(POWER((flux-1)/(flux+1),2)+  

    POWER((radius-1)/(radius+1),2))))  

    as esistandard  

FROM alldata  

Group by pname;  
  

SELECT pname, 1-SQRT((1/5)*(POWER((flux-1)/(flux+1),2)+  

    (0.57*POWER((radius-1)/(radius+1),2))+  

    (1.07*POWER((density-5.51)/(density+5.51),2))+  

    (0.7*POWER((velocity-11.186)/(velocity+11.186),2))+  

    (5.58*POWER((temp-288)/(temp+288),2))))  

    as esiweighted  

FROM alldata  

Group by pname;  
  

SELECT pname, 1-SQRT((1/9)*(POWER((flux-1)/(flux+1),2)+  

    POWER((radius-1)/(radius+1),2)+  

    POWER((gravity-9.82)/(gravity+9.82),2)+  

    POWER((mass-1)/(mass+1),2)+  

    POWER((temp-288)/(temp+288),2)+  

    POWER((sttemp-5778)/(sttemp+5778),2)+  

    POWER((stmass-1)/(stmass+1),2)+  

    POWER((operiod-365)/(operiod+365),2)+  

    POWER((density-5.51)/(density+5.51),2)))  

    as esicustom  

FROM alldata  

Group by pname;  
  

SELECT pname, 1-SQRT((1/9)*(3.2*(POWER((flux-1)/(flux+1),2))+  

    (0.57*POWER((radius-1)/(radius+1),2))+  

    (4.75*POWER((gravity-9.82)/(gravity+9.82),2))+  

    (0.2*POWER((mass-1)/(mass+1),2))+  

    (10.58*POWER((temp-288)/(temp+288),2))+  

    POWER((sttemp-5778)/(sttemp+5778),2)+  

    POWER((stmass-1)/(stmass+1),2)+  

    POWER((operiod-365)/(operiod+365),2)+  

    (2.8*POWER((density-5.51)/(density+5.51),2))))  

    as esirevised  

FROM alldata  

Group by pname;

```

```

#ESI variants analysis  

#ESI Standard  

standard <- gravity %>% mutate(ESI_Standard=  

(1-sqrt((1/2)*(((Stellar_Flux-1)/(Stellar_Flux+1))^2+  

    ((Planet_Radius-1)/(Planet_Radius+1))^2)))  

#ESI Weighted  

weighted <- standard %>% mutate(ESI_Weighted=  

(1-sqrt((1/5)*(((Stellar_Flux-1)/(Stellar_Flux+1))^2+  

    (0.57*((Planet_Radius-1)/(Planet_Radius+1))^2)+  

    (1.07*((Planet_Density-5.51)/(Planet_Density+5.51))^2)+  

    (0.7*((Escape_Velocity-11.186)/(Escape_Velocity+11.186))^2)+  

    (5.58*((Temperature-288)/(Temperature+288))^2))))  

#ESI Custom  

custom <- weighted %>% mutate(ESI_Custom=  

(1-sqrt((1/9)*(((Stellar_Flux-1)/(Stellar_Flux+1))^2+  

    ((Planet_Radius-1)/(Planet_Radius+1))^2+  

    ((Gravity-9.82)/(Gravity+9.82))^2+  

    ((Planet_Mass-1)/(Planet_Mass+1))^2+  

    ((Temperature-288)/(Temperature+288))^2+  

    ((Star_Temperature-5778)/(Star_Temperature+5778))^2+  

    ((Star_Mass-1)/(Star_Mass+1))^2+  

    ((Orbit_Period-365)/(Orbit_Period+365))^2+  

    ((Planet_Density-5.51)/(Planet_Density+5.51))^2))))  

