FAU Astronomy

Digital Data Laboratory

Research Paper

Physics Department - Florida Atlantic University - Spring 2013

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Lab Instructor: whahn@fau.edu

Student:_____First and Last Name_____

Email:_____Your Email Here_____

Section: _____Your Section Here_____

Introduction

Welcome to the FAU Astronomy Digital Data Laboratory Manual. This document is stored and updated online so that our group can have a place to share ideas and work together. Changed made here are recorded and saved automatically eliminating the need to email attachments.

FAU Email has integrated with Google Documents and Google Drive to provide students with a place to create and store digital files. You FAU email is already setup to use Google Docs and Google Drive. A big part of the Digital Data Lab is learning how to use these new tools. Video demonstrations will show you all of the steps needed to complete the assignments.

The first step in this projects is to make a copy of this document so that it is saved on your personal google drive and then to share the new document with the Lab Instructor. The video link below will show you how to get started.

!!!This first step in this assignment is to create a copy of this instruction template and share it with the TA so that you have a personal copy saved on your google drive !!!

This video link will demonstrate the process:

http://www.youtube.com/watch?v=61vXpdjTmM8

For this project, you will research and write a paper about one of four different models. This paper will focus on two things (1) a scatter plot graph that your create and (2) a question that you answer using your graph. The data, models, and questions are all given in the document below.

Your task is to watch the instructional videos and use the Google Documents Spreadsheet tools to create a graph and calculate the slope of a linear model fit to the data points. You will then add your graph to this document and write a short research paper answering the accompanying question. After you have made your copy of this document and shared it then you simply use the template at the end of this document to write your report.

This document will evolve throughout the semester as you add content and complete the projects. If you have any questions about this document or the lab projects please email the Lab Instructor/TA: William Hahn (whahn@fau.edu)

Data Exploration and Modeling

In this project you will learn the basics of graphical analysis. These tools will be used to answer interesting questions about astronomy

Graphs are powerful tools for analysing data. Given a simple list of numbers most people have no ability to internalize those number efficiently. By plotting the numbers on a graph you can use the visual processing system in your brain and this allows a much richer understanding of the relationships between the numbers.

Project Objectives

1) Learn how to use Google Documents

2) Create scatter plot graphs of real data

3) Learn how to fit a simple linear model

4) Answer an interesting question about astronomy using your model

5) Write a short research paper presenting your question/answer

Grading Rubric

Part 1

10% Google Documents Lab Manual Setup

10% Google Documents Class Discussion #1

Part 2

20% Scatter Plot

20% Slope of Linear Fit

Part 3

40% Short Research Paper Presenting your Question/Answer and Graph

Total:___/100%

Paper Due: March 26, 2013

Google Documents Class Discussion #1

Please follow the link below to access the group discussion portion of this project:

https://docs.google.com/a/fau.edu/document/d/1Jtkma3fpa1WeDvcgfmZ6UMKQn4a7PksKtLPeqcOKw_c/edit

Kepler Data

Kepler		
Planet	**Semi-Major Axis (AU)**	**Period (years)**
Mercury	0.39	0.24
Venus	0.72	0.61
Earth	1.00	1.00
Mars	1.52	1.88
Jupiter	5.20	11.86
Saturn	9.54	29.46
Uranus	19.19	84.01
Neptune	30.06	164.79
Pluto	39.53	248.54

Data:

https://docs.google.com/a/fau.edu/spreadsheet/ccc?key=0AiVVmw5skT_DdHozcFR5MkQ2bE40YUZJdlBQMlUxOEE

Model:

$m = 1$

$S^3 = P^2$

Question: How many days would be in a year if the earth were 2 AU from the sun?

Pluto Data

Pluto		
Moon	**Distance (km)**	**Period (days)**
Pluto V	42,000	20.20
Nix	48,708.00	24.90
Pluto IV	59,000	32.10
Hydra	64,749.00	38.20

Data:

https://docs.google.com/a/fau.edu/spreadsheet/ccc?key=0AiVVmw5skT_DdDdHV2UzVHNpVWptM1V2cHZFbFpsV3c

Model:

$$R = \frac{D^3}{P^2}$$

$$M[kg] = (6.9 * 10^{10}) * (R)$$

Question: What is the mass of pluto?

