**MODERN COLLEGE OF ARTS,SCI. & COMM. PUNE-05.**

**DEPARTMENT OF STATISTICS.(Autonomous)**

**M.Sc.( I )- ST-15**

**EXPT.NO. 02 Date:**

**Sub. Date:**

**TITLE : Matrices: Properties of matrices, Row Space,Column Space and Null Space.**

1. Determine rank for each of the following matrix.

(i)  (ii) B= iii)C=

2.(i) Compute the determinants of matrix by reduction order method using3rd row and

2nd column as pivot element

A= 

.(ii) Compute the determinants of matrix by reduction order method using 2nd row and

1st  column as pivot element

A=

3. Find inverse for each of the following matrix.

(i) A= (ii) B=

4. Show that determinant of upper triangular matrix is the product of diagonal element

using matrix given below

B = 

5. (i) Find the rank and basis of the row space of the following matrix.

A=

(ii) Find the rank and basis of the column space of each of the following matrix.

B= 

6. Find a basis for the null space of

A=

**1. Determine rank for each of the following matrix.**

**(i) **

**ANS.**

**A=[2 5 -3 4 8 ;4 7 -4 -3 9;6 9 -5 2 4;0 -9 6 5 -6]**

**A =**

**2 5 -3 4 8**

**4 7 -4 -3 9**

**6 9 -5 2 4**

**0 -9 6 5 -6**

**>>**a1=[A(1,:)/2;A(2,:)-2\*A(1,:);A(3,:)-3\*A(1,:);A(4,:)]

a1 =

1.00000 2.50000 -1.50000 2.00000 4.00000

0.00000 -3.00000 2.00000 -11.00000 -7.00000

0.00000 -6.00000 4.00000 -10.00000 -20.00000

0.00000 -9.00000 6.00000 5.00000 -6.00000

a2=[a1(1,:);a1(2,:)/3;a1(3,:)-2\*a1(2,:);a1(4,:)-3\*a1(2,;)]

^

>> a2=[a1(1,:);a1(2,:)/3;a1(3,:)-2\*a1(2,:);a1(4,:)-3\*a1(2,:)]

a2 =

1.00000 2.50000 -1.50000 2.00000 4.00000

0.00000 -1.00000 0.66667 -3.66667 -2.33333

0.00000 0.00000 0.00000 12.00000 -6.00000

0.00000 0.00000 0.00000 38.00000 15.00000

>> a3=[a2(1,:);a2(2,:);a2(3,:)/12;a2(4,:)]

a3 =

1.00000 2.50000 -1.50000 2.00000 4.00000

0.00000 -1.00000 0.66667 -3.66667 -2.33333

0.00000 0.00000 0.00000 1.00000 -0.50000

0.00000 0.00000 0.00000 38.00000 15.00000

a4=[a3(1,:);a3(2,:);a3(3,:);a3(4,:)-38\*a3(3,:)]

a4 =

1.00000 2.50000 -1.50000 2.00000 4.00000

0.00000 -1.00000 0.66667 -3.66667 -2.33333

0.00000 0.00000 0.00000 1.00000 -0.50000

0.00000 0.00000 0.00000 0.00000 34.00000

>> a5=[a4(1,:);a4(2,:);a4(3,:)-38\*a3(3,:)]

a5 =

1.00000 2.50000 -1.50000 2.00000 4.00000

0.00000 -1.00000 0.66667 -3.66667 -2.33333

0.00000 0.00000 0.00000 -37.00000 18.50000

>> a5=[a4(1,:);a4(2,:);a4(3,:);a4(4,:)/34]

a5 =

1.00000 2.50000 -1.50000 2.00000 4.00000

0.00000 -1.00000 0.66667 -3.66667 -2.33333

0.00000 0.00000 0.00000 1.00000 -0.50000

0.00000 0.00000 0.00000 0.00000 1.00000

>> # no of non zero rows in a5 i.e row echelon form is therefore rank of matrix is

4

>> # rank(A)=4

>>rank(A)

ans = 4

ii) B=

**ANS.**

B=[1 2 -3 -2;1 3 -2 0;3 8 -7 -2;2 1 -9 -10]

