SHOW WORK (17 questions) Ch 1, Ch 2 + game

Honors Math 141 Exam 1 Review

1. Is the given matrix in row-reduced form? Explain.

$$\left[\begin{array}{cccc|c} 1 & 0 & -2 & 0 & 0 \\ 0 & 1 & 1 & 1 & 3 \\ 0 & 0 & 0 & 0 & 4 \end{array}\right]$$

yes it is in RREF

$0 = 4 \Rightarrow$ NO SOLN.

2. Matrix F below shows the number of stuffed animals sold at a local shop during a month. The daddy animals sell for \$7.00, the mommies for \$6.00 and the babies for \$4.00. Find a matrix G such that the product of matrix G and matrix F will show the revenue, R, for selling each kind of animal.

G

$$F = \begin{array}{c} \\ \text{horse} \\ \text{dog} \\ \text{cat} \end{array} \begin{array}{c} \begin{array}{ccc} \text{daddy} & \text{mommy} & \text{baby} \end{array} \\ \left[\begin{array}{ccc} 15 & 12 & 22 \\ 21 & 14 & 19 \\ 23 & 25 & 17 \end{array}\right] \end{array}$$

F

G

$$\begin{array}{c} \\ D \\ M \\ B \end{array} \begin{array}{c} \$ \\ \left[\begin{array}{c} 7 \\ 6 \\ 4 \end{array}\right] \end{array}$$

3. Solve the following matrix equation for X: $2X + D = XB$.

$$D = XB - 2X = XB - X2I$$

$$= X(B - 2I)$$

$$D(B-2I)^{-1} = X(B-2I)(B-2I)^{-1}$$

$$= XI = X$$

$$X = D(B-2I)^{-1}$$

4. A cordless drill company has monthly fixed costs of $92,500. If each month 12,000 cordless drills are produced and sold for $130 each, then there is a profit of $795,500.

(a) Find the linear cost function.

(b) Each month how much revenue is generated at the break-even point?

x = # of drills, C, R, P in $

$C(x) = cx + 92500$, $R = 130x$

$P = R - C = 130x - (cx + 92500)$

$P(x) = (130 - c)x - 92500$

$P(12000) = 795500 = (130 - c)(12000) - 92,500$

a) $\rightarrow c = 56$

$C(x) = 56x + 92500$

b) $P = 0$ or $R = C \Rightarrow 130x = 56x + 92500$

$x = 1250$ drills

$R = 1250 * 130 =$ $162,500

$X = (I - A)^{-1} D$

5. The economy of the stone-age village Bedrock has three industries, stone cutting (S), farming (F), and hunting (H). The input-output matrix is given below and the demand from the local city of Rock Vegas is \$1500 of stone, \$6500 of farming and \$4000 of hunting. How much of stone, farming, and hunting needs to be produced in total to meet all demands? What is the meaning of the entry a_{12}?

To make 1 unit ($) of farming you need .3 units ($) of stone cutting

$$A = \begin{array}{c} \\ S \\ F \\ H \end{array} \begin{array}{c} \begin{array}{ccc} S & F & H \end{array} \\ \begin{bmatrix} 0.3 & 0.3 & 0.25 \\ 0.2 & 0.25 & 0.3 \\ 0.2 & 0.1 & 0.2 \end{bmatrix} \end{array}$$

$X = (I_3 - A)^{-1} D$

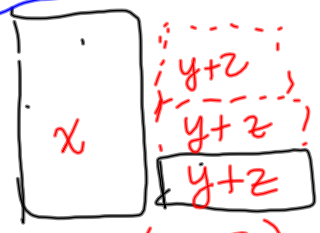
$$X = \begin{pmatrix} 12693.63\ldots \\ 16127.36\ldots \\ 10189.32\ldots \end{pmatrix}$$

$\Rightarrow$ make \$12,694 of stone cutting, \$16127 of farming and \$10189 of hunting

$$D = \begin{matrix} S \\ F \\ H \end{matrix} \begin{pmatrix} 1500 \\ 6500 \\ 4000 \end{pmatrix}$$

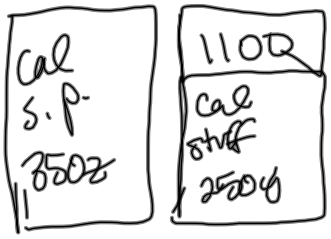
6. Farmer Fran is cooking Thanksgiving dinner. He plans to cook (among other things) turkey, stuffing, and sweet potatoes. Each serving of turkey has 200 calories, each serving of stuffing has 250 calories, and each serving of sweet potatoes has 350 calories. Farmer Fran made three times as many servings of turkey as stuffing and sweet potatoes combined. Assuming all the food was eaten, the number of calories consumed from stuffing was one-sixth the number of calories consumed from turkey, and there were 1100 more calories consumed from sweet potatoes than from stuffing. How many servings of each food were made and eaten?

x = # of servings of turkey
y = " " " " stuffing
z = " " " " sweet pot.



