CHEN 1703 - HOMEWORK 2

Submit your MATLAB solutions via the course web site. Be sure to include your name and UNID in your m-file. Submit each solution seperately. Also be sure to document your solutions well. Include a description of the equations you are solving.

Problem 1 (5 points)

In class we discussed using solar energy to power our cars. Write a MATLAB script to calculate the area required for a solar energy collector to provide enough energy to power an average automobile. Assume the following:

- Gasoline energy density: 1.3×10^5 kJ/gal.

- Incident solar energy per day: approximately $2 \times 10^4 \frac{kJ}{day \cdot m^2}$.

Ask the user to input the following:

- Car mileage.

- Average number of miles driven per day.

- Efficiency of the solar energy capture and car system.

Be sure to document your code well. Specifically, describe the problem, the equations you are solving, and also include your name and UNID in your m-file.

Problem 2 (5 points)

It has been suggested that solar power could provide a substantial portion of our country's electrical energy needs[1]. In 2006, the United States produced approximately 1.46×10^{16} kJ of electricity[2]. Estimate the area required (in square miles) to supply the U.S. electrical demand for a solar system that functions at 3% overall efficiency. Implement this in a MATLAB script. Be sure to document your code well. Specifically, describe the problem, the equations you are solving, and also include your name and UNID in your m-file.

Assume the following:

- Average solar energy flux of $2 \times 10^4 \frac{kJ}{day \cdot m^2}$.

- Commercial photovoltaic solar cells typically convert approximately 8-15% of the incident solar energy to electricity. Assume that the overall solar system efficiency is 9%. Assume that 2/7 days are too cloudy to produce electricity. Therefore the total energy efficiency is approximately 3%

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[1]http://www.sciam.com/article.cfm?id=a-solar-grand-plan
[2]http://en.wikipedia.org/wiki/Energy_use_in_the_United_States

Note: To convert m^2 to square miles, multiply by 3.861×10^{-7}.

Note: The total area of the state of Utah is approximately 84,900 square miles.

Note: The area of the entire University of Utah campus (including the medical center, Fort Douglas, and Research Park) is approximately 2.4 square miles.

Problem 3 (5 points)

Create a MATLAB code that will determine the molecular weight of a compound given its molecular formula. The user should enter the molecular formula, and the code should print the molecular weight to the screen. The code should be able to calculate molecular weights for species containing any of the following elements: C, H, O, N, S.

Be sure to document your code well. Specifically, describe the problem, the equations you are solving, and also include your name and UNID in your m-file.

Hints

- The `input` function can be used to prompt a user for input. For example,

  ```
  x = input('Enter the value for x:');
  ```

  prints *Enter the value for x* to the screen. When the user enters a value and presses the return key, that value is stored in the variable `x`.

- The `disp` function can be used to output information easily. Example:

  ```
  disp('Hello');
  ```

  prints *Hello* to the screen, and

  ```
  disp(a);
  ```

  prints the contents of the variable a to the screen. For example, if we set `a=[2,5];` then `disp(a)` would print 2 5 while `disp(a')` would print $\begin{smallmatrix} 2 \\ 5 \end{smallmatrix}$.

- The wiki page may be helpful for learning MATLAB syntax.