B =

1 2 -3 -2

1 3 -2 0

3 8 -7 -2

2 1 -9 -10

>> b1=[B(1,:);B(2,:)-B(1,:);B(3,:)-3\*B(1,:);B(4,:)-2\*B(1,:)]

b1 =

1 2 -3 -2

0 1 1 2

0 2 2 4

1. -3 -3 -6

b2=[b1(1,:);b1(2,:);b1(3,:)-2\*b1(2,:);b1(4,:)+3\*b1(2,:)]

b2 =

1 2 -3 -2

0 1 1 2

0 0 0 0

0 0 0 0

>> # the rank(B)=2

>> # check by direct command

>>rank(B)

ans = 2

iii)C=

ANS.

C=[2 5 -3 -2;-2 -3 2 -5;1 3 -2 2;-2 -6 4 -4]

C =

2 5 -3 -2

-2 -3 2 -5

1 3 -2 2

-2 -6 4 -4

>> c1=[C(3,:);C(2,:)+2\*C(3,:);C(1,:)-2\*C(3,:);C(4,:)+2\*C(3,:)]

c1 =

1 3 -2 2

0 3 -2 -1

0 -1 1 -6

0 0 0 0

>> c2=[c1(1,:);-c1(3,:);c1(2,:)+3\*c1(3,:);c1(4,:)]

c2 =

1 3 -2 2

-0 1 -1 6

0 0 1 -19

0 0 0 0

>> # rank(C)=3

>> # check the direct command

>> rank(C)

ans = 3

**2.(i) Compute the determinants of matrix by reduction order method using3rd row and**

**2nd column as pivot element**

A= 

ANS.

A=[6 2 1 0 5;3 1 1 -2 1;1 1 2 -2 3;3 0 2 3 -1;-1 -1 -3 4 2]

A =

6 2 1 0 5

3 1 1 -2 1

1 1 2 -2 3

3 0 2 3 -1

-1 -1 -3 4 2

>> A1=[A(1,:)-2\*A(3,:);A(2,:)-A(3,:);A(3,:);A(4,:);A(5,:)+A(3,:)]

A1 =

4 0 -3 4 -1

2 0 -1 0 -2

1 1 2 -2 3

3 0 2 3 -1

0 0 -1 2 5

>> a1=A1([1,2,4,5],[1,3,4,5])

a1 =

4 -3 4 -1

2 -1 0 -2

3 2 3 -1

0 -1 2 5

>> a1(1,:)=(1/4)\*a1(1,:);a1(2,:)=a1(2,:)-2\*a1(1,:);,a1(3,:)=a1(3,:)-3\*a1(1,:)

a1 =

1.00000 -0.75000 1.00000 -0.25000

0.00000 0.50000 -2.00000 -1.50000

0.00000 4.25000 0.00000 -0.25000

0.00000 -1.00000 2.00000 5.00000

A2=a1([2,3,4],[2,3,4])

A2 =

0.50000 -2.00000 -1.50000

4.25000 0.00000 -0.25000

-1.00000 2.00000 5.00000

det(A2)

ans = 29.500

>> (-1)^(3+2+2)\*4\*det(A2)

ans = -118

>>det(A)

ans = -118

ii)Compute the determinants of matrix by reduction order method using 2nd row and

1st  column as pivot element

A=

ANS.

A=[4 -2 5 -5;-9 7 -8 0;-6 4 5 3;5 -3 8 -4]

A =

4 -2 5 -5

-9 7 -8 0

-6 4 5 3

5 -3 8 -4

>>format rat

>>det(A)

ans = 0

A(2,:)=(1/-9)\*A(2,:);A(1,:)=A(1,:)-4\*A(2,:);A(3,:)=A(3,:)+6\*A(2,:)-5\*A(2,:)

A =

0 10/9 13/9 -5

1 -7/9 8/9 -0

-5 29/9 53/9 3

5 -3 8 -4

>> A1=A([1,3,4],[2,3,4])

