

Himanshu Rana

2/26

MA 232 Hw 4 5, 12

"I pledge my honor that I have abided by the
Stevens Honor System" - Himanshu Rana

3.2

$$1) a) A = \begin{array}{c|cccc} & x & y & z & t & u \\ \hline 1 & 2 & 2 & 4 & 6 \\ 1 & 2 & 3 & 6 & 9 \\ 0 & 0 & 1 & 2 & 3 \end{array} \xrightarrow{R_2 \rightarrow R_2 - R_1} \begin{array}{c|cccc} & x & y & z & t & u \\ \hline 1 & 2 & 2 & 4 & 6 \\ 0 & 0 & 1 & 2 & 3 \\ 0 & 0 & 1 & 2 & 3 \end{array}$$

$$\xrightarrow{R_3 \rightarrow R_3 - R_2} \begin{array}{c|cccc} & x & y & z & t & u \\ \hline 1 & 2 & 2 & 4 & 6 \\ 0 & 0 & 1 & 2 & 3 \\ 0 & 0 & 0 & 0 & 0 \end{array} \quad \begin{array}{l} \text{pivot: } x, z \\ \text{free: } y, t, u \end{array}$$

$$b) B = \begin{array}{c|ccc} & x & y & z \\ \hline 2 & 4 & 2 \\ 0 & 4 & 4 \\ 0 & 8 & 8 \end{array} \xrightarrow{R_3 \rightarrow R_3 - 2R_2} \begin{array}{c|ccc} & x & y & z \\ \hline 2 & 4 & 2 \\ 0 & 4 & 4 \\ 0 & 0 & 0 \end{array} \quad \begin{array}{l} \text{pivot: } x, y \\ \text{free: } z \end{array}$$

$$\xrightarrow{\begin{array}{l} R_2 \rightarrow \frac{R_2}{4} \\ R_1 \rightarrow \frac{R_1}{2} \end{array}} \begin{array}{c|cc} & x & y \\ \hline 1 & 2 & 1 \\ 0 & 1 & 1 \\ 0 & 0 & 0 \end{array}$$

$$2) a) \begin{array}{c|ccccc} & x & y & z & t & u \\ \hline 1 & 2 & 2 & 4 & 6 \\ 0 & 0 & 1 & 2 & 3 \\ 0 & 0 & 0 & 0 & 0 \end{array} \quad \begin{array}{l} y=1, t=0, u=0 \\ (-2, 1, 0, 0, 0) \end{array} \quad \begin{array}{l} z + 2t + 3u = 0 \\ z + 0 + 0 = 0 \rightarrow z = 0 \\ x + 2y + 2z + 4t + 6u = 0 \\ x + 2(1) + 2(0) + 4(0) + 6(0) = 0 \\ x = -2 \end{array}$$

$$y=0, t=1, u=0$$

$$(2, 0, -2, 1, 0)$$

$$z + 2t + 3u = 0$$

$$z + 2(1) + 3(0) = 0$$

$$z = -2$$

$$x + 2y + 3z + 4t + 6u = 0$$

$$x + 2(0) + 3(-2) + 4(1) + 6(0) = 0$$

$$x = 2$$

$$y=0, t=0, u=1$$

$$(3, 0, -3, 0, 1)$$

$$z + 2t + 3u = 0$$

$$z + 2(0) + 3(1) = 0$$

$$z = -3$$

$$x + 2y + 3z + 4t + 6u = 0$$

$$x + 2(0) + 3(-3) + 4(0) + 6(1) = 0$$

$$x = 3$$

$$b) \begin{bmatrix} 2 & 4 & 2 \\ 0 & 4 & 4 \\ 0 & 0 & 0 \end{bmatrix}$$

$$z=1, y=-1$$

$$(1, -1, 1)$$

$$2x + 4y + 2z = 0$$

$$2x + 4(-1) + 2(1) = 0$$

$$x = 1$$

5) a) False $\rightarrow A = \begin{bmatrix} 1 & 1 \\ 0 & 0 \end{bmatrix}$ has one free variable

b) True \rightarrow otherwise there would be a nonzero vector x s.t. $Ax = 0$

c) True $\rightarrow n =$ number of variables with some being pivots

d) True $\rightarrow m =$ # of rows, only one pivot per row, can't have more ^{pivots} than rows

12) $x - 3y - 2z = 0$ $A = \begin{bmatrix} 1 & -3 & -2 \end{bmatrix}$

Free variables: y, z

$$y=1, z=0 \quad x - 3(1) - 2(0) = 0$$

$$x = 3$$

$$\begin{bmatrix} (-3, 1, 0) \\ (1, 0, 1) \end{bmatrix}$$

$$y=0, z=1 \quad x - 3(0) - 2(1) = 0$$

$$x = 2$$