MAU11S02 Group A1 Quiz 04 9am 19/2/20 ANSWERS

Rules and procedures.
1. Answers must be handed up at the end of the tutorial, no other time. **2.** Attempt 3 questions. Only *your first three answers* will be marked. **3.** Each question carries 20 marks, so the maximum quiz mark is 60. **4.** Marked quizzes will be returned, and answers published, the following week. **5.** If a particular method of solution is stipulated, you get no marks if you don't use it. **6.** The (9) quizzes will contribute 20% to your overall mark. **7.** You are allowed to collaborate and compare answers during the tutorial. **8.** ***Show all work.*** No marks will be given for answers which do not show the calculations.

Answer 1.

```
Gauss-Jordan Elimination:
  -1  -2  -9
   0   1   3
  -1  -4 -15
Reduced Row-Echelon Form:
 1 0 3
 0 1 3
 0 0 0
```

Row space basis $[1,0,3], [0,1,3]$.

$$\text{Col. space} \begin{bmatrix} -1 \\ 0 \\ -1 \end{bmatrix}, \begin{bmatrix} -2 \\ 1 \\ -4 \end{bmatrix}, \quad \text{nullspace} \begin{bmatrix} -3 \\ -3 \\ 1 \end{bmatrix}$$

Answer 2. The first two: this is equivalent to the column space of the matrix in Question 1.

Answer 3.

```
Gauss-Jordan Elimination:
  0 -3 -9 -9 -2
  0  1  3  3  1
 -2  0 -4 -6  4
  1  3 11 12  0
Reduced row-echelon form
  1  0  2  3  0
  0  1  3  3  0
  0  0  0  0  1
  0  0  0  0  0
```

Row space

$$\begin{bmatrix} 1 & 0 & 2 & 3 & 0 \end{bmatrix} \quad \begin{bmatrix} 0 & 1 & 3 & 3 & 0 \end{bmatrix} \quad \begin{bmatrix} 0 & 0 & 0 & 0 & 1 \end{bmatrix}$$

Column Space: columns 1,2, and 5.

$$\begin{bmatrix} 0 \\ 0 \\ -2 \\ 1 \end{bmatrix} \quad \begin{bmatrix} -3 \\ 1 \\ 0 \\ 3 \end{bmatrix} \quad \begin{bmatrix} -2 \\ 1 \\ 4 \\ 0 \end{bmatrix}$$

Answer 4.

$$x_1 + 2x_3 + 3x_4 = 0 \quad x_2 + 3x_3 + 3x_4 = 0 \quad x_3 = s \quad x_4 = tx_5 = 0$$

$$\text{nullspace:} \quad \left\{ \begin{bmatrix} -2s - 3t \\ -3s - 3t \\ s \\ t \\ 0 \end{bmatrix} = s \begin{bmatrix} -2 \\ -3 \\ 1 \\ 0 \\ 0 \end{bmatrix} + t \begin{bmatrix} -3 \\ -3 \\ 0 \\ -1 \\ 0 \end{bmatrix} : \ s, t \in \mathbb{R} \right\}$$

The last two column vectors are a basis for the nullspace.

Answer 5.

$$\begin{bmatrix} 5/13 & -12/13 \\ 12/13 & 5/13 \end{bmatrix}$$