A1 =

10/9 13/9 -5

29/9 53/9 3

-3 8 -4

(-1)^(2+1)\*(-9)\*det(A)

ans = 0

3. Find inverse for each of the following matrix.

(i) A=

A=[4 0 -7 -7;-6 1 11 9;7 -5 10 19;-1 2 3 -1]

A =

4 0 -7 -7

-6 1 11 9

7 -5 10 19

-1 2 3 -1

>>det(A)=1.000

error: det(-6): subscripts must be either integers 1 to (2^31)-1 or logicals

>>det(A)

ans = 1

>>A(1,:)=[]

A =

-6 1 11 9

7 -5 10 19

-1 2 3 -1

>>A(:,1)=[]

A =

1 11 9

-5 10 19

2 3 -1

C11=

^

>>det(A)

ans = -19

>> C12=

parse error:

syntax error

>>> C12=

^

>> A=[4 0 -7 -7;-6 1 11 9;7 -5 10 19;-1 2 3 -1]

A =

4 0 -7 -7

-6 1 11 9

7 -5 10 19

-1 2 3 -1

>>A(1,:)=[]

A =

-6 1 11 9

7 -5 10 19

-1 2 3 -1

>>A(:,2)=[]

A =

-6 11 9

7 10 19

-1 3 -1

det(A)

ans = 549

>> C13=

parse error:

syntax error

>>> C13=

^

>> A=[4 0 -7 -7;-6 1 11 9;7 -5 10 19;-1 2 3 -1]

A =

4 0 -7 -7

-6 1 11 9

7 -5 10 19

-1 2 3 -1

>>A(1,:)=[]

A =

-6 1 11 9

7 -5 10 19

-1 2 3 -1

>>A(:,3)=[]

A =

-6 1 9

7 -5 19

-1 2 -1

>>det(A)

ans = 267

>>> C14=

^

>> A=[4 0 -7 -7;-6 1 11 9;7 -5 10 19;-1 2 3 -1]

A =

4 0 -7 -7

-6 1 11 9

7 -5 10 19

-1 2 3 -1

>>A(1,:)=[]

A =

-6 1 11 9

7 -5 10 19

-1 2 3 -1

>>A(:,4)=[]

A =

-6 1 11

7 -5 10

-1 2 3

>> -det(A)

ans = -278

C21=

^

>> A=[4 0 -7 -7;-6 1 11 9;7 -5 10 19;-1 2 3 -1]

A =

4 0 -7 -7

-6 1 11 9

7 -5 10 19

-1 2 3 -1

>>A(2,:)=[]

A =

4 0 -7 -7

7 -5 10 19

-1 2 3 -1

>>A(:,1)=[]

A =

0 -7 -7

-5 10 19

2 3 -1

>> -det(A)

ans = -14

>>> C22=

^

>> A=[4 0 -7 -7;-6 1 11 9;7 -5 10 19;-1 2 3 -1]

A =

4 0 -7 -7

-6 1 11 9

7 -5 10 19

-1 2 3 -1

>>A(2,:)=[]

A =

4 0 -7 -7

7 -5 10 19

-1 2 3 -1

>>A(:,2)=[]

A =

4 -7 -7

7 10 19

-1 3 -1

>>det(A)

ans = -401

A=[4 0 -7 -7;-6 1 11 9;7 -5 10 19;-1 2 3 -1]

A =

4 0 -7 -7

-6 1 11 9

7 -5 10 19

-1 2 3 -1

>>A(2,:)=[]

A =

4 0 -7 -7

7 -5 10 19

-1 2 3 -1

>>A(:,3)=[]

A =

4 0 -7

7 -5 19

-1 2 -1

>> -det(A)

ans = 195

>> C24=

A=[4 0 -7 -7;-6 1 11 9;7 -5 10 19;-1 2 3 -1]

A =

4 0 -7 -7

-6 1 11 9

7 -5 10 19

-1 2 3 -1

>>A(2,:)=[]

A =

4 0 -7 -7

7 -5 10 19

-1 2 3 -1

>>A(:,4)=[]

A =

4 0 -7

7 -5 10

-1 2 3

>>det(A)

ans = -203

C31

>> A=[4 0 -7 -7;-6 1 11 9;7 -5 10 19;-1 2 3 -1]