#ESI Revised  

revised <- custom %>% mutate(ESI_Revised=  

(1-sqrt((1/9)*((3.2*((Stellar_Flux-1)/(Stellar_Flux+1))^2)+  

    (0.57*((Planet_Radius-1)/(Planet_Radius+1))^2)+  

    (4.75*((Gravity-9.82)/(Gravity+9.82))^2)+  

    (0.2*((Planet_Mass-1)/(Planet_Mass+1))^2)+  

    (10.58*((Temperature-288)/(Temperature+288))^2)+  

    ((Star_Temperature-5778)/(Star_Temperature+5778))^2+  

    ((Star_Mass-1)/(Star_Mass+1))^2+  

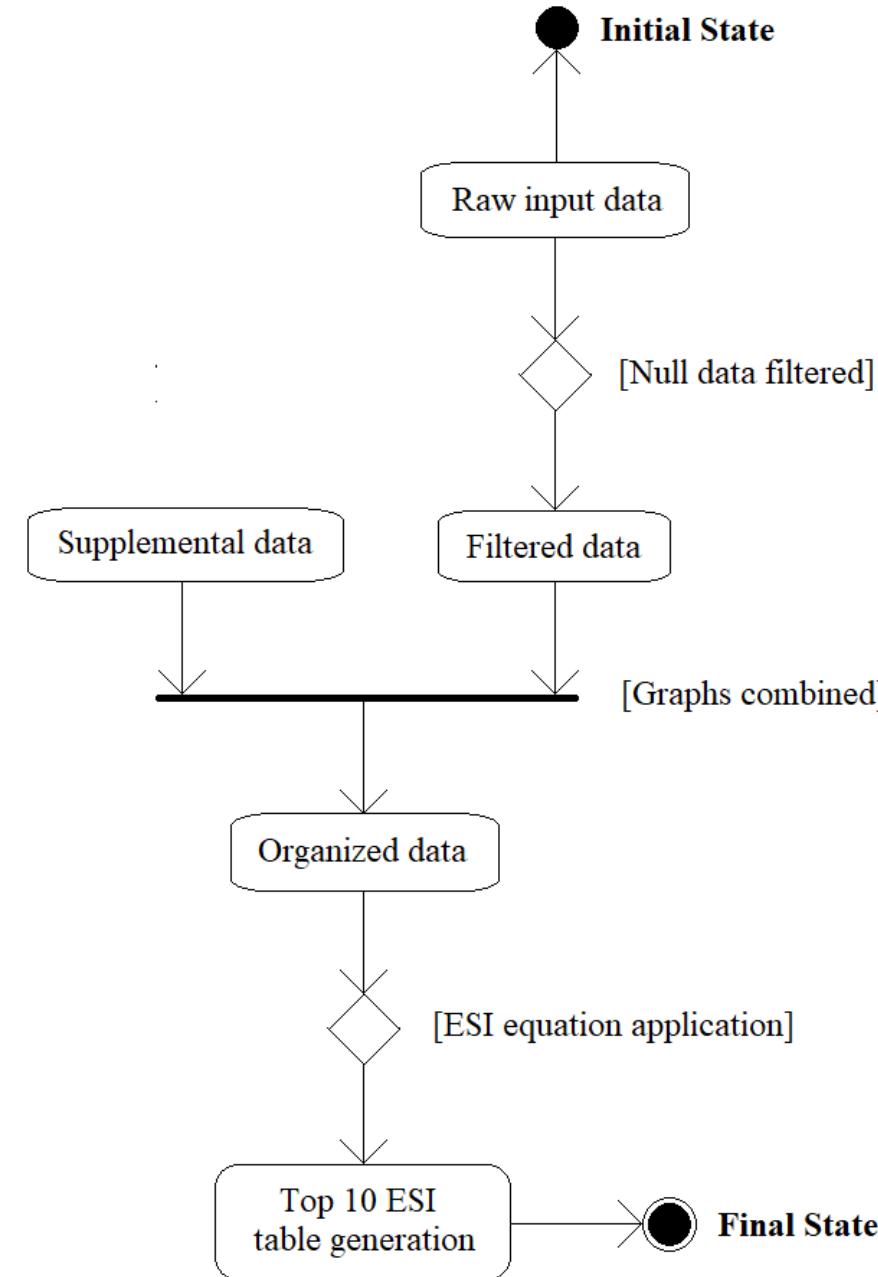
    ((Orbit_Period-365)/(Orbit_Period+365))^2+  