Hubble Data

Hubble		
Galaxy Location (Constellation)	**Distance (Mpc)**	**Speed (km/s)**
Virgo	19	1,150
Pegasus	65	3,800
Pisces	66	5,000
Cancer	80	4,800
Perseus	97	5,400
Coma	113	6,700
Hercules	175	10,300
Ursa Major 1	270	15,400
Leo	310	19,500
Gemini	350	23,200
Corona Borealis	350	21,600
Bootes	650	39,400
Ursa Major 2	680	41,000

Data:

https://docs.google.com/a/fau.edu/spreadsheet/ccc?key=0AiVVmw5skT_DdGppMXRDWU9yQmJzbWd2Nm1ZSU5mOUE

Model:

$v = Hd$

Question: How old is our universe?

Radiometric Dating

Radiometric Dating		
Meteorites	**X (87Rb/86Sr)**	**Y (87Sr/86Sr)**
Modoc	0.8600	0.7570
Homestead	0.8000	0.7510
Bruderheim	0.7200	0.7470
Kyushu	0.6000	0.7390
Buth Furnace	0.0900	0.7060

Data:

https://docs.google.com/a/fau.edu/spreadsheet/ccc?key=0AiVVmw5skT_DdGRNRHdyeEh5R1dxT3l1N25VbS1tb2c

Model:

$$Y = mX$$

$$m = e^{\lambda t} - 1$$

Question: How old is our solar system?

Scatter Plots, Slope and Intercept

Video Link:

http://www.youtube.com/watch?v=Js8GscJwW0A

http://www.youtube.com/watch?v=A_Vdzb2gnUk

Example Spreadsheets:

https://docs.google.com/a/fau.edu/spreadsheet/ccc?key=0AiVVmw5skT_DdEtoNW12WUsyazRYeE54V0hfSVdzanc

https://docs.google.com/spreadsheet/ccc?key=0AiVVmw5skT_DdGlHOTUzV29OWjlsSkxiVTZiNDRPTFE

Publish Chart

Video Link:

http://www.youtube.com/watch?v=-d1c022QSk4

Paper Section Details

INTRODUCTION: This is the section that sets the background for the important part of the paper. It is not just an abbreviated review of what you are going to discuss in detail later. This section of the narrative should present the necessary theoretical and experimental background such that a knowledgeable colleague, who might not be expert in the field, will be able to understand the data presentation and discussion. If you are going to use a particular theoretical model to extract some information from your data, this model should be discussed in the introduction.

DATA PRESENTATION: This section should lead the reader through the data. The data values are presented in tables and figures, each with its own number and caption, e.g.. "The results of the conductivity measurements are shown in Table 3". All figures and tables should be referred to by their number.

THE MODEL: This section will describe the mathematical models that you are using. These models are quite technical. It is ok if you don't understand the model completely. The purpose of this assignment is to learn how to use modern tools and present scientific ideas in an intelligent manner, not to become experts in radioactive decay or expansion of the universe. The models were chosen because they are a little more difficult. If you have questions email whahn@fau.edu

CALCULATIONS: Show the model you used and your calculations.

CONCLUSIONS: How has creating this graph and researching your topic changed your ideas about measurements and modeling in astronomy? What other questions might be answered using the tools you developed?

REFERENCES: All references, numbered in order from beginning to end of the paper, are collected together at the end of the paper. (There are websites like http://www.easybib.com that can assist you in creating a properly formatted citation)

Sample Student

Spring 2013

FAU AST

Sec 001

Creative Title

INTRODUCTION:

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DATA PRESENTATION:

Donec vitae turpis est. Suspendisse erat orci, pretium id tempus quis, bibendum at nulla. Nam felis elit, tincidunt adipiscing bibendum ac, luctus sit amet massa. Nam non sapien id ipsum pellentesque consectetur non at ante. Nulla id ornare ipsum. Ut suscipit auctor faucibus. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Proin quis mauris a justo vestibulum auctor a rutrum nulla. Mauris placerat vehicula eros. Nam sit amet tincidunt arcu. Cras in dolor eget tellus imperdiet commodo. Nulla mollis eros sit amet neque gravida eu ultrices lacus sagittis. Ut tincidunt ipsum eu nibh congue fringilla. Aliquam tempus diam sit amet sem iaculis molestie.