A =

4 0 -7 -7

-6 1 11 9

7 -5 10 19

-1 2 3 -1

>>A(3,:)=[]

A =

4 0 -7 -7

-6 1 11 9

-1 2 3 -1

>>A(:,1)=[]

A =

0 -7 -7

1 11 9

2 3 -1

>>det(A)

ans = 0

C32

>> A=[4 0 -7 -7;-6 1 11 9;7 -5 10 19;-1 2 3 -1]

A =

4 0 -7 -7

-6 1 11 9

7 -5 10 19

-1 2 3 -1

>>A(3,:)=[]

A =

4 0 -7 -7

-6 1 11 9

-1 2 3 -1

>>A(:,2)=[]

A =

4 -7 -7

-6 11 9

-1 3 -1

>> -det(A)

ans = -2

C33

>> A=[4 0 -7 -7;-6 1 11 9;7 -5 10 19;-1 2 3 -1]

A =

4 0 -7 -7

-6 1 11 9

7 -5 10 19

-1 2 3 -1

>>A(3,:)=[]

A =

4 0 -7 -7

-6 1 11 9

-1 2 3 -1

>>A(:,3)=[]

A =

4 0 -7

-6 1 9

-1 2 -1

>>det(A)

ans = 1

>> C34

A=[4 0 -7 -7;-6 1 11 9;7 -5 10 19;-1 2 3 -1]

A =

4 0 -7 -7

-6 1 11 9

7 -5 10 19

-1 2 3 -1

>>A(3,:)=[]

A =

4 0 -7 -7

-6 1 11 9

-1 2 3 -1

>>A(:,4)=[]

A =

4 0 -7

-6 1 11

-1 2 3

>> -det(A)

ans = -1

>> C41

A=[4 0 -7 -7;-6 1 11 9;7 -5 10 19;-1 2 3 -1]

A =

4 0 -7 -7

-6 1 11 9

7 -5 10 19

-1 2 3 -1

>>A(4,:)=[]

A =

4 0 -7 -7

-6 1 11 9

7 -5 10 19

>>A(:,1)=[]

A =

0 -7 -7

1 11 9

-5 10 19

>> -det(A)

ans = 7

>>

>> C42

A=[4 0 -7 -7;-6 1 11 9;7 -5 10 19;-1 2 3 -1]

A =

4 0 -7 -7

-6 1 11 9

7 -5 10 19

-1 2 3 -1

>>A(4,:)=[]

A =

4 0 -7 -7

-6 1 11 9

7 -5 10 19

>>A(:,2)=[]

A =

4 -7 -7

-6 11 9

7 10 19

>>det(A)

ans = 196

C43

>> A=[4 0 -7 -7;-6 1 11 9;7 -5 10 19;-1 2 3 -1]

A =

4 0 -7 -7

-6 1 11 9

7 -5 10 19

-1 2 3 -1

>>A(4,:)=[]

A =

4 0 -7 -7

-6 1 11 9

7 -5 10 19

>>A(:,3)=[]

A =

4 0 -7

-6 1 9

7 -5 19

>> -det(A)

ans = -95

>> C44

A=[4 0 -7 -7;-6 1 11 9;7 -5 10 19;-1 2 3 -1]

A =

4 0 -7 -7

-6 1 11 9

7 -5 10 19

-1 2 3 -1

>>A(4,:)=[]

A =

4 0 -7 -7

-6 1 11 9

7 -5 10 19

>>A(:,4)=[]

A =

4 0 -7

-6 1 11

7 -5 10

>>det(A)

ans = 99

>>cofactor=[-19 -549 267 -278;-14 -401 195 -203;7.3830e-15 -2 1 -1;7 193 -95 99]

cofactor =

-19 -549 267 -278

-14 -401 195 -203

0 -2 1 -1

7 193 -95 99

adj=cofactor'

adj =

-19 -14 0 7

-549 -401 -2 193

267 195 1 -95

-278 -203 -1 99

>>Ainverse=(1/det(A))\*adj

Ainverse =

-19/99 -14/99 0 7/99

-61/11 -401/99 -2/99 193/99

89/33 65/33 1/99 -95/99

-278/99 -203/99 -1/99 1

>> #lets check by command

>> A=[4 0 -7 -7;-6 1 11 9;7 -5 10 19;-1 2 3 -1]