    (2.8*((Planet_Density-5.51)/(Planet_Density+5.51))^2)))))

```

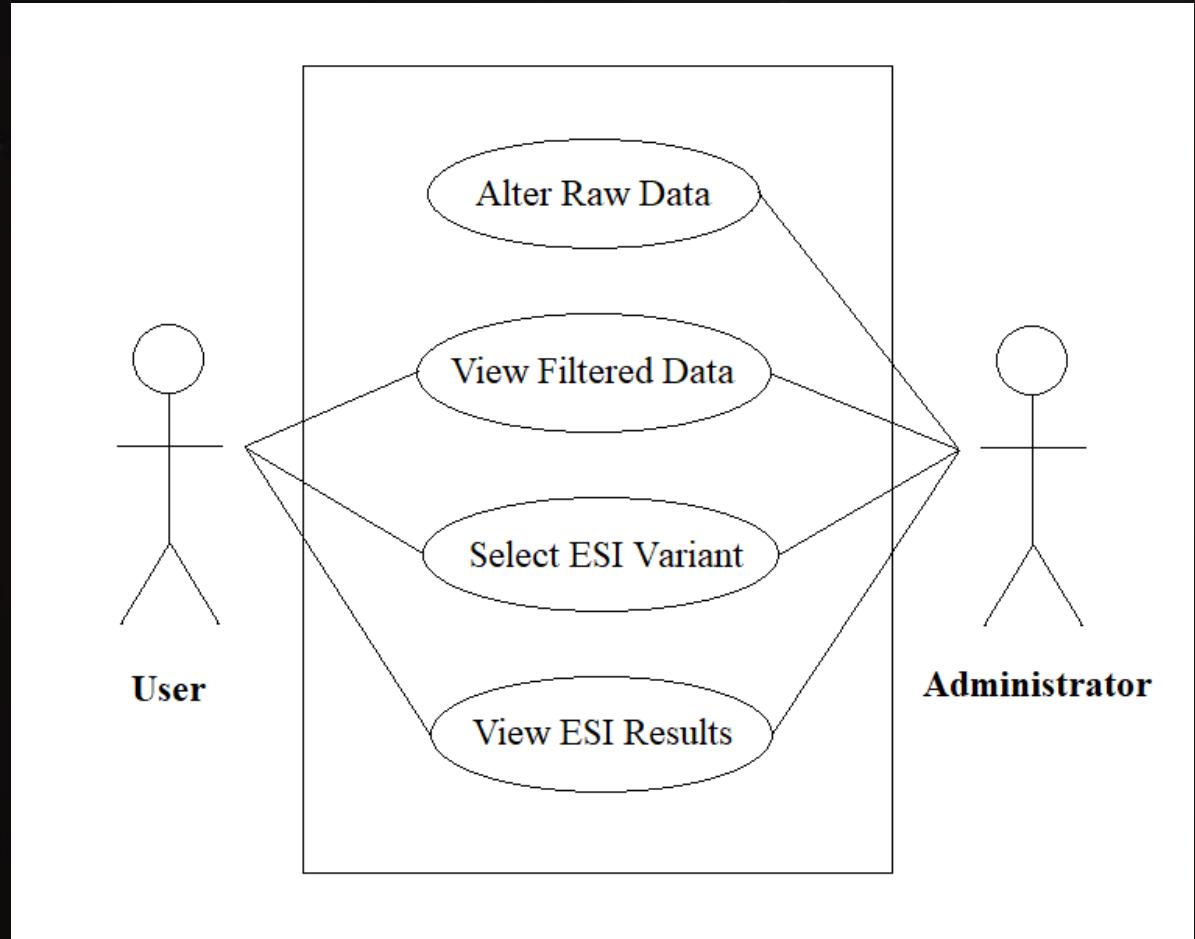
# SOFTWARE DESIGN DIAGRAM

- Initial state is the downloaded NASA data
- Final state is the generation of 4 top 10 ESI variant tables



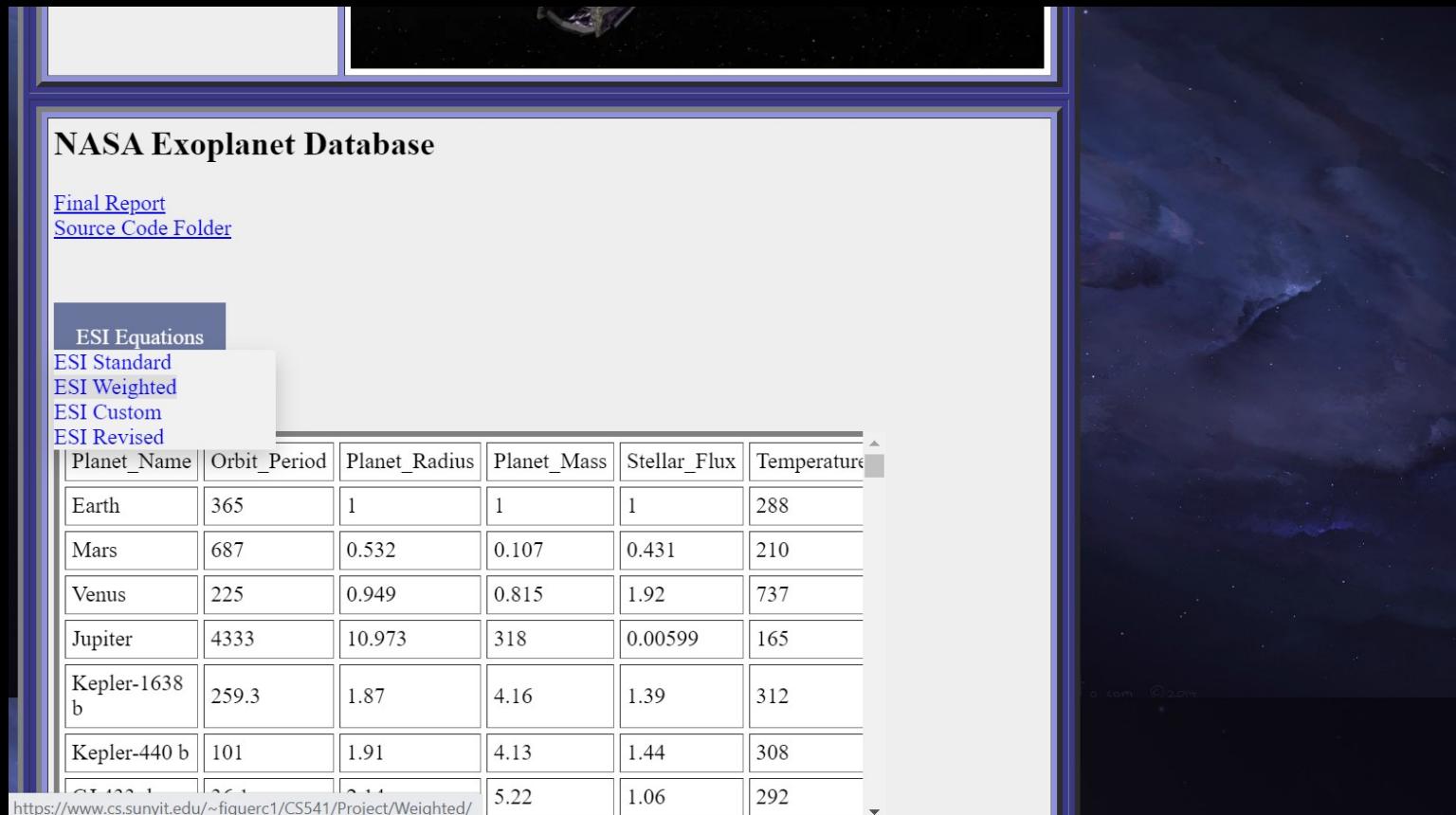
# CASE DIAGRAM

- Simple user interface
- Options include selection and comparison of the ESI variants
- Uses CSS to create menu
- PHP to display tables



# WEBSITE DEMO

- Link: <https://www.cs.sunyit.edu/~figuerc1/CS541/Project/>



The screenshot shows a web application interface for the NASA Exoplanet Database. At the top, there is a navigation bar with a logo and links for "Final Report" and "Source Code Folder". Below the navigation bar, the title "NASA Exoplanet Database" is displayed. On the left side, there is a sidebar with a dark blue header containing the text "ESI Equations" and several menu items: "ESI Standard", "ESI Weighted", "ESI Custom", and "ESI Revised". The main content area features a table with data for various planets. The table has columns for Planet\_Name, Orbit\_Period, Planet\_Radius, Planet\_Mass, Stellar\_Flux, and Temperature. The data rows include Earth, Mars, Venus, Jupiter, Kepler-1638 b, Kepler-440 b, and GL 422 b. The table is styled with alternating row colors and rounded corners.

Planet_Name	Orbit_Period	Planet_Radius	Planet_Mass	Stellar_Flux	Temperature
Earth	365	1	1	1	288
Mars	687	0.532	0.107	0.431	210
Venus	225	0.949	0.815	1.92	737
Jupiter	4333	10.973	318	0.00599	165
Kepler-1638 b	259.3	1.87	4.16	1.39	312
Kepler-440 b	101	1.91	4.13	1.44	308
GL 422 b	26.1	2.11	5.22	1.06	292

<https://www.cs.sunyit.edu/~figuerc1/CS541/Project/Weighted/>

# CHALLENGES OF CODING

- No direct link to NASA's database server
- Problem connecting R to Gaben server
- Possible permissions restriction
- Needed to copy .csv files into Gaben
- Renamed index HTML file to PHP

