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Program – MBA Tech Data Science

Batch – C1

Course – LADE

Year – sem 2 Year 1

Experiment 2

```
%Question 1 Examine following system of vectors for linear dependence
%(1,2,3); (2,4,6); (1,0,1)
%Define vectors as columns
v1 = [1; 2; 3];
v2 = [2; 4; 6];
v3 = [1; 0; 1];

%Form matrix
A = [v1, v2, v3];

%Compute rank
r = rank(A)

%Number of vectors
n = size(A,2);

if r == n
   disp('The vectors are linearly independent.');
else
   disp('The vectors are linearly dependent.');
end
```

```
r =

     2

The vectors are linearly dependent.
```

```
%Question 2 Examine following system of vectors for linear dependence
%(1,-1,1); (2,1,1); (3,0,2)
%Define vectors as columns
v1 = [1; -1; 1];
v2 = [2; 1; 1];
v3 = [3; 0; 2];

%Form matrix
A = [v1, v2, v3];

%Compute rank
r = rank(A)

%Number of vectors
n = size(A,2);

if r == n
    disp('The vectors are linearly independent.');
else
    disp('The vectors are linearly dependent.');
end
```

```
r =

     2

The vectors are linearly dependent.
```

```
%Question 3 Examine following system of vectors for linear dependence
%(3,1,-4); (2,2,-3); (0,-4,1)
%Define vectors as columns
v1 = [3; 1; -4];
v2 = [2; 2; -3];
v3 = [0; -4; 1];

%Form matrix
A = [v1, v2, v3];

%Compute rank
r = rank(A)

%Number of vectors
n = size(A,2);
```

```
if r == n
    disp('The vectors are linearly independent.');
else
    disp('The vectors are linearly dependent.');
end
```

```
r =

     2

The vectors are linearly dependent.
```

```
%Question 4 Examine following system of vectors for linear dependence
%(1,-1,2,0); (2,1,1,1); (3,-1,2,-1); (3,0,3,1)
%Define vectors as columns
v1 = [1; -1; 2; 0];
v2 = [2; 1; 1; 1];
v3 = [3; -1; 2; -2];
v4 = [3; 0; 3; 1];

%Form matrix
A = [v1, v2, v3, v4];

%Compute rank
r = rank(A)

%Number of vectors
n = size(A,2);

if r == n
    disp('The vectors are linearly independent.');
else
    disp('The vectors are linearly dependent.');
end
```

```
r =

     3

The vectors are linearly dependent.
```

```
%Question 5 Examine following system of vectors for linear dependence
%(1,1,-1,1); (1,-1,2,-1); (3,1,0,1)
%Define vectors as columns
v1 = [1; 1; -1; 1];
v2 = [1; -1; 2; -1];
v3 = [3; 1; 0; 1];

%Form matrix
A = [v1, v2, v3];

%Compute rank
r = rank(A)

%Number of vectors
n = size(A,2);

if r == n
   disp('The vectors are linearly independent.');
else
   disp('The vectors are linearly dependent.');
end
```

```
r =

     2

The vectors are linearly dependent.
```

Application based questions

Gen AI interpretation

```
%Question 1 Three sensor measure voltages are given. Check whether the sensor outputs are linearly dependent
%(1,0,2); (0,1,3); (1,1,5)
%Define vectors as columns
v1 = [1; 0; 2];
v2 = [0; 1; 3];
v3 = [1; 1; 5];

%Form matrix
A = [v1, v2, v3];

%Compute rank
r = rank(A)

%Number of vectors
n = size(A,2);

if r == n
   disp('The vectors are linearly independent.');
else
   disp('The vectors are linearly dependent.');
end
```

```
r =

     2

The vectors are linearly dependent.
```

Linear independence means each sensor provides unique and useful information about the system, improving accuracy and reliability. Linear dependence means one sensor's output can be predicted from the others, so it does not add new information. In the given case, the sensor outputs are linearly dependent, which indicates redundancy. This means one sensor is unnecessary and the same measurement information can be obtained using the remaining sensors.

```
%Question 2 Price movement vectors are given. Interpret the number of
independent market factors.
%(1,1,2,0); (0,1,1,1); (1,0,3,1)
%Define vectors as columns
v1 = [1; 1; 2; 0];
v2 = [0; 1; 1; 1];
v3 = [1; 0; 3; 1];

%Form matrix
A = [v1, v2, v3];

%Compute rank
r = rank(A)

%Number of vectors
n = size(A,2);

if r == n
   disp('The vectors are linearly independent.');
else
   disp('The vectors are linearly dependent.');
end
```

```
r =

     3

The vectors are linearly independent.
```

Linear independence in price movement vectors means each movement reflects a distinct underlying market factor. Linear dependence would indicate that some price changes are driven by the same factor, showing redundancy. In this case, the given price movements are linearly independent, which implies there are three independent market factors influencing prices. Each movement contributes unique information about market behaviour and dynamics.

```
%Question 3 In a 3-D engineering drawing, the direction vectors of the axes are as given
%(1,0,0); (0,1,0); (2,2,0)
%Define vectors as columns
v1 = [1; 0; 0];
v2 = [0; 1; 0];
v3 = [2; 2; 0];

%Form matrix
A = [v1, v2, v3];

%Compute rank
r = rank(A)

%Number of vectors
n = size(A,2);

if r == n
   disp('The vectors are linearly independent.');
else
   disp('The vectors are linearly dependent.');
end
```

```
r =

     2

The vectors are linearly dependent.
```

Linear independence of direction vectors means each axis represents a unique spatial direction, allowing a complete and accurate three-dimensional representation. Linear dependence indicates that one axis lies in the same plane or direction as the others and does not add new spatial information. In this case, the given direction vectors are linearly dependent, so there are only two independent directions, meaning the drawing does not fully define three-dimensional space.