A =

4 0 -7 -7

-6 1 11 9

7 -5 10 19

-1 2 3 -1

inv(A)

ans =

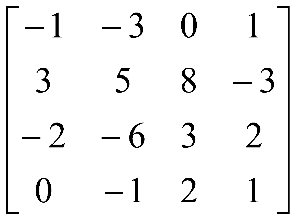
-19 -14 0 7

-549 -401 -2 196

267 195 1 -95

-278 -203 -1 99

**(ii) B=**

****

**ANS.**

**B=[-1 -3 0 1;3 5 8 -3;-2 -6 3 2;0 -1 2 1]**

**B =**

**-1 -3 0 1**

**3 5 8 -3**

**-2 -6 3 2**

**0 -1 2 1**

**>>det(B)**

**ans = 12**

**>> C11=**

**parse error:**

**syntax error**

**>>> C11=**

**^**

**>> B=[-1 -3 0 1;3 5 8 -3;-2 -6 3 2;0 -1 2 1]**

**B =**

**-1 -3 0 1**

**3 5 8 -3**

**-2 -6 3 2**

**0 -1 2 1**

**>>B(1,:)=[]**

B =

3 5 8 -3

-2 -6 3 2

0 -1 2 1

>>B(:,1)=[]

B =

5 8 -3

-6 3 2

-1 2 1

>>det(B)

ans = 54

>> C12=

parse error:

syntax error

>>> C12=

^

>> B=[-1 -3 0 1;3 5 8 -3;-2 -6 3 2;0 -1 2 1]

B =

-1 -3 0 1

3 5 8 -3

-2 -6 3 2

0 -1 2 1

>>B(1,:)=[]

B =

3 5 8 -3

-2 -6 3 2

0 -1 2 1

>>B(:,2)=[]

B =

3 8 -3

-2 3 2

0 2 1

>> -det(B)

ans = -25

>>> C13=

^

>> B=[-1 -3 0 1;3 5 8 -3;-2 -6 3 2;0 -1 2 1]

B =

-1 -3 0 1

3 5 8 -3

-2 -6 3 2

0 -1 2 1

>>B(1,:)=[]

B =

3 5 8 -3

-2 -6 3 2

0 -1 2 1

>>B(:,3)=[]

B =

3 5 -3

-2 -6 2

0 -1 1

>>det(B)

ans = -8

>> C14=

C14=

^

>> B=[-1 -3 0 1;3 5 8 -3;-2 -6 3 2;0 -1 2 1]

B =

-1 -3 0 1

3 5 8 -3

-2 -6 3 2

0 -1 2 1

>>B(1,:)=[]

B =

3 5 8 -3

-2 -6 3 2

0 -1 2 1

>>B(:,4)=[]

B =

3 5 8

-2 -6 3

0 -1 2

>> -det(B)

ans = -9

>> C21=

C21=

^

>> B=[-1 -3 0 1;3 5 8 -3;-2 -6 3 2;0 -1 2 1]

B =

-1 -3 0 1

3 5 8 -3

-2 -6 3 2

0 -1 2 1

>>B(2,:)=[]

B =

-1 -3 0 1

-2 -6 3 2

0 -1 2 1

>>B(:,1)=[]

B =

-3 0 1

-6 3 2

-1 2 1

>> -det(B)

ans = 6

>> C22=

B=[-1 -3 0 1;3 5 8 -3;-2 -6 3 2;0 -1 2 1]

B =

-1 -3 0 1

3 5 8 -3

-2 -6 3 2

0 -1 2 1

>>B(2,:)=[]

B =

-1 -3 0 1

-2 -6 3 2

0 -1 2 1

>>B(:,2)=[]

B =

-1 0 1

-2 3 2

0 2 1

>>det(B)

ans = -3

>> C23=

B=[-1 -3 0 1;3 5 8 -3;-2 -6 3 2;0 -1 2 1]