```
figuerc1@gaben1:~/www/CS541/Project$ nano index.html
figuerc1@gaben1:~/www/CS541/Project$ ls
All_Data.csv      index.html      Top_Revised.csv   Top_Weighted.csv
FinalReport.pdf  Top_Custom.csv  Top_Standard.csv
figuerc1@gaben1:~/www/CS541/Project$ mv index.html index.php
figuerc1@gaben1:~/www/CS541/Project$ ls
All_Data.csv      index.php      Top_Revised.csv   Top_Weighted.csv
FinalReport.pdf  Top_Custom.csv  Top_Standard.csv
figuerc1@gaben1:~/www/CS541/Project$
```

```
96 #rm (remained) #removes any unneeded table
97
98 #import for exportation of data into SQL server
99 #install.packages("RODBC")
100 library(RODBC)
101
102 #writes tables into SQL database
103 sqlSave(revised, all_data, rownames = FALSE)
104 revised <- DBI::dbConnect("Driver={SQLServer};Server=10.156.192.30;Uid=f
105
```



103:1 (Top Level) ▾

Console Terminal × Background Jobs ×

R 4.2.2 · C:/Users/Administrator/Desktop/Documents/CS541/Assignments/Project/ ↵

```
> revised <- DBI::odbcConnect("Driver={SQLServer};Server=10.156.192.30;Uid=figuercl
Error: 'odbcConnect' is not an exported object from 'namespace:DBI'
> #writes tables into SQL database
> sqlSave(revised, all_data, rownames = FALSE)
Error in sqlSave(revised, all_data, rownames = FALSE) :
  first argument is not an open RODBC channel
> revised <- odbcDriverConnect("Driver={SQLServer};Server=10.156.192.30;Uid=figuercl
Error in odbcDriverConnect("Driver={SQLServer};Server=10.156.192.30;Uid=figuercl
  could not find function "odbcDriverConnect"
> #writes tables into SQL database
```

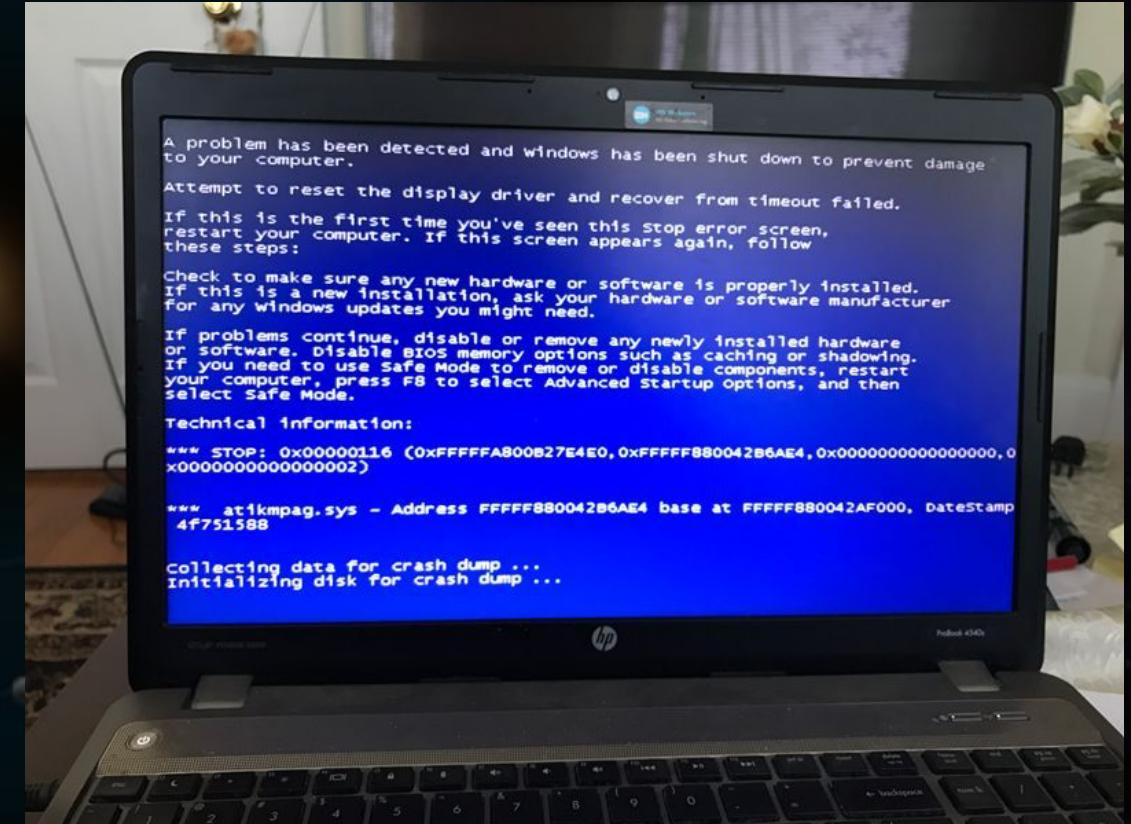
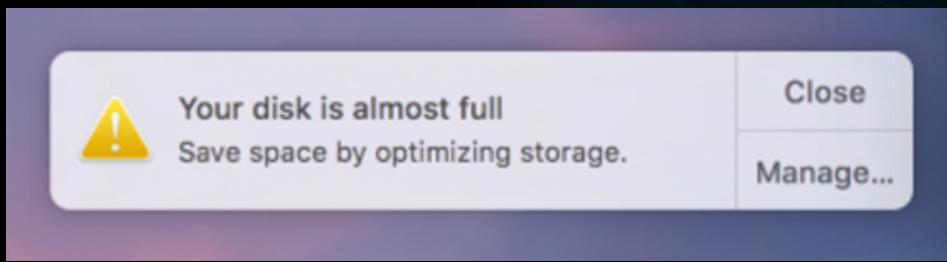
# DATA BASE CORRUPTION

