

Multiple-Choice Test - Gaussian Elimination
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1. The goal of forward elimination steps in the Naïve Gauss elimination method is to reduce the coefficient matrix to a (an) _____ matrix.
- (A) diagonal
 - (B) identity
 - (C) lower triangular
 - (D) upper triangular

2. Division by zero during forward elimination steps in Naïve Gaussian elimination of the set of equations $[A][X] = [C]$ implies the coefficient matrix $[A]$
- (A) is invertible
 - (B) is nonsingular
 - (C) may be singular or nonsingular
 - (D) is singular

3. Using a computer with four significant digits with chopping, the Naïve Gauss elimination solution to

$$0.0030x_1 + 55.23x_2 = 58.12$$

$$6.239x_1 - 7.123x_2 = 47.23$$

is

- (A) $x_1 = 26.66; x_2 = 1.051$
- (B) $x_1 = 8.769; x_2 = 1.051$
- (C) $x_1 = 8.800; x_2 = 1.000$
- (D) $x_1 = 8.771; x_2 = 1.052$

4. Using a computer with four significant digits with chopping, the Gaussian elimination with partial pivoting solution to

$$0.0030x_1 + 55.23x_2 = 58.12$$

$$6.239x_1 - 7.123x_2 = 47.23$$

is

- (A) $x_1 = 26.66; x_2 = 1.051$
- (B) $x_1 = 8.769; x_2 = 1.051$

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- (C) $x_1 = 8.800$; $x_2 = 1.000$
(D) $x_1 = 8.771$; $x_2 = 1.052$

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5. At the end of the forward elimination steps of the Naïve Gauss elimination method on the following equations

$$\begin{bmatrix} 4.2857 \times 10^7 & -9.2307 \times 10^5 & 0 & 0 \\ 4.2857 \times 10^7 & -5.4619 \times 10^5 & -4.2857 \times 10^7 & 5.4619 \times 10^5 \\ -6.5 & -0.15384 & 6.5 & 0.15384 \\ 0 & 0 & 4.2857 \times 10^7 & -3.6057 \times 10^5 \end{bmatrix} \begin{bmatrix} c_1 \\ c_2 \\ c_3 \\ c_4 \end{bmatrix} = \begin{bmatrix} -7.887 \times 10^3 \\ 0 \\ 0.007 \\ 0 \end{bmatrix}$$

the resulting equations in matrix form are given by

$$\begin{bmatrix} 4.2857 \times 10^7 & -9.2307 \times 10^5 & 0 & 0 \\ 0 & 3.7688 \times 10^5 & -4.2857 \times 10^7 & 5.4619 \times 10^5 \\ 0 & 0 & -26.9140 & 0.579684 \\ 0 & 0 & 0 & 5.62500 \times 10^5 \end{bmatrix} \begin{bmatrix} c_1 \\ c_2 \\ c_3 \\ c_4 \end{bmatrix} = \begin{bmatrix} -7.887 \times 10^3 \\ 7.887 \times 10^3 \\ 1.19530 \times 10^{-2} \\ 1.90336 \times 10^4 \end{bmatrix}$$

The determinant of the original coefficient matrix is

- (A) 0.00
 (B) 4.2857×10^7
 (C) 5.486×10^{19}
 (D) -2.445×10^{20}
6. The following data is given for the velocity of the rocket as a function of time. To find the velocity at $t=21$ s, you are asked to use a quadratic polynomial, $v(t) = at^2 + bt + c$ to approximate the velocity profile.

| | | | | | | | |
|--------|-------|---|--------|--------|--------|--------|--------|
| t | (s) | 0 | 14 | 15 | 20 | 30 | 35 |
| $v(t)$ | (m/s) | 0 | 227.04 | 362.78 | 517.35 | 602.97 | 901.67 |

The correct set of equations that will find a , b and c are

(A)
$$\begin{bmatrix} 176 & 14 & 1 \\ 225 & 15 & 1 \\ 400 & 20 & 1 \end{bmatrix} \begin{bmatrix} a \\ b \\ c \end{bmatrix} = \begin{bmatrix} 227.04 \\ 362.78 \\ 517.35 \end{bmatrix}$$



$$(B) \begin{bmatrix} 225 & 15 & 1 \\ 400 & 20 & 1 \\ 900 & 30 & 1 \end{bmatrix} \begin{bmatrix} a \\ b \\ c \end{bmatrix} = \begin{bmatrix} 362.78 \\ 517.35 \\ 602.97 \end{bmatrix}$$

$$(C) \begin{bmatrix} 0 & 0 & 1 \\ 225 & 15 & 1 \\ 400 & 20 & 1 \end{bmatrix} \begin{bmatrix} a \\ b \\ c \end{bmatrix} = \begin{bmatrix} 0 \\ 362.78 \\ 517.35 \end{bmatrix}$$

$$(D) \begin{bmatrix} 400 & 20 & 1 \\ 900 & 30 & 1 \\ 1225 & 35 & 1 \end{bmatrix} \begin{bmatrix} a \\ b \\ c \end{bmatrix} = \begin{bmatrix} 517.35 \\ 602.97 \\ 901.67 \end{bmatrix}$$

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