B =

-1 -3 0 1

3 5 8 -3

-2 -6 3 2

0 -1 2 1

>>B(2,:)=[]

B =

-1 -3 0 1

-2 -6 3 2

0 -1 2 1

>>B(:,3)=[]

B =

-1 -3 1

-2 -6 2

0 -1 1

>> -det(B)

ans = -0

>> C24=

B=[-1 -3 0 1;3 5 8 -3;-2 -6 3 2;0 -1 2 1]

B =

-1 -3 0 1

3 5 8 -3

-2 -6 3 2

0 -1 2 1

>>B(2,:)=[]

B =

-1 -3 0 1

-2 -6 3 2

0 -1 2 1

>>B(:,4)=[]

B =

-1 -3 0

-2 -6 3

0 -1 2

>>det(B)

ans = -3

>> C31=

B=[-1 -3 0 1;3 5 8 -3;-2 -6 3 2;0 -1 2 1]

B =

-1 -3 0 1

3 5 8 -3

-2 -6 3 2

0 -1 2 1

>>B(3,:)=[]

B =

-1 -3 0 1

3 5 8 -3

0 -1 2 1

>>B(:,1)=[]

B =

-3 0 1

5 8 -3

-1 2 1

>>det(B)

ans = -24

>>

>> C32=

C32=

^

>> B=[-1 -3 0 1;3 5 8 -3;-2 -6 3 2;0 -1 2 1]

B =

-1 -3 0 1

3 5 8 -3

-2 -6 3 2

0 -1 2 1

>>B(3,:)=[]

B =

-1 -3 0 1

3 5 8 -3

0 -1 2 1

>>B(:,2)=[]

B =

-1 0 1

3 8 -3

0 2 1

>> -det(B)

ans = 8

>> C33=

B=[-1 -3 0 1;3 5 8 -3;-2 -6 3 2;0 -1 2 1]

B =

-1 -3 0 1

3 5 8 -3

-2 -6 3 2

0 -1 2 1

>>B(3,:)=[]

B =

-1 -3 0 1

3 5 8 -3

0 -1 2 1

>>B(:,3)=[]

B =

-1 -3 1

3 5 -3

0 -1 1

>>det(B)

ans = 4

>> C34=

B=[-1 -3 0 1;3 5 8 -3;-2 -6 3 2;0 -1 2 1]

B =

-1 -3 0 1

3 5 8 -3

-2 -6 3 2

0 -1 2 1

>>B(3,:)=[]

B =

-1 -3 0 1

3 5 8 -3

0 -1 2 1

>>B(:,4)=[]

B =

-1 -3 0

3 5 8

0 -1 2

>> -det(B)

ans = 0

>> C41=

B=[-1 -3 0 1;3 5 8 -3;-2 -6 3 2;0 -1 2 1]

B =

-1 -3 0 1

3 5 8 -3

-2 -6 3 2

0 -1 2 1

>>B(4,:)=[]

B =

-1 -3 0 1

3 5 8 -3

-2 -6 3 2

>>B(:,1)=[]

B =

-3 0 1

5 8 -3

-6 3 2

>>det(B)

ans = -12

>>

>> C42=

B=[-1 -3 0 1;3 5 8 -3;-2 -6 3 2;0 -1 2 1]

B =

-1 -3 0 1

3 5 8 -3

-2 -6 3 2

0 -1 2 1

>>B(4,:)=[]

B =

-1 -3 0 1

3 5 8 -3

-2 -6 3 2

>>B(:,2)=[]

B =

-1 0 1

3 8 -3

-2 3 2

>>det(B)

ans = 0

>> C43=

B=[-1 -3 0 1;3 5 8 -3;-2 -6 3 2;0 -1 2 1]

B =

-1 -3 0 1

3 5 8 -3

-2 -6 3 2

0 -1 2 1

>>B(4,:)=[]

B =

-1 -3 0 1

3 5 8 -3

-2 -6 3 2

>>B(:,3)=[]

B =

-1 -3 1

3 5 -3

-2 -6 2

>>det(B)

ans = 0

>> C44=

>> B=[-1 -3 0 1;3 5 8 -3;-2 -6 3 2;0 -1 2 1]

