CVG2181 Numerical Modelling in Civil Engineering **Winter 2016**

Assignment 4 **Due: Thursday, 17 March 2016, 4:00 pm**

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1 (10)- Solve the specified problems of **Lab 4**.

2 (10)- Solve the specified problems of **Lab 5**.

3 (30)- The following system of equations is given,

$$\begin{cases} 4a + b + c = 27 \\ a + 4b + c = 36 \\ a + 2b + 5c = 60 \end{cases}$$

The exact solution is $\begin{bmatrix} a \\ b \\ c \end{bmatrix}_{exact} = \begin{bmatrix} 3 \\ 6 \\ 9 \end{bmatrix}$. Using the initial values of $\begin{bmatrix} a \\ b \\ c \end{bmatrix}_{initial} = \begin{bmatrix} 2 \\ 7 \\ 7 \end{bmatrix}$:

a- Solve the system using Gauss method with two iterations.

b- Calculate the ∞-norm of the true error and approximate relative error vectors at second iteration of part **a**.

c- Solve the system using Gauss-Seidel method with two iterations.

d- Calculate the ∞-norm of the true error and approximate relative error vectors at second iteration of part **c**.

e- Compare your results of parts **b** and **d** and comment on it.

4 (20)- The following non-linear system is given:

$$\begin{cases} \ln(x) + e^{y} = 8.48 \\ x^3 + x^2 y^2 = 63 \end{cases}$$

a- Solve the system for two iterations. Consider $\begin{bmatrix} x \\ y \end{bmatrix}_{initial} = \begin{bmatrix} 3.1 \\ 2.1 \end{bmatrix}$ as the starting point. Note that $\begin{bmatrix} x \\ y \end{bmatrix}_{exact} = \begin{bmatrix} 3 \\ 2 \end{bmatrix}$ is the exact solution for this system.

b- Calculate the 1st norm of the true error vector and approximate relative error vector in the second iteration.

5 (30)- Consider the following data:

Notation	x0	x1	x2	x3
X	-3	-2.5	-1	0.5
f(x)	2.2	1.8	0.8	1.25

a- Find $f(-1.75)$ using Lagrange interpolation method.

b- Find $f(-1.75)$ using Newton's interpolation method.

c- We would like to add another point ($x4 = 1.25, f(x4) = 1.5$) to the data set to approximate $f(-1.75)$. Which method you propose to do so?Why?

d- Considering the new point, find $f(-1.75)$ using your proposed method in part $\boldsymbol{c}$.