THE MODEL:

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$$y = mx + b$$

Proin consequat nisi tristique purus pulvinar at semper erat viverra. Suspendisse viverra, justo id auctor suscipit, est felis ultrices libero, vitae ullamcorper dolor felis ac odio. Nullam id dapibus erat. Proin imperdiet quam eu leo malesuada tincidunt. Aliquam facilisis mauris aliquet lorem hendrerit vitae hendrerit felis gravida. Mauris tristique odio eget arcu lacinia in dignissim ligula fermentum. Morbi congue sollicitudin justo vitae laoreet.

CALCULATIONS:

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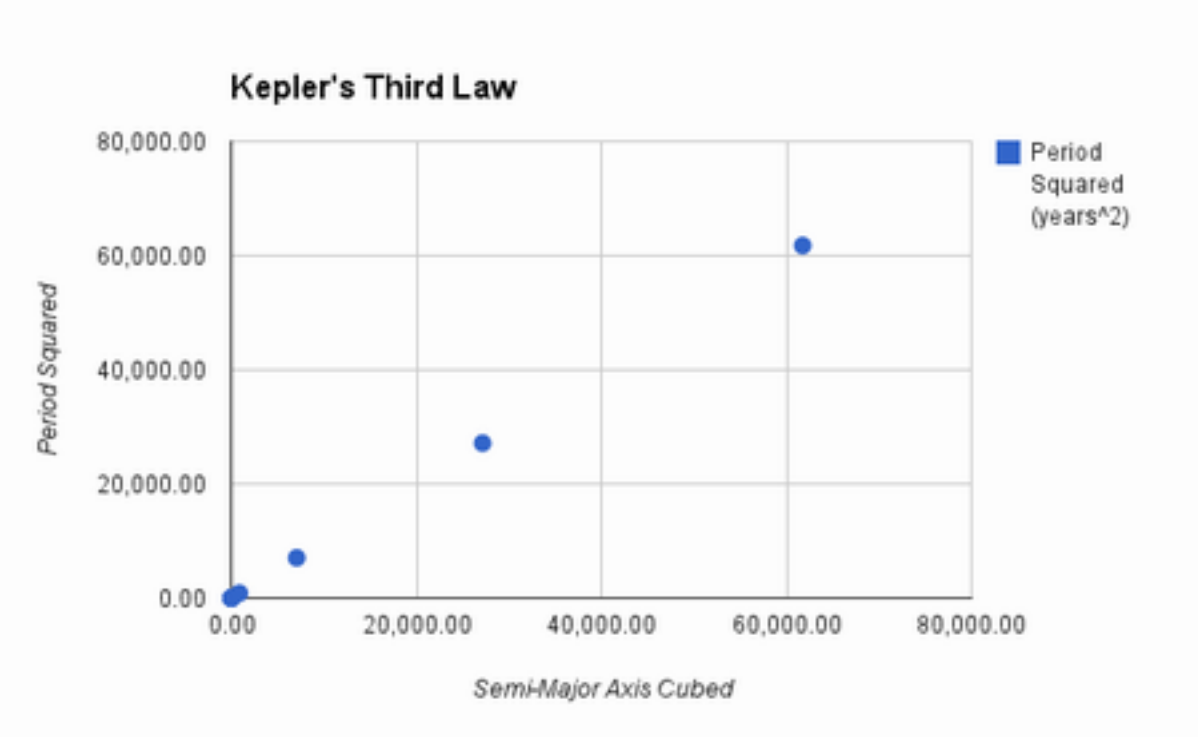
$$y = mx + b$$

m=?

$$b = 0$$



Caption: Tempor congue tellus, sed tristique mauris laoreet sit amet. Praesent accumsan libero a elit faucibus pulvinar. Nulla eget ipsum at felis pulvinar suscipit. Nullam imperdiet sem a augue tempus at semper augue vestibulum. Aliquam sed suscipit nisi.

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CONCLUSIONS:

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REFERENCES:

Hoyle, Fred. *Astronomy*. Garden City, NY: Doubleday, 1962. Print.

Tomecek, Steve, and Liisa Chauncy Guida. *Moon*. Washington, D.C.: National Geographic Society, 2005. Print.

Ritter, Gordon. *Planets, Stars, and Galaxies*. New York: Chelsea House, 2008. Print.