B =

-1 -3 0 1

3 5 8 -3

-2 -6 3 2

0 -1 2 1

>>B(4,:)=[]

B =

-1 -3 0 1

3 5 8 -3

-2 -6 3 2

>>B(:,4)=[]

B =

-1 -3 0

3 5 8

-2 -6 3

>>det(B)

ans = 12

cofactor=[544 -25 -8 -9;6 -3 0 -3;-24 8 4 -1.6283e-15;12 4.9960e-16 0 12]

cofactor =

544 -25 -8 -9

6 -3 0 -3

-24 8 4 0

12 0 0 12

>>adj=cofactor'

adj =

544 6 -24 12

-25 -3 8 0

-8 0 4 0

-9 -3 0 12

>>Ainverse=(1/det(B))\*adj

Ainverse =

136/3 1/2 -2 1

-25/12 -1/4 2/3 0

-2/3 0 1/3 0

-3/4 -1/4 0 1

>> B=[-1 -3 0 1;3 5 8 -3;-2 -6 3 2;0 -1 2 1]

B =

-1 -3 0 1

3 5 8 -3

-2 -6 3 2

0 -1 2 1

#check by direct command

>>inv(B)

ans =

9/2 1/2 -2 1

-25/12 -1/4 2/3 0

-2/3 0 1/3 0

-3/4 -1/4 0 1

4. Show that determinant of upper triangular matrix is the product of diagonal element

using matrix given below

B = 

ANS.

B=[4 -6 8 9;0 -2 7 -3;0 0 5 6;0 0 0 3]

B =

4 -6 8 9

0 -2 7 -3

0 0 5 6

0 0 0 3

>>B(1,:)=[]

B =

0 -2 7 -3

0 0 5 6

0 0 0 3

>>B(:,1)=[]

B =

-2 7 -3

0 5 6

0 0 3

b1=B

b1 =

-2 7 -3

0 5 6

0 0 3

>> B=[4 -6 8 9;0 -2 7 -3;0 0 5 6;0 0 0 3]

B =

4 -6 8 9

0 -2 7 -3

0 0 5 6

0 0 0 3

>>B(1,:)=[]

B =

0 -2 7 -3

0 0 5 6

0 0 0 3

>>B(:,2)=[]

B =

0 7 -3

0 5 6

0 0 3

>> b2=B

b2 =

0 7 -3

0 5 6

0 0 3

>> B=[4 -6 8 9;0 -2 7 -3;0 0 5 6;0 0 0 3]

B =

4 -6 8 9

0 -2 7 -3

0 0 5 6

0 0 0 3

>>B(1,:)=[]

B =

0 -2 7 -3

0 0 5 6

0 0 0 3

>>B(:,3)=[]

B =

0 -2 -3

0 0 6

0 0 3

>> b3=B

b3 =

0 -2 -3

0 0 6

0 0 3

>> B=[4 -6 8 9;0 -2 7 -3;0 0 5 6;0 0 0 3]

B =

4 -6 8 9

0 -2 7 -3

0 0 5 6

0 0 0 3

B(1,:)=[]

B =

0 -2 7 -3

0 0 5 6

0 0 0 3

>>B(:,4)=[]

B =

0 -2 7

0 0 5

0 0 0

>> b4=B

b4 =

0 -2 7

0 0 5

0 0 0

>> d=4\*det(b1)+6\*det(b2)+8\*det(b3)-9\*det(b4)

d = -120

>> #

>> #check the determinant by command

>> B=[4 -6 8 9;0 -2 7 -3;0 0 5 6;0 0 0 3]

B =

4 -6 8 9

0 -2 7 -3

0 0 5 6

0 0 0 3

>>det(B)

ans = -120

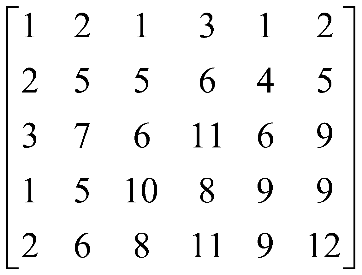
>> #now the product of diagonal elements of upper triangular matrix is

>>product=B(1,1)\*B(2,2)\*B(3,3)\*B(4,4)

product = -120

>> #hence d=product=-120

**5. (i) Find the rank and basis of the row space of the following matrix.**

**A=**

ANS.

