1.3 Vector and Matrix Equations

MATH 294 SPRING 1985 FINAL # 8 294SP85FQ8.tex

1.3.1 Vector $\vec{p}$ contains m elements, and vector $\vec{q}$ contains n elements. The vector $\vec{r} = \vec{p}+\vec{q}$

a) Is always defined.
b) Is only defined when m = n.
c) Is never defined.
d) Is defined for m = n and m ¡ n.

MATH 293 SPRING 1990 PRELIM 1 # 2 293SP90P1Q2.tex

1.3.2 The following [question] refer to the real 2x2 matrix $\underline{\underline{A}}$.
Solve for the vector $\vec{u}+\vec{v}$ in V_4 if

$$\begin{array}{rcrcl} 3\vec{u} & + & 4\vec{v} & = & (0,1,0,1) \quad \text{and} \\ -2\vec{u} & + & 7\vec{v} & = & (-1,2,-7,0) \end{array}$$

MATH 293 FALL 1990 PRELIM 2 # 1 293FA90P2Q1.tex

1.3.3 **a**) Express the vectors **u**, **v** in terms of **a**, **b**, given that

$$3\mathbf{u} + 2\mathbf{v} = \mathbf{a},\ \mathbf{u} - \mathbf{v} = \mathbf{b}$$

b) If **a**, **b** are linearly independent, find a basis for the span of $\{\mathbf{u}, \mathbf{v}, \mathbf{a}, \mathbf{b}\}$
c) Find **u**, **v**, if $\mathbf{a} = (-1, 2, 8)$, $\mathbf{b} = (-2, -1, 1)$.

MATH 293 FALL 1992 PRELIM 2 # 4 293FA92P2Q4.tex

1.3.4 If A is a n x n matrix and if x and y are (n x 1) vector, that satisfy the equations

$$Ax = b,\ Ay = c \text{ (1,2)}$$

find the solution z of the equation

$$Az = 2b - 3c \text{ (3)}$$

and verify that z is a solution of (3).

MATH 293 FALL 1992 PRELIM 3 # 5 293FA92P3Q5.tex

1.3.5 Fill in the blanks of the following statements.
In what follows A is an m x n matrix
a) The dimension of the row space is 2.
The dimension of the null space is 3.
The number of columns of A is _ .
b) $Ax = b$ has a solution x if and only if b is in the _ space of A.
c) If $Ax = 0$ and $Ay = 0$ and if C_1 and C_2 are arbitrary constants then $A(C_1x + C_2y) =$ _ .

MATH 293 SPRING 1994 PRELIM 2 # 5 293SP94P2Q5.tex

1.3.6 Given that:

$A\mathbf{x} = \mathbf{b}$ has a particular solution $\mathbf{x_p} = \begin{pmatrix} 1 \\ 1 \\ 1 \\ 1 \end{pmatrix}$, and $A\mathbf{x} = \mathbf{0}$ has the general solution $\mathbf{x_h} = s \begin{pmatrix} 1 \\ 2 \\ 0 \\ 1 \end{pmatrix} + t \begin{pmatrix} 2 \\ 0 \\ 1 \\ -1 \end{pmatrix}$, where s and t are arbitrary parameters, determine which of the following vectors are solutions of $A\mathbf{x} = \mathbf{b}$.

a) $\mathbf{x} = \begin{pmatrix} 0 \\ 3 \\ 0 \\ 3 \end{pmatrix}$,

b) $\mathbf{x} = \begin{pmatrix} 1 \\ 3 \\ 1 \\ 2 \end{pmatrix}$.

MATH 294 SPRING 1999 PRELIM 1 # 4 294SP99P1Q4.tex

1.3.7 One serving of Kellogg's Cracklin' Oat Bran supplies 110 calories, 3g of protein, 21g of carbohydrate, and 3g of fat. One serving of Kellogg's Crispix supplies 110 calories, 2g of protein, 25g of carbohydrate, and 0.4g of fat. It is desired to have b_1, b_2, b_3 and b_4 calories, and grams of proteins, carbohydrate, and fat, respectively.

a) Setup, but do not solve, a matrix equation that would tell you how many servings of each cereal to eat.

b) Find a **b** (the column vector with b_1, b_2, b_3, b_4 as entries) where the matrix equation has a solution and find the solution.(One example with numbers is desired, not the general case.)

c) Is there a solution for all **b**? If so explain why, if not find a **b** where there is no solution and explain why there is no solution.