Multiple-Choice Test

Chapter 04.06
Gaussian Elimination

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) $x_1 = 8.769;\ x_2 = 1.051$
   (C) $x_1 = 8.800;\ x_2 = 1.000$
   (D) $x_1 = 8.771;\ x_2 = 1.052$

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

$$\begin{bmatrix} 4.2857\times10^{7} & -9.2307\times10^{5} & 0 & 0 \\ 4.2857\times10^{7} & -5.4619\times10^{5} & -4.2857\times10^{7} & 5.4619\times10^{5} \\ -6.5 & -0.15384 & 6.5 & 0.15384 \\ 0 & 0 & 4.2857\times10^{7} & -3.6057\times10^{5} \end{bmatrix} \begin{bmatrix} c_1 \\ c_2 \\ c_3 \\ c_4 \end{bmatrix} = \begin{bmatrix} -7.887\times10^{3} \\ 0 \\ 0.007 \\ 0 \end{bmatrix}$$

the resulting equations in matrix form are given by

$$\begin{bmatrix} 4.2857\times10^{7} & -9.2307\times10^{5} & 0 & 0 \\ 0 & 3.7688\times10^{5} & -4.2857\times10^{7} & 5.4619\times10^{5} \\ 0 & 0 & -26.9140 & 0.579684 \\ 0 & 0 & 0 & 5.62500\times10^{5} \end{bmatrix} \begin{bmatrix} c_1 \\ c_2 \\ c_3 \\ c_4 \end{bmatrix} = \begin{bmatrix} -7.887\times10^{3} \\ 7.887\times10^{3} \\ 1.19530\times10^{-2} \\ 1.90336\times10^{4} \end{bmatrix}$$

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 $t = 21\,\text{s}$, 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) $\begin{bmatrix} 400 & 20 & 1 \\ 900 & 30 & 1 \\ 1225 & 35 & 1 \end{bmatrix} \begin{bmatrix} a \\ b \\ c \end{bmatrix} = \begin{bmatrix} 517.35 \\ 602.97 \\ 901.67 \end{bmatrix}$

For a complete solution, refer to the links at the end of the book.