A=[1 2 1 3 1 2;2 5 5 6 4 5;3 7 6 11 6 9;1 5 10 8 9 9;2 6 8 11 9 12]

A =

1 2 1 3 1 2

2 5 5 6 4 5

3 7 6 11 6 9

1 5 10 8 9 9

2 6 8 11 9 12

>> a1=[A(1,:);A(2,:)-2\*A(1,:);A(3,:)-3\*A(1,:);A(4,:)-A(1,:);A(5,:)-2\*A(1,:)]

a1 =

1 2 1 3 1 2

0 1 3 0 2 1

0 1 3 2 3 3

0 3 9 5 8 7

0 2 6 5 7 8

a2=[a1(1,:);a1(2,:);a1(3,:)-a1(2,:);a1(4,:)-3\*a1(2,:);a1(5,:)-2\*a1(2,:)]

a2 =

1 2 1 3 1 2

0 1 3 0 2 1

0 0 0 2 1 2

0 0 0 5 2 4

0 0 0 5 3 6

>> a3=[a2(1,:);a2(2,:);a2(3,:);a2(4,:)-5\*a2(3,:);a2(5,:)-5\*a2(3,:)]

a3 =

1 2 1 3 1 2

0 1 3 0 2 1

0 0 0 2 1 2

0 0 0 -5 -3 -6

0 0 0 -5 -2 -4

>> a4=[a3(1,:);a3(2,:);a3(3,:);-a3(4,:)/0.5;a3(5,:)+a3(4,:)]

a4 =

1 2 1 3 1 2

0 1 3 0 2 1

0 0 0 2 1 2

-0 -0 -0 10 6 12

0 0 0 -10 -5 -10

>> #a4 contain 4 nonzero rows hense

>> #rank(A)=4

>> #check rank by command

>>rank(A)

ans = 4

>> #basis for row space are the non zero rows of above row echelon form of A

>> basis=a4(1,:),a4(2,:),a4(3,:),a4(4,:)

basis =

1 2 1 3 1 2

ans =

0 1 3 0 2 1

ans =

0 0 0 2 1 2

ans =

-0 -0 -0 10 6 12

(ii) Find the rank and basis of the column space of each of the following matrix.

B= 

ANS.

B=[1 3 1 -2 -3;1 4 3 -1 -4;2 3 -4 -7 -3;3 8 1 -7 -8]

B =

1 3 1 -2 -3

1 4 3 -1 -4

2 3 -4 -7 -3

3 8 1 -7 -8

>> r=rref(B)

r =

1 0 -5 -5 0

0 1 2 1 -1

0 0 0 0 0

0 0 0 0 0

>> #here in row reduced form of B there are only two leading one

>> #hence the rank(B)=2

>> #lets chech rank by command

>>rank(B)

ans = 2

>>basis=B(:,1),B(:,2)

basis =

1

1

2

3

ans =

3

4

3

8

6. Find a basis for the null space of

A=

ANS.

A=[1 4 5 6 9;3 -2 1 4 -1;-1 0 -1 -2 -1;2 3 5 7 8]

A =

1 4 5 6 9

3 -2 1 4 -1

-1 0 -1 -2 -1

2 3 5 7 8

X=

>> #by reducing given system to reduced row echelon form we

>> r=rref(A)

r =

1 0 1 2 1

0 1 1 1 2

0 0 0 0 0

0 0 0 0 0

>>rank(A)

ans = 2

X=

Solving we get

X1= -X3-2\*X4-X5

X2= -X3-X4-2\*X5

X3,X4 X5 are free variables therefore

Let,

X3=s

X4=r

X5=t

Then

X1= - s - 2\*r - t

X2= - s – r – 2\*t

X3= s

X4= r

X5= t

Then the basis for the null space is

(-1,-1,0,0,0) , (-2,-1,0,0,0) , (-1,-2,0,0,0)