14.4 Notes: Communication Matrices - Applications for Systems of Eq'ns

ex 1: Set up a matrix equation that can be used to find the intersection of the 3 planes:

$$3x - 4y + 7z = -3$$
$$6x + 3y + 5z = 23$$
$$-4x + 9y + 3z = -17$$

A X = B

$$\begin{bmatrix} & & \\ & & \\ & & \end{bmatrix}\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} \\ \\ \end{bmatrix}$$

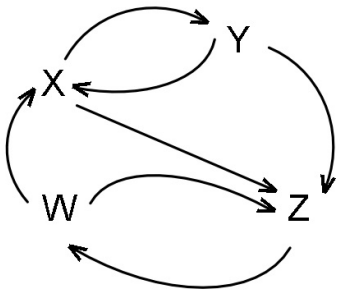
On T.I.: 2nd >> Matrices >> Edit

[A] Enter 3 x 3 >> Enter elements
[B] Enter 3 x 1 >> Enter elements

2nd >> Matrices >> Names

[A] $^{-1}$ [B] >> Enter >> Screen will show sol'n: [[ ]
[ ]
[ ]]

ex 2: 4 ranger stations X, Y, W, & Z can communicate as shown.
(a) Use a matrix to show all communication networks.



FROM / TO

$$\mathbf{C} = \begin{array}{c} \\ X \\ Y \\ Z \\ W \end{array}\begin{array}{c} \begin{array}{cccc} X & Y & Z & W \end{array} \\ \begin{bmatrix} 0 & & & \\ & 0 & & \\ & & 0 & \\ & & & 0 \end{bmatrix} \end{array}$$

This matrix shows the # of ways a station can communicate directly to another.

↖ Diagonal is zeros since stations do not talk to themselves

(b) Now build a matrix using 1 relay:

FROM / TO

$$\begin{array}{c} \\ X \\ Y \\ Z \\ W \end{array}\begin{array}{c} \begin{array}{cccc} X & Y & Z & W \end{array} \\ \begin{bmatrix} & & & \\ & & & \\ & & & \\ & & & \end{bmatrix} \end{array}$$

This matrix shows the # of ways a station can communicate using one relay.

(c) Calculate C^2 ; what does C^2 represent?

On T.I.: 2nd >> Matrices >> Edit

[C] Enter 4 x 4 >> Enter elements

2nd >> Matrices >> Names

[C] ^{2} >> Enter >> Screen will show sol'n: [[ ]
[ ]
[ ]
[ ]]

Notice: this is so C^2 represents

(d) Calculate $C + C^2$; what does this sum represent?

$$\begin{bmatrix} 0 & 1 & 1 & 0 \\ 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \\ 1 & 0 & 1 & 0 \end{bmatrix} + \begin{bmatrix} 1 & 0 & 1 & 1 \\ 0 & 1 & 1 & 1 \\ 1 & 0 & 1 & 0 \\ 0 & 1 & 1 & 1 \end{bmatrix} = \begin{bmatrix} & & & \\ & & & \\ & & & \\ & & & \end{bmatrix}$$

The sum $C + C^2$ represents the number of ways to communicate with

(e) What would C^3 represent?

# of ways to communicate with

(f) What would $C + C^2 + C^3$ represent?

# of ways to communiate with (i.e.,

(g) What other applications might this communication mapping be useful for besides communications between ranger stations?

Example: