Python – Numpy Problem Sheet

1. Assume there are 4 students namely Mia, Riya, Ridhi and Siddhu. Each of them has bought cakes out of a choice of 3. The flavors are A, B and C. Mia bought 175 g of flavor A, 100 g of flavor B and 210 g of C. Riya choose 90 g of A, 160 g of B and 150 g of C. Ridhi bought 200g of A, 50 g of B and 100 g of C. Siddhu apparently didn't like the flavor B, because he hadn't bought any of those. But he bought 310 g of C and 120 g of A. A costs $2.98, B costs $3.90 and C costs $1.99 per 100 g. Using Numpy and matrix multiplication, calculate how much each of them had to pay.

2. Use the np.linspace function to create a row vector called meshPoints containing exactly 500 values with values evenly spaced between –1 and 1. 6. What expression will yield the value of the 53rd element of meshPoints? What is that value? Produce a plot of a sinusoid on the interval [–1, 1] using the command plt.plot(meshPoints,np.sin(2*pi*meshPoints)).

3. Define a vector and a matrix as: vec1, mat1. You can multiply vectors by constants. Compute vec2 = (np.pi/4) * vec1. You can add vectors and multiply by scalars. Compute vec3 = vec1 + 2 * vec2. Compute Euclidean norm of a matrix. Compute the product of mat1 and vec3. Compute the transpose, determinant and trace of mat1. Find the smallest element of the matrix mat1.

4. As you know, a magic square is a matrix all of whose row sums, column sums and the sums of the two diagonals are the same. (One diagonal of a matrix goes from the top left to the bottom right, the other diagonal goes from top right to bottom left.) Verify that given 5×5 matrix A is a magic square by constructing the 5 column sums and computing the maximum and minimum values of the column sums. Do the same for the 5 row sums, and compute the two diagonal sums. Check that these six values are the same. If the maximum and minimum values are same, the flyswatter 2 principle says that all values are the same.

   Hint: The function np.diag extracts the diagonal of a matrix, and the function np.fliplr extracts the other diagonal.

5. Solve system of linear equations using numpy. (linalg.solve()).Test the consistency of the system of linear equations by checking rank of the matrices.

6. Find eigen values and eigen vectors of a given matrix. (linalg.eig())