

GAUSS ELIMINATION METHOD

PRACTICAL - 5 (B)

QUE 1: SOLVE THE GIVEN SYSTEM OF LINEAR EQUATION USING GAUSS ELIMINATION METHOD:

```
In[50]:= A = {{2, 1, 1}, {3, 5, 2}, {2, 1, 4}};
```

```
In[51]:= A // MatrixForm
```

```
Out[51]//MatrixForm=
```

$$\begin{pmatrix} 2 & 1 & 1 \\ 3 & 5 & 2 \\ 2 & 1 & 4 \end{pmatrix}$$

```
In[52]:= b = {4, 15, 8};
```

```
In[53]:= b // MatrixForm
```

```
Out[53]//MatrixForm=
```

$$\begin{pmatrix} 4 \\ 15 \\ 8 \end{pmatrix}$$

```
In[54]:= m1 = Length[A];
```

```
In[55]:= m2 = Length[b];
```

```
In[56]:= x = Table[0, {m1}];
```

```
In[57]:= If[m1 ≠ m2, Print["The system cannot be solved"], Table[AppendTo[A[[i]], b[[i]], {i, m1}];  
Print["A|b=", A // MatrixForm];  
For[i = 1, i ≤ m1 - 1, i++, s = Abs[A[[i, i]]];  
c = i;  
For[j = i + 1, j ≤ m1, j++, If[Abs[A[[j, i]]] > s, s = A[[j, i]];  
c = j];];  
For[k = 1, k ≤ m1 + 1, k++, d[k] = A[[i, k]];  
A[[i, k]] = A[[c, k]];  
A[[c, k]] = d[k]];  
Print["Step=", i, A // MatrixForm];  
For[j = i + 1, j ≤ m1, j++, m = A[[j, i]] / A[[i, i]];  
For[k = 1, k ≤ m1 + 1, k++, A[[j, k]] = A[[j, k]] - (m * A[[i, k]])];];  
Print[A // MatrixForm];];  
For[i = 0, i ≤ m1 - 1, i++, x[[m1 - i]] =  
(A[[m1 - i, m1 + 1]] - Sum[A[[m1 - i, j]] * x[[j]], {j, m1 - i + 1, m1}]) / A[[m1 - i, m1 - i]]];  
Print["x", x // MatrixForm];]
```

$$[A|b] = \begin{pmatrix} 2 & 1 & 1 & 4 \\ 3 & 5 & 2 & 15 \\ 2 & 1 & 4 & 8 \end{pmatrix}$$

$$\text{Step}=1 \begin{pmatrix} 3 & 5 & 2 & 15 \\ 2 & 1 & 1 & 4 \\ 2 & 1 & 4 & 8 \end{pmatrix}$$

$$\begin{pmatrix} 3 & 5 & 2 & 15 \\ 0 & -\frac{7}{3} & -\frac{1}{3} & -6 \\ 0 & -\frac{7}{3} & \frac{8}{3} & -2 \end{pmatrix}$$

$$\text{Step}=2 \begin{pmatrix} 3 & 5 & 2 & 15 \\ 0 & -\frac{7}{3} & -\frac{1}{3} & -6 \\ 0 & -\frac{7}{3} & \frac{8}{3} & -2 \end{pmatrix}$$

$$\begin{pmatrix} 3 & 5 & 2 & 15 \\ 0 & -\frac{7}{3} & -\frac{1}{3} & -6 \\ 0 & 0 & 3 & 4 \end{pmatrix}$$

$$x \begin{pmatrix} \frac{1}{7} \\ \frac{50}{21} \\ \frac{4}{3} \end{pmatrix}$$

QUE 2:

In[58]:= **A = {{2, -1, 1}, {2, -3, 1}, {1, 3, -4}};**

In[59]:= **A // MatrixForm**

Out[59]//MatrixForm=

$$\begin{pmatrix} 2 & -1 & 1 \\ 2 & -3 & 1 \\ 1 & 3 & -4 \end{pmatrix}$$

In[60]:= **b = {5, 3, 4};**

In[61]:= **b // MatrixForm**

Out[61]//MatrixForm=

$$\begin{pmatrix} 5 \\ 3 \\ 4 \end{pmatrix}$$

In[62]:= **m1 = Length[A];**

In[63]:= **m2 = Length[b];**

In[64]:= **x = Table[0, {m1}];**

```

In[65]:= If[m1 ≠ m2, Print["The system cannot be solved"], Table[AppendTo[A[[i]], b[[i]], {i, m1}];
Print["[A|b]=", A // MatrixForm];
For[i = 1, i ≤ m1 - 1, i++, s = Abs[A[[i, i]]];
c = i;
For[j = i + 1, j ≤ m1, j++, If[Abs[A[[j, i]]] > s, s = A[[j, i]];
c = j];];
For[k = 1, k ≤ m1 + 1, k++, d[k] = A[[i, k]];
A[[i, k]] = A[[c, k]];
A[[c, k]] = d[k]];
Print["Step=", i, A // MatrixForm];
For[j = i + 1, j ≤ m1, j++, m = A[[j, i]] / A[[i, i]];
For[k = 1, k ≤ m1 + 1, k++, A[[j, k]] = A[[j, k]] - (m * A[[i, k]])];];
Print[A // MatrixForm];];
For[i = 0, i ≤ m1 - 1, i++, x[[m1 - i]] =
(A[[m1 - i, m1 + 1]] - Sum[A[[m1 - i, j]] * x[[j]], {j, m1 - i + 1, m1}]) / A[[m1 - i, m1 - i]];];
Print["x", x // MatrixForm];]

