Name: **Recitation Section:**

MATH 2802 N1-N3 QUIZ 1
SOLUTIONS

JANUARY 19TH, 2018

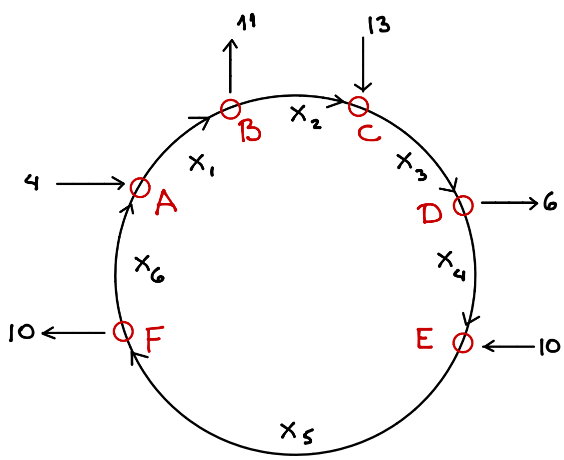
The quiz has a total of 10 points and you have 10 minutes. Read carefully.

(1) (**2 points each**) For each of the following statements, circle the correct answer (row or column):

Let A be an $n \times m$ matrix and b be a vector in $\mathbb{R}^m$.

- If all **columns** of A have a pivot, then there is a unique solution to the system.
- If all **rows** of A have a pivot, then there is no $b \in \mathbb{R}^m$ that makes the equation inconsistent.

(2) (**2pts**) Translate the traffic flow diagram to a system of linear equations



Solution. The system is given by

$$\begin{aligned} x_6 - x_1 &= -4 \\ x_1 - x_2 &= 11 \\ x_2 - x_3 &= -13 \\ x_3 - x_4 &= 6 \\ x_4 - x_5 &= -10 \\ x_5 - x_6 &= 10 \end{aligned}$$

(3) (**1 point each**) From the system of linear equations of previous question. Write down the asociated

(a) augmented matrix,
(b) vector equation,
(c) matrix equation,
(d) homogeneous matrix equation.

Solution.

(a)

$$\left(\begin{array}{cccccc|c} -1 & 0 & 0 & 0 & 0 & 1 & -4 \\ 1 & -1 & 0 & 0 & 0 & 0 & 11 \\ 0 & 1 & -1 & 0 & 0 & 0 & -13 \\ 0 & 0 & 1 & -1 & 0 & 0 & 6 \\ 0 & 0 & 0 & 1 & -1 & 0 & -10 \\ 0 & 0 & 0 & 0 & 1 & -1 & 10 \end{array}\right)$$

(b)

$$x_1 \begin{pmatrix} -1 \\ 1 \\ 0 \\ 0 \\ 0 \\ 0 \end{pmatrix} + x_1 \begin{pmatrix} 1 \\ 0 \\ 0 \\ 0 \\ 0 \\ -1 \end{pmatrix} + x_1 \begin{pmatrix} 0 \\ -1 \\ 1 \\ 0 \\ 0 \\ 0 \end{pmatrix} + x_1 \begin{pmatrix} 0 \\ 0 \\ -1 \\ 1 \\ 0 \\ 0 \end{pmatrix} + x_1 \begin{pmatrix} 0 \\ 0 \\ 0 \\ -1 \\ 1 \\ 0 \end{pmatrix} + x_1 \begin{pmatrix} 0 \\ 0 \\ 0 \\ 0 \\ -1 \\ 1 \end{pmatrix} = x_1 \begin{pmatrix} -4 \\ 11 \\ -13 \\ 6 \\ -10 \\ 10 \end{pmatrix}$$

(c)

$$\begin{pmatrix} -1 & 0 & 0 & 0 & 0 & 1 \\ 1 & -1 & 0 & 0 & 0 & 0 \\ 0 & 1 & -1 & 0 & 0 & 0 \\ 0 & 0 & 1 & -1 & 0 & 0 \\ 0 & 0 & 0 & 1 & -1 & 0 \\ 0 & 0 & 0 & 0 & 1 & -1 \end{pmatrix} x = \begin{pmatrix} -4 \\ 11 \\ -13 \\ 6 \\ -10 \\ 10 \end{pmatrix}$$

(d)

$$\begin{pmatrix} -1 & 0 & 0 & 0 & 0 & 1 \\ 1 & -1 & 0 & 0 & 0 & 0 \\ 0 & 1 & -1 & 0 & 0 & 0 \\ 0 & 0 & 1 & -1 & 0 & 0 \\ 0 & 0 & 0 & 1 & -1 & 0 \\ 0 & 0 & 0 & 0 & 1 & -1 \end{pmatrix} x = 0$$