Practice Problems

1.

$$f(2)=3$$
, $f(4)=5$, $f(5)=8$

Prepare an overdetermined system and then solve using

- 1. Least Square Method
- 2. QR Decomposition

$$f(18)=22$$
, $f(19)=35$, $f(20)=60$

Prepare an overdetermined system and then solve using

- 3. Least Square Method
- 4. QR Decomposition

$$f(18)=22$$
, $f(19)=35$, $f(20)=60$, $f(25)=80$

Prepare an overdetermined system using quadratic Polynomial and then solve using

- 5. Least Square Method
- 6. QR Decomposition

Using Gauss elimination method solve the below system:

$$3x_{1} + 5x_{2} + 7x_{3} + 9x_{4} = 1.4$$

$$7x_{1} + 3x_{2} + 11x_{3} + 4x_{4} = 1.8$$

$$2x_{1} + 5x_{2} + 3x_{3} + 2x_{4} = 2.7$$

$$8x_{1} + 7x_{2} + 7x_{3} + 4x_{4} = 3.4$$

Solve using LU Decomposition as well

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Using Gauss elimination method solve the below system:

$$x_{1} + 3x_{2} + 2x_{3} + 4x_{4} = 1.4$$

$$2x_{1} + x_{2} + x_{3} + 3x_{4} = 1.8$$

$$2x_{1} + 5x_{2} + x_{3} + x_{4} = 2.7$$

$$3x_{1} + 4x_{2} + 2x_{3} + 5x_{4} = 3.4$$

Solve using LU Decomposition as well

Using Gauss elimination method solve the below system:

$$12x_{1} + 10x_{2} - 7x_{3} = 15$$

$$6x_{1} + 5x_{2} + 3x_{3} = 14$$

$$24x_{1} - x_{2} + 5x_{3} = 28$$

Solve using LU Decomposition as well

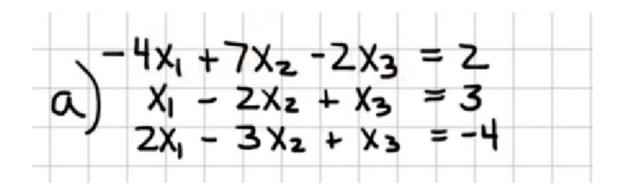
Consider the following set of vectors $S = \{v_1, v_2, v_3\}$ in R^3 where

$$ec{v}_1=egin{pmatrix} rac{3}{5} \ 0 \ rac{4}{5} \end{pmatrix}, \quad ec{v}_2=egin{pmatrix} 0 \ 1 \ 0 \end{pmatrix} \quad ext{and} \quad ec{v}_3=egin{pmatrix} -rac{3}{5} \ 0 \ rac{4}{5} \end{pmatrix}\,.$$

- a. Check if S is an orthonormal set.
- b. Let's say the following matrix below is an orthonormal matrix

$$\begin{pmatrix} 1 & 1 & 1 & 1 \\ 1 & 1 & -1 & -1 \\ 1 & -1 & 0 & 0 \\ 0 & 0 & 1 & -1 \end{pmatrix}.$$

Compute the value of $(A^T A)^{-1}$



- a. Construct F (1) and F (2)
- b. Find Lower Triangular Matrix
- c. Solve the System using LU Decomposition

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State two situations for which the Simpson's rule is limited. Find the exact value of the following integral

$$\int_{0}^{0.8} f(x) dx$$

where
$$f(x) = 0.2 + 25x - 200x^2 + 675x^3 - 900x^4 + 400x^5$$
 .

Use multi segment Trapezoidal rule with m=4 to approximate the integral in the previous part. And also find the actual relative error.

Compute the following integration

$$\int_{0}^{2}f\left(x\right) dx$$

numerically by using Trapezoidal and Simpson's rules if the functions $f\left(x\right)$ are given as: (i) $f\left(x\right)=\sqrt{1+x^2}$, (ii) $f\left(x\right)=\sin\left(x\right)$ and (iii) $f\left(x\right)=e^x$.