Kernel: SageMath 10.3

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ROLL NO : 53

EXPERIMENT NO : 04

AIM : TO FIND LINEAR COMBINATION, SPAN, AND BASIS OF A VECTOR SPACE .

QUESTION : 1.A.

In [1]:
```
M = Matrix([[1,3,1,3],[0,1,1,0],[-3,0,6,-1],[3,4,-2,1],[2,0,-4,-3]])
```

In [2]:
```
M_echelon = M.echelon_form()
```

In [3]:
```
basis = M_echelon.rows()
```

In [4]:
```
rank = M.rank()
```

In [5]:
```
print("Basis of the row space:", basis)
```

Out[5]:
```
Basis of the row space: [(1, 0, -2, 0), (0, 1, 1, 0), (0, 0, 0, 1), (0, 0, 0, 0), (0, 0, 0, 0)]
```

In [6]:
```
print("Dimension of the row space (Rank):", rank)
```

Out[6]:
```
Dimension of the row space (Rank): 3
```

QUESTION : 1.B.

In [7]:
```
M = Matrix([[2,4,6,8],[0,1,1,0],[3,0,-6,1],[4,-2,3,-1],[2,0,-4,3]])
```

In [8]:
```
M_echelon = M.echelon_form()
```

In [9]:
```
basis = M_echelon.rows()
```

In [10]:
```
rank = M.rank()
```

In [11]:
```
print("Basis of the row space:", basis)
```

Out[11]:
```
Basis of the row space: [(1, 0, 0, 0), (0, 1, 0, 0), (0, 0, 1, 0), (0, 0, 0, 1), (0, 0, 0, 0)]
```

In [12]:
```
print("Dimension of the row space (Rank):", rank)
```

Out[12]:
```
Dimension of the row space (Rank): 4
```

QUESTION : 2.A.

In [13]:
```
from sage.modules.free_module_element import vector
from sage.matrix.constructor import Matrix
```

In [14]:
```
v1 = vector([1, 2, 3])
v2 = vector([4, 5, 6])
v3 = vector([7, 8, 9])
target_vector = vector([10, 11, 12])
```

In [15]:
```
A = Matrix([v1, v2, v3]).transpose()
```

In [16]:
```
A = A.augment(target_vector, subdivide=True)
```

In [17]:
```
rref = A.rref()
```

In [19]:
```
if all(entry == 0 for entry in rref[-1][:-1]):
    print("The target vector is a linear combination of the given vectors.")
else:
    print("The target vector is not a linear combination of the given vectors.")
```

Out[19]:
```
The target vector is a linear combination of the given vectors.
```

QUESTION : 2.B.

In [20]:
```
v1 = vector([2, 3, 1])
v2 = vector([7, 6, 3])
v3 = vector([4, 9, 3])
target_vector = vector([12, 13, 14])
```

In [21]:
```
A = Matrix([v1, v2, v3]).transpose()
```

In [22]:
```
A = A.augment(target_vector, subdivide=True)
```

In [23]:
```
rref = A.rref()
```

In [25]:
```
if all(entry == 0 for entry in rref[-1][:-1]):
    print("The target vector is a linear combination of the given vectors.")
else:
    print("The target vector is not a linear combination of the given vectors.")
```

Out[25]:
```
The target vector is not a linear combination of the given vectors.
```

Conclusion : Problems on linear combination, span and basis are successfully executed .

In [0]:
```
```