$x = 3(y+z)$

$200x = 6(250y)$



$350z = 1100 + 250y$

$x = 3(y+z)$ svg ratio
$200x = 6(250y)$ cal ratio
$350z = 250y + 1100$
↓ cal ratio

$$x - 3y - 3z = 0$$
$$200x - 1500y = 0$$
$$-250y + 350z = 1100$$

$$\Rightarrow \left[\begin{array}{ccc|c} 1 & -3 & -3 & 0 \\ 200 & -1500 & 0 & 0 \\ 0 & -250 & 350 & 1100 \end{array}\right]$$

RREF $\rightarrow \left[\begin{array}{ccc|c} 1 & 0 & 0 & 30 \\ 0 & 1 & 0 & 4 \\ 0 & 0 & 1 & 6 \end{array}\right] \Rightarrow$ 30 serv. of Turkey, 4 serv of stuffing, 6 sev of sw. pot

7. Which of the following are particular solutions to the parametric solution $(3t-7,-2s+1,s,t)$?

A. $(-7,1,0,0)$ $x=3(0)-7$, $y=-2(0)+1$ (s, t)

B. $(-4,1,0,1)$ $s=0, t=1$

C. $(-7,1,1,0)$ $s=1, t=0$ → should have $y=-1$

D. $(-4,-1,1,1)$

E. None of these

8. The supply and demand for cartons of blueberries are given by the equations

$p = D(x) = -0.15x + 8 = y$

$p = S(x) = 0.08x + 1.1 = y$

Where p is the price in dollars and x is the number of cartons of blueberries.

a) What is the lowest price the supplier is willing to accept for a carton of blueberries?

$S(0) = 1.1 \Rightarrow$ \$1.10 for a carton of blueberries

b) Find and interpret the equilibrium point.

$S(x) = D(x)$ or graph or RREF

$x = 30, y = 3.5$

A total of 30 cartons are supplied and purchased at a price of \$3.50 each

9. A jeweler makes three kinds of rings out of white and yellow gold. A Celtic ring uses 3 grams of white gold and 2 grams of yellow gold. A Roman ring uses 1 gram of white gold and 1 gram of yellow gold. A Greek ring uses 6 grams of white gold and 3 grams of yellow gold. The jeweler has 27 grams of white gold and 18 grams of yellow gold. How many of each kind of ring can she make?

x = # of Celtic rings
y = # of Roman rings
z = # of Greek rings

$3x + 1y + 6z = 27$ gm white gold
$2x + 1y + 3z = 18$ gm yellow gold

$$\left[\begin{array}{ccc|c} 3 & 1 & 6 & 27 \\ 2 & 1 & 3 & 18 \end{array}\right] \xrightarrow{\text{rref}} \left[\begin{array}{ccc|c} 1 & 0 & 3 & 9 \\ 0 & 1 & -3 & 0 \end{array}\right]$$

x, y, $z \to t$

$x + 3t = 9$
$y - 3t = 0$

$\Rightarrow (x, y, z) = (9 - 3t, 3t, t)$

t = # of greek rings

$t = 0 \Rightarrow (9, 0, 0)$ make 9 celtic, 0 roman, 0 greek ring
$t = 1 \Rightarrow (6, 3, 1)$ " 6 " 3 " 1 "
$t = 2 \Rightarrow (3, 6, 2)$ " 3 " 6 " 2 "
$t = 3 \Rightarrow (0, 9, 3)$ " 0 " 9 " 3 "

10. A student has a quiz in his math class. He can study hard for the quiz, study a bit for the quiz or not study at all. The quiz can be challenging, moderate or easy. The student assigns a "satisfaction value" to each of the outcomes as shown in the matrix below:

	challenging	moderate	easy	
study hard	5	3	2	2
study a little	2	4	1	1
don't study	−1	1	0	−1

a) What should the student do if he is an optimist? Why?

(lucky)

choose to study hard and expect a chall. quiz

b) What should the student do if he is a pessimist? Why?

study hard and at worst have an easy quiz

c) What is the expected value of studying a little if there is a 25% chance of a challenging quiz, 50% chance of a moderate quiz and 25% chance of an easy quiz?

$E = 2(.25) + 4(.5) + 1(.25) = 2.75$

11. Bill and Sue play a game with coins. Both flip a coin at the same time. If both coins show heads or both coins show tails, Bill wins \$2 from Sue. If one coin shows heads and one shows tails, Sue wins \$2 from Bill. Construct the payoff matrix for this game.

Sue

Bill	H	T
H	2	−2
T	−2	2

Bill

Sue	H	T
H	−2	2
T	2	−2