Scipy questions

August 2017

1. Find all the zeroes of the polynomial $x^9 - 3x^6 + x^2 + 1$.

2. Find a solution to this system of transcendental equations $xy = 2, \log x \log y = -\log 2$

3. Perform a linear least squares fit on the data set $\{(1, 2), (2, 3.5), (3, 6.5), (4, 7.8), (5, 11)\}$.

4. The following data were collected for the harmonic oscillations of a vertically suspended spring-mass system. The time measurements were

   ```
   [0.0,  0.1,  0.2,  0.3,  0.4,  0.5,  0.6, 0.7,  0.8,  0.9,  1.0,
   1.1,  1.2,  1.3,  1.4,  1.5,  1.6,  1.7,  1.8,  1.9,  2.0]
   ```

   and the corresponding displacements from equilibirum were

   ```
   [1.78,  1.43, 1.12, 0.79,  0.30, -0.14, -0.62, -0.99, -1.30, -1.64, -1.91,
   -1.97, -2.00, -1.89, -1.74,-1.44, -1.14, -0.78, -0.30, 0.12, 0.51]
   ```

   The attached mass is 1. Find the spring constant k.

5. Write a program that will generate a normally distributed data sample of 100 numbers , with pdf mean $\overline{x} = 3$ and standard deviation $\sigma = 1$. Print out the mean, variance, and standard deviation of this data sample.

6. Write a program that will generate a normally distributed data sample of 10000 numbers with pdf mean 0 and standard deviation 1. Print out what percentage of these numbers falls within 1, 2 and 3 standard deviations from the mean.

7. The position of a certain particle was measured at times

   ```
   [0, 0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 1.0]
   ```

   and the measurements were

   ```
   [0, 1, 1, 2, 3, 5, 8, 13, 21, 34, 55]
   ```

   Write a program that writes this data to a file called data.txt. The data should be formatted into two columns, the first being labelled 'time' and the second being labelled 'position'. Then write a program that will read the data from the file, store it in an array, and produce a position-time graph for the motion.