CSC 152

Test 3C

You should save and submit your Wolfram/Mathematica notebook(s) (for Problems #3, #4), your R Script(s) (for Problems #5 and #6), and edited Excel spreadsheet (for Problems #1, #2, #7, #8, #9). In addition, you should paste any information requested into this document and submit it as well.

1. **Excel: Lorentzian Fit**

* 1. Use the data on the Peak sheet of the Excel provided and fit the data to the following form



where λ is the wavelength variable (corresponding to the first column) and there are three parameters h, λ0, and Λ.

* 1. Choose parameters that make the Lorentzian form fit the Absorbance data.
	2. Paste fit (with title and labels) below.

***Paste peak fit here***

2. **Excel Simultaneous Equations**. On the ***Matrix*** Sheet of the Excel file provided, use a matrix approach in Excel to solve the following set of linear equations



3. **Wolfram/Mathematica: Plot a function**

* 1. **Define** the following function in Mathematica with parameters A, B, C, and D as well as the variable x.

$$\left(1-x\right)^{3}A+3x\left(1-x\right)^{2}B+3x^{2}\left(1-x\right)C+x^{3}D$$

* 1. Plot the function with A=2.1, B=1.2, C=4.3 and D=3.4 from x=0 to x=1
	2. Paste a screen of your function definition AND plot below

***Paste Wolfram function definition and plot here***

4. **Wolfram/Mathematica Expand**

* 1. Use Mathematica to expand (x+x^2+x^3+x^4+x^5+x^6)^5. Paste your result below.

***Paste Expand result here***

* 1. If one rolls 5 dice coins, in how many different ways can one get a sum of 15?

|  |  |
| --- | --- |
| Number of ways to get 15 |  |

5. **R: Read from Web/Fit to Power law**

1. Have R read the data from

<http://www1.lasalle.edu/~blum/c152wks/PendulumBobSpeed.csv>

making sure that the first line (header line) is not considered part of the data.

1. Rename the fields
2. Plot the data (speed versus height)
3. Give the plot a title of “Pendulum Bob Speeds” with “Smith” replaced by your last name
4. Give the x-axis a label of “Bob Height (cm)”
5. Give the y-axis a label of “Speed at bottom of swing (m/s)”
6. Fit the data to a power-law
7. Display the fit-equation on the plot
8. Display the fit-curve on the plot
9. Save your R Script and paste your Power-law fit below

***Paste your R Power-Law Fit here***

6. **R:Fit to Exponential**

1. Paste the two vectors below into R

time=c(4, 36, 68, 100, 132, 164, 196, 218)

counts=c(395, 159, 68, 26, 12, 5, 2, 1)

1. Create a data frame from these vectors.
2. Plot the data (Iodine Radiation (counts/s) versus Time (minutes)).
3. Give the plot a title of “Smith’s Radioactive Iodine Decay” with “Smith” replaced by your last name
4. Give the x-axis a label of “Time (minutes)”
5. Give the y-axis a label of “Counts/s"
6. Fit the data to an exponential
7. Display the fit-equation on the plot
8. Display the fit-curve on the plot
9. Save your R Script and paste your Exponential fit below

7. **Excel: Skill MID Function**. On the MID sheet of the Excel file provided, use Excel’s MID function to extract the word “sense” from the quote provided.

Where **sense** is wanting, everything is wanting. Benjamin Franklin

8. **Excel Weight VLOOKUP**. Create and use a VLOOKUP table to categorize the weights found on the Weight sheet

|  |  |
| --- | --- |
| Category | kilograms |
| Flyweight | <=52 |
| Featherweight | 52-57 |
| Lightweight | 57-63 |
| Welterweight | 63-69 |
| Middleweight | 69-75 |
| Light heavyweight | 75-81 |
| Heavyweight | 81-91 |
| Super Heavyweight | >91 |

**Then make a histogram showing the number you found in each category. Paste it below.**

9. **Excel: Scientific Notation.** Use Excel (on the Laser sheet) to calculate each laser’s photon energy given by the formula

**E = hc/ λ**

where λ is the laser’s wavelength and h and c are the following constants

h = 6.626 × 10-34 Js

c = 2.998 × 108 m/s

Then convert the photon energy to electron-volts (1 eV =1.62 × 10-19 Joules) – basically just divide by 1.62 × 10-19

|  |  |  |  |
| --- | --- | --- | --- |
| **LASER TYPE** | **WAVELENGTH λ (m)** | **Photon Energy (E=hc/λ) Joules** | **Photon Energy (eV)** |
| Argon Fluoride | 1.93 × 10-7 |   |   |
| Frequency doubled Nd:YAG | 5.32 × 10-7 |   |   |
| Ruby | 6.943 × 10-7 |  2.86 × 10-19 |  1.77 |
| Nd:YAG | 1.064 × 10-6 |   |   |
| Erbium:Glass | 1.540 × 10-6 |   |   |
| Carbon Dioxide | 1.06 × 10-5 |   |   |