

Mid Exam Simulation #2

1. A sample of the data of the amount of water in liter used by some washing machines are of the following.

5.5	1.1	6.5	4.9	6.4
7.0	1.5	5.7	5.9	5.4
6.1	1.2	7.3	6.1	4.4

Write a python program to compute the statistic descriptive of the sample data.

- a) Present the data graphically by using dot plot, error bar, and boxplot. Your results may look like the following.



2. We consider the linear algebra problem $Ax = b$ where the system matrix and the right-hand-side vector are:

$$A = \begin{bmatrix} 6 & 2 & 0 & 0 & 0 \\ -1 & 7 & 2 & 0 & 0 \\ 0 & -2 & 8 & 2 & 0 \\ 0 & 0 & 3 & 7 & -2 \\ 0 & 0 & 0 & 3 & 5 \end{bmatrix} \quad b = \begin{bmatrix} 2 \\ -3 \\ 4 \\ -3 \\ 1 \end{bmatrix}$$

Use python, to compute the following. Copy your solutions to the answer sheet.

- a) Transpose of matrix A and vector b
b) The Euclidean norm of the vector x .

3. If $|x| < 1$, it is known that:

$$\frac{1}{1-x} = 1 + x + x^2 + x^3 + \dots$$

- a) Write a python function that compute $1/(1-x)$ for $x = 0.1$. Your function should have the following interface that allows the user to adjust the number of the terms of the series n .

```
def taylor_1(x, n):
    # Your codes
```

- b) Use your function to compute $1/(1-x)$ with $x = 0.1$ by using the first 5 and 10 terms of the series.
c) Compute the relative errors of the results in (b).

4. Compute the exact solution and the numerical solution for the problem:

$$\int_1^2 \left(2x + \frac{3}{x}\right)^2 dx$$

As for the numerical solution using Gauss quadrature with two quadrature points of $\xi_0 = -0.577350$ and $\xi_1 = +0.577350$, and the two points have the same weight of $A_i = 1.0$. Compute the relative error of the numerical solution compared to the exact integration result.