# DAMA50 - 1st assignment

### **Exercise 7**

```
In [5]: | m = matrix(QQ, 3, 4, lambda i,j: i + j - 1); show(m)
In [6]: m.rref()
 Out[6]: [ 1 0 -1 -2]
         [0 1 2 3]
         [0 0 0 0]
In [7]: m.rank()
Out[7]: 2
In [8]: | n = matrix(QQ, 3, 4, lambda i,j: (-1)^j); show(n)
Out[8]:  \begin{pmatrix} 1 & -1 & 1 & -1 \\ 1 & -1 & 1 & -1 \\ 1 & -1 & 1 & -1 \end{pmatrix} 
In [9]: n.rref()
 Out[9]: [ 1 -1 1 -1]
         [0 0 0 0]
         [0 0 0 0]
In [10]: n.rank()
Out[10]: 1
```

#### **Exercise 8**

#### A.

```
In [23]: var('p \ q \ r \ s \ \lambda');

\lambda = 0;

a1 = p + 2*q + 3*r + s == 1;

a2 = 2*p + q + 8*r + 2*s == 2;

a3 = p + 6*q - 3*r + 5*s == -2;

a4 = 2*p - q + r - s == \lambda;

solve([a1,a2,a3,a4],p,q,r,s,)

Out[23]: [[p == (-18/65), q == (17/65), r == (51/130), s == (-11/26)]]
```

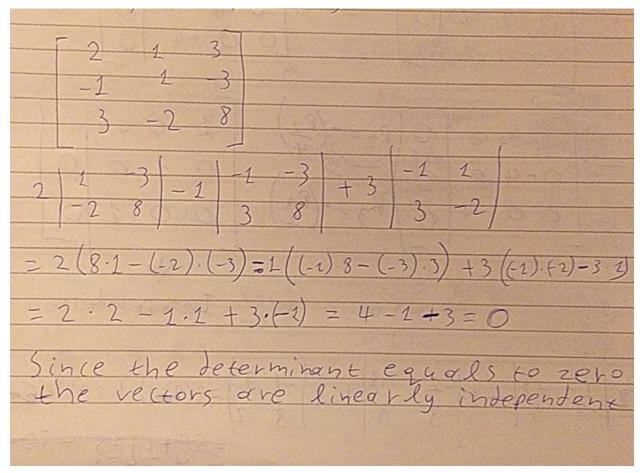
В.

```
In [17]: K = matrix(QQ, [[1,2,3,1],[2,1,8,2],[1,6,-3,5],[2,-1,1,-1]]); show(K)
    Out[17]:
                \left(\begin{array}{ccccc} 1 & 2 & 3 & 1 \\ 2 & 1 & 8 & 2 \\ 1 & 6 & -3 & 5 \\ 2 & -1 & 1 & -1 \end{array}\right)
    In [20]: K.inverse()*vector([1,2,-2,0])
    Out[20]: (-18/65, 17/65, 51/130, -11/26)
C.
 In [24]: |var('p q r s λ');
           a1 = p + 2*q + 3*r + s == 1;
          a2 = 2*p + q + 8*r + 2*s == 2;
          a3 = p + 6*q - 3*r + 5*s == -2;
          a4 = 2*p - q + r - s == \lambda;
          solve([a1,a2,a3,a4],p,q,r,s,)
 Out[24]: [[p == 31/65*\lambda - 18/65, q == -4/65*\lambda + 17/65, r == -6/65*\lambda + 51/130, s == -1/13*\lambda - 11/26]]
D.
    In [21]: K.augment(vector([1,2,-2,0]))
    Out[21]: [ 1 2 3 1 1]
                [2 1 8 2 2]
                [16-35-2]
               [2-1 1-1 0]
    In [22]: K.augment(vector([1,2,-2,0])).echelon_form()
    Out[22]: [
                                                 0 -18/65]
                               1
                                               0 17/65]
                              0
                       0
                                      1
                                               0 51/130]
                               0
                                        0
                                                 1 -11/26]
```

# **Exercise 9**

Exercise 9
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For $X_6 = r$ we have $X_2 = 1 - r$ , $X_4 = -2 - r$ , $X_5 = 1 + r$ , $X_6 = r$

## **Exercise 10**



## Quiz

Q1

```
In [1]: C = matrix([[1,1,0,-1],[1,-1,1,0],[1,0,-1,1]]); show(C)

Out[1]: \begin{pmatrix} 1 & 1 & 0 & -1 \\ 1 & -1 & 1 & 0 \\ 1 & 0 & -1 & 1 \end{pmatrix}

In [2]: C.rank()

Out[2]: 3
```

Q2

```
In [4]: A = matrix([[1,3],[5,1]]); show(A)
   In [6]: | show(A^(-1)*A.transpose())
   Out[6]: \begin{pmatrix} \frac{4}{7} & -\frac{1}{7} \\ \frac{1}{7} & \frac{12}{7} \end{pmatrix}
Q4
  In [16]: x1 = vector([1,-3,4]);
               x2 = vector([-2,1,-1]);
               x3 = vector([1,1,0]);
               a = vector((1/2)*(x1 + 2*x2 -x3));
  Out[16]: (-2, -1, 1)
Q6
   In [7]: A = matrix([[1,2],[3,4]]); show(A)
   Out[7]: \begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}
   In [9]: det(A^7)
   Out[9]: -128
```