MAU11S02 Group A2 Quiz 04 3pm 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.

```
Matrix:
  1  0  6
  3 -1 17
  1  1  7
Reduced Row-Echelon Form:
 1 0 6
 0 1 1
 0 0 0
```

Row space basis $[1, 0, 6], [0, 1, 1]$.

$$\text{Col. space} \begin{bmatrix} 1 \\ 3 \\ 1 \end{bmatrix}, \quad \begin{bmatrix} 0 \\ -1 \\ 1 \end{bmatrix}, \quad \text{nullspace} \begin{bmatrix} -6 \\ -1 \\ 1 \end{bmatrix}$$

Answer 2. This is equivalent to the row space of the matrix in Question 1, so the row space basis will do.

Answer 3.

```
Gauss-Jordan Elimination:
  2  4  0  0  8
  3  6  0  1 13
  0  0  1 -1  3
  3  6  0  3 15
Reduced Row-Echelon Form:
 1 2 0 0 4
 0 0 1 0 4
```

```
0 0 0 1 1
0 0 0 0 0
```

Row space

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

Column Space: columns 1,3, and 4.

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

Answer 4.

$$\begin{gathered} x_1 + 2x_2 + 4x_5 = 0 \\ x_2 = s \\ x_3 + 4x_5 = 0 \\ x_4 + x_5 = 0 \\ x_5 = t \end{gathered}$$

$$\text{nullspace:} \quad \left\{ \begin{bmatrix} -2s - 4t \\ s \\ -4t \\ -t \\ t \end{bmatrix} = s \begin{bmatrix} -2 \\ 1 \\ 0 \\ 0 \\ 0 \end{bmatrix} + t \begin{bmatrix} -3 \\ 0 \\ -4 \\ -1 \\ 1 \end{bmatrix} : \quad s, t \in \mathbb{R} \right\}$$

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

Answer 5. Expanded they become (with respect to $x^2, x, 1$)

```
  1  1  1
 -2  0  0
  1  0 -1
RREF
  1  0  0
  0  1  0
  0  0  1  in rref
```

Matrix is invertible; linearly independent.