```
+-----+  
| Tables_in_figuerc1 |  
+-----+  
| book  
| book_authors  
| book_copies  
| book_loans  
| borrower  
| car  
| course  
| department  
| dependent  
| dept_locations  
| employee  
| grade_report  
| library_branch  
| option  
| option2
```

```
mysql> describe option2  
      -> ;  
+-----+-----+-----+-----+-----+-----+  
| Field      | Type       | Null | Key | Default | Extra |  
+-----+-----+-----+-----+-----+-----+  
| serial_no   | varchar(25) | NO   | PRI |          |          |  
| option_name  | varchar(20)  | NO   | PRI |          |          |  
| price       | varchar(10) | YES  |     | NULL    |          |  
+-----+-----+-----+-----+-----+-----+  
3 rows in set (0.01 sec)  
  
| price       | varchar(10) | YES  |     | NULL    |          |  
+-----+-----+-----+-----+-----+-----+  
3 rows in set (0.01 sec)  
  
mysql> describe option;  
ERROR 1064 (42000): You have an error in your SQL syntax; check  
      for the right syntax to use near 'option' at line 1  
mysql>
```

# WHY NO MORE ATTEMPTS?

- Windows PC broke down
- Stuck working with Mac with limited storage



# SOURCES

---

- [1] <https://exoplanets.nasa.gov/discovery/exoplanet-catalog/>
- [2] <https://phl.upr.edu/projects/habitable-exoplanets-catalog>
- [3] <https://phl.upr.edu/projects/earth-similarity-index-esi>
- [4] <https://interestingengineering.com/science/earth-similarity-index-where-could-we-livebesides-earth>
- [5] <http://www.imatheq.com/imatheq/com/imatheq/math-equation-editor.html>
- [6] [https://www.upi.com/Science\\_News/2017/02/08/NASA-Red-dwarf-habitable-zones-maynot-be-so-habitable/2881486579322/](https://www.upi.com/Science_News/2017/02/08/NASA-Red-dwarf-habitable-zones-maynot-be-so-habitable/2881486579322/)
- [7] <https://www.geeksforgeeks.org/how-to-display-data-from-csv-file-using-php/>
- [8] [https://www.w3schools.com/howto/howto\\_css\\_dropdown.asp](https://www.w3schools.com/howto/howto_css_dropdown.asp)
- [9] <https://popsql.com/learn-sql/sql-server/how-to-import-a-csv-in-sql-server>
- [10] <https://stackoverflow.com/questions/7367750/average-of-multiple-columns>