

Week 4 Math Assignment

Puneet Auluck

July 20, 2015

1. Using matrix operations, describe the solutions for the following family of equations:

$$x + 2y - 3z = 5$$

$$2x + y - 3z = 13$$

$$-x + y = -8$$

Equation in matrix form

The diagram illustrates the row reduction of the augmented matrix $\begin{bmatrix} 1 & 2 & -3 & 5 \\ 2 & 1 & -3 & 13 \\ -1 & 1 & 0 & -8 \end{bmatrix}$. The first step is $-2 \cdot R_2 + R_2$, which results in $\begin{bmatrix} 1 & 2 & -3 & 5 \\ 0 & -3 & 3 & 3 \\ -1 & 1 & 0 & -8 \end{bmatrix}$. The second step is $R_1 + R_2$, resulting in $\begin{bmatrix} 1 & 2 & -3 & 5 \\ 0 & -3 & 3 & 3 \\ 0 & 3 & -3 & -3 \end{bmatrix}$. The final step is $R_2 + R_3$, resulting in $\begin{bmatrix} 1 & 2 & -3 & 5 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix}$.

This is a singular matrix and its inverse cannot be determined.

There is interdependence among these family of equations provided.

2. Provide a solution for #1, using R functions of your choice.

```
A <- matrix(c(1,2,-3,2,1,-3,-1,1,0), nrow=3, ncol=3, byrow=TRUE)
B <- matrix(c(5,13,-8))
solve(A,B)
```

```
## Error in solve.default(A, B): Lapack routine dgesv: system is exactly singular: U[3,3] = 0
```

3. Solve for AB by hand:

$$A = \begin{bmatrix} 4 & -3 \\ -3 & 5 \\ 0 & 1 \end{bmatrix}, \quad B = \begin{bmatrix} 1 & 4 \\ 3 & -2 \end{bmatrix}$$

$$AB = \begin{bmatrix} (4*1)+(-3*3) & (4*4)+(-3*-2) \\ (-3*1)+(5*3) & (-3*4)+(5*-2) \\ (0*1)+(1*3) & (0*4)+(1*-2) \end{bmatrix} = \begin{bmatrix} 4-9 & 16+6 \\ -3+15 & -12-10 \\ 0+3 & 0-2 \end{bmatrix} = \begin{bmatrix} -5 & 22 \\ 12 & -22 \\ 3 & -2 \end{bmatrix}$$

4. Solve AB from #3 using R functions of your choice.

```
A <- matrix(c(4,-3,-3,5,0,1),nrow=3, ncol=2, byrow=TRUE)
B <- matrix(c(1,4,3,-2), nrow=2, ncol=2, byrow=TRUE)
AB <- A %*% B
AB
```

```
##      [,1] [,2]
## [1,]   -5  22
## [2,]   12 -22
## [3,]    3  -2
```