```

$$[A|b] = \begin{pmatrix} 2 & -1 & 1 & 5 \\ 2 & -3 & 1 & 3 \\ 1 & 3 & -4 & 4 \end{pmatrix}$$

$$\text{Step}=1 \begin{pmatrix} 2 & -1 & 1 & 5 \\ 2 & -3 & 1 & 3 \\ 1 & 3 & -4 & 4 \end{pmatrix}$$

$$\begin{pmatrix} 2 & -1 & 1 & 5 \\ 0 & -2 & 0 & -2 \\ 0 & \frac{7}{2} & -\frac{9}{2} & \frac{3}{2} \end{pmatrix}$$

$$\text{Step}=2 \begin{pmatrix} 2 & -1 & 1 & 5 \\ 0 & \frac{7}{2} & -\frac{9}{2} & \frac{3}{2} \\ 0 & -2 & 0 & -2 \end{pmatrix}$$

$$\begin{pmatrix} 2 & -1 & 1 & 5 \\ 0 & \frac{7}{2} & -\frac{9}{2} & \frac{3}{2} \\ 0 & 0 & -\frac{18}{7} & -\frac{8}{7} \end{pmatrix}$$

$$x \begin{pmatrix} \frac{25}{9} \\ 1 \\ \frac{4}{9} \end{pmatrix}$$

QUE 3 :

```

In[66]:= A = {{3, -6, 2}, {4, -1, 1}, {1, -3, 7}};

```

```

In[67]:= A // MatrixForm

```

```

Out[67]//MatrixForm=

```

$$\begin{pmatrix} 3 & -6 & 2 \\ 4 & -1 & 1 \\ 1 & -3 & 7 \end{pmatrix}$$

```

In[68]:= b = {14, 2, 22};

```

```
In[69]:= b // MatrixForm
```

```
Out[69]//MatrixForm=
```

$$\begin{pmatrix} 14 \\ 2 \\ 22 \end{pmatrix}$$

```
In[71]:= m1 = Length[A];
```

```
In[72]:= m2 = Length[b];
```

```
In[73]:= x = Table[0, {m1}];
```

```
In[74]:= If[m1 ≠ m2, Print["The system cannot be solved"], Table[AppendTo[A[[i]], b[[i]]], {i, m1}];
Print["[A|b]=", A // MatrixForm];
For[i = 1, i ≤ m1 - 1, i++, s = Abs[A[[i, i]]];
c = i;
For[j = i + 1, j ≤ m1, j++, If[Abs[A[[j, i]]] > s, s = A[[j, i]];
c = j];];
For[k = 1, k ≤ m1 + 1, k++, d[k] = A[[i, k]];
A[[i, k]] = A[[c, k]];
A[[c, k]] = d[k]];
Print["Step=", i, A // MatrixForm];
For[j = i + 1, j ≤ m1, j++, m = A[[j, i]] / A[[i, i]];
For[k = 1, k ≤ m1 + 1, k++, A[[j, k]] = A[[j, k]] - (m * A[[i, k]])];];
Print[A // MatrixForm];];
For[i = 0, i ≤ m1 - 1, i++, x[[m1 - i]] =
(A[[m1 - i, m1 + 1]] - Sum[A[[m1 - i, j]] * x[[j]], {j, m1 - i + 1, m1}]) / A[[m1 - i, m1 - i]];
Print["x", x // MatrixForm];]
```

$$[A|b] = \begin{pmatrix} 3 & -6 & 2 & 14 \\ 4 & -1 & 1 & 2 \\ 1 & -3 & 7 & 22 \end{pmatrix}$$

$$\text{Step}=1 \begin{pmatrix} 4 & -1 & 1 & 2 \\ 3 & -6 & 2 & 14 \\ 1 & -3 & 7 & 22 \end{pmatrix}$$

$$\begin{pmatrix} 4 & -1 & 1 & 2 \\ 0 & -\frac{21}{4} & \frac{5}{4} & \frac{25}{2} \\ 0 & -\frac{11}{4} & \frac{27}{4} & \frac{43}{2} \end{pmatrix}$$

$$\text{Step}=2 \begin{pmatrix} 4 & -1 & 1 & 2 \\ 0 & -\frac{21}{4} & \frac{5}{4} & \frac{25}{2} \\ 0 & -\frac{11}{4} & \frac{27}{4} & \frac{43}{2} \end{pmatrix}$$

$$\begin{pmatrix} 4 & -1 & 1 & 2 \\ 0 & -\frac{21}{4} & \frac{5}{4} & \frac{25}{2} \\ 0 & 0 & \frac{128}{21} & \frac{314}{21} \end{pmatrix}$$

$$x \begin{pmatrix} -\frac{9}{16} \\ -\frac{115}{64} \\ \frac{157}{64} \end{pmatrix}$$