

## Multiple-Choice Test

### Chapter 04.09

### Adequacy of Solutions

1. The row sum norm of the matrix

$$[A] = \begin{bmatrix} 6 & -7 & 3 & 13 \\ 19 & -21 & 23 & -29 \\ 41 & 47 & -51 & 61 \end{bmatrix}$$

is

- (A) 29  
(B) 61  
(C) 98  
(D) 200
2. The adequacy of the solution of simultaneous linear equations  $[A][X] = [C]$  depends on  
(A) the condition number of coefficient matrix  $[A]$   
(B) the machine epsilon  
(C) the condition number for matrix  $[A]$  and the machine epsilon  
(D) norm of the coefficient matrix  $[A]$
3. Given a set of equations in matrix form  $[A][X] = [C]$ ,  $\|A\| = 250$ ,  $\|A^{-1}\| = 40$  and  $\varepsilon_{mach} = 0.119 \times 10^{-6}$ , then the number of significant digits you can at least trust in the solution are  
(A) 1  
(B) 2  
(C) 3  
(D) 4

4. The solution to a set of simultaneous linear equations

$$\begin{bmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 44 \\ 94 \\ 138 \end{bmatrix}$$

is given as

$$\begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 2 \\ 4 \\ 7 \end{bmatrix}$$

The solution to another set of simultaneous linear equations is given by (note the coefficient matrix is the same as above)

$$\begin{bmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 43.99 \\ 93.98 \\ 138.03 \end{bmatrix}$$

is given as

$$\begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 214.01 \\ -208.01 \\ 60 \end{bmatrix}$$

Based on the row sum norm, the condition number of the coefficient matrix is greater than (choose the largest possible value)

- (A) 1
  - (B) 138
  - (C) 4500
  - (D) 139320
5. The condition number of the  $n \times n$  identity matrix based on the row sum norm is
- (A) 0
  - (B) 1
  - (C)  $n$
  - (D)  $n^2$
6. Let  $[A] = \begin{bmatrix} 1 & 2 + \delta \\ 2 - \delta & 1 \end{bmatrix}$ . Based on the row sum norm and given that  $\delta \rightarrow 0, \delta > 0$ , the condition number of the matrix is
- (A)  $\frac{3 - \delta}{3 + \delta}$
  - (B)  $\frac{9 - \delta^2}{3 - \delta^2}$
  - (C)  $\frac{(3 + \delta)^2}{3 - \delta^2}$
  - (D)  $\frac{3 - 2\delta - \delta^2}{3 - \delta^2}$