## EML3041 Computational Methods Fall 2023 Week Five: Sep 18 – Sep 22 Session: Two

Answer the free-response question starting on a fresh sheet of paper. Use as many sheets as possible of paper you need. Solve the problem as if you were submitting them for a test. Put your last name, first name, and the first letter of the last name in bold on the top of the page. Submit I(a) at the end of the class.

1. Given the following set of equations in matrix form.

[12	16	28	56]	$\begin{bmatrix} x_1 \end{bmatrix}$		[ 444 ]	
24	36	66	76	<i>x</i> <sub>2</sub>	_	746	
48	32	64	96	$x_3$	_	928	
60	66	78	92	$\lfloor x_4 \rfloor$		1066	

a) At the *end of the first step* of forward elimination part in the Naïve Gauss elimination algorithm, the equations obtained in a matrix form on a given set of equations are as follows.

[12	16	28	56 ]	$\begin{bmatrix} x_1 \end{bmatrix}$		444
0	4	10	-36	<i>x</i> <sub>2</sub>	_	-142
0	-32	-48	-128	<i>x</i> <sub>3</sub>	-	-848
L 0	-14	-62	-188	$\lfloor x_4 \rfloor$		-1154

Conduct <u>only the second step of forward elimination</u> of the Naïve Gauss elimination method and show the result in matrix form. Show your work for full credit and put your final answer in the box.

b) At the end of the forward elimination part of Naïve Gauss Elimination, I obtain the following system of equations.

[12	16	28	56 ]	$\begin{bmatrix} x_1 \end{bmatrix}$		[ 444 ]
0	4	10	-36	<i>x</i> <sub>2</sub>	_	-142
0	0	32	-416	$x_3$	_	-1984
L 0	0	0	-665	$x_4$		_3325

Now using a computer that uses only **three** significant digits with **chopping**, what is the value of  $x_3$  using back substitution **Show your work for full credit and put your final answer in the box.** 

c) What is the determinant of the original coefficient matrix

[12	16	28	56]
24	36	66	76
48	32	64	96
60	66	78	92

You can use previous parts of the problem to answer the question. Show your work for full credit and put your final answer in the box.

d) Does the inverse of the coefficient matrix of the given equations exist? Yes or No. How did you come to this conclusion?

Answers

	[12	16	28	56 ]	$\begin{bmatrix} x_1 \end{bmatrix}$		[ 444 ]	
a)	0	4	10	-36	<i>x</i> <sub>2</sub>	_	-142	
	0	0	32	-416	<i>x</i> <sub>3</sub>	_	-1984	
	0	0	-27	-314	$\begin{bmatrix} x_4 \end{bmatrix}$		_1651	

b) 2.81 (The answer is not 3 as you are only allowed to carry 3 significant digits with chopping)

c) -1021440

d) Answer not given intentionally