Assignment 3

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***Problem Set 4***

**Problem Set 4-1:**

Enter the matrices and vectors:

Find the products (where they exist): c\*A, c\*B, A\*B, d\*A

c \* A

c \* B

A\*B

% d \* A

display('d \* A does not exist')

**Results**

ans =

20 11 27

ans =

17 6 25

ans =

29 10 44

5 2 17

21 6 50

d \* A does not exist

**Problem Set 4-2:**

If x is the column vector [x1;x2;x3], solve the system of the equations Ax=d.

x = inv(A) \* d

**Results**

x =

0.5000

-0.2500

0.2500

**Problem Set 4-3:**

Solve the system of equations:

3x1 + 2x2 + x3 = 10

5x1 + x2 – x3 = -1

4x1 – 2x2 + 2x3 = 2

m = [3,2,1;5,1,-1;4,-2,2];

v = [10,-1,2]';

y = inv(m) \* v

**Results**

y =

0.0000

3.0000

4.0000

**Problem Set 4-4:**

Compute: A - B

A - B

**Results**

ans =

1 3 -2

-1 1 -4

1 0 3

**Problem Set 4-5:**

Use scalar expansion to create a new matrix, A\_new, such that each element of A (from problem 1) is decreased by 4.

A\_new = A – 4

**Results**

A\_new =

-2 -1 3

-3 -2 -4

0 -3 1

**Problem Set 4-6:**

For matrix A (in problem 1), find:

%a. the determinant

detA = det(A)

%b. the inverse

inverseA = inv(A)

%c. the eigenvalue and eigenvector

[v, lamda] = eig(A)

**Results**

detA =

-44

inverseA =

-0.2273 0.1818 0.3182

0.1136 0.4091 -0.1591

0.1591 -0.2273 -0.0227

v =

-0.7124 -0.8704 -0.0589

-0.0984 0.2021 -0.9177

-0.6949 0.4489 0.3928

lamda =

9.2423 0 0

0 -2.3064 0

0 0 2.0641

**Problem Set 4-7:**

For vector c (in problem 1) use MATLAB to compute

%a. the number of element or entries

size(c)

%b. the geometric (or Euclidean length)

length(c)

**Results**

ans =

1 3

ans =

3

**Problem Set 4-8:**

Create a row vector with 3 entries containing

% a. the sum of the entries for the 3 columns given

% in matrix A (from problem 1).

A

R = sum(A)

% b. the product of the entries for the 3 columns

% given in matrix A (from problem 1).

A

R = prod(A)

**Results**

A =

2 3 7

1 2 0

4 1 5

R =

7 6 12

A =

2 3 7

1 2 0

4 1 5

R =

8 6 0

**Problem Set 4-9:**

% 9a. Create a 4 x 5 matrix of all 0’s.

zeros(4,5)

% 9b. Create a row vector containing twenty 1’s.

ones(1,20)

% 9c. Create a 5 x 5 identity matrix.

eye(5)

**Results**

ans =

0 0 0 0 0

0 0 0 0 0

0 0 0 0 0

0 0 0 0 0

ans =

Columns 1 through 10

1 1 1 1 1 1 1 1 1 1

Columns 11 through 20

1 1 1 1 1 1 1 1 1 1

ans =

1 0 0 0 0

0 1 0 0 0

0 0 1 0 0

0 0 0 1 0

0 0 0 0 1

**Problem Set 4-10:**

Consider the vectors cur = [4 5 6 7] and volt = [2 8 9 3] containing the currents (in Amps) through and the voltages (in Volts) across 4 particular resistors at some point in time. Create a vector containing

the power dissipated by the 4 resistors.

%P = iV

cur = [4:7]; %Amps

volt = [2,8,9,3]; %Volts

pwr = cur .\* volt %Watts

**Results**

pwr =

8 40 54 21

**Problem Set 4-11:**

Consider two functions: s(t) = t^3+ 5 and w(t) = 2t^4. Create a 3-column table, showing t, s(t) and w(t), for t values 0, .25, ..., 2.

t = [0:0.25:2]';

disp('------------------------------')

disp(' t s(t) w(t)')

disp('------------------------------')

[ t t.^3+5 2\*t.^4]

**Results**

------------------------------

t s(t) w(t)

------------------------------

ans =

0 5.0000 0

0.2500 5.0156 0.0078

0.5000 5.1250 0.1250

0.7500 5.4219 0.6328

1.0000 6.0000 2.0000

1.2500 6.9531 4.8828

1.5000 8.3750 10.1250

1.7500 10.3594 18.7578

2.0000 13.0000 32.0000

**Problem Set 4-12:**

A company manufactures 5 disks with radii given (in inches) in the following vector: rad = [2 2.5 3 5 7]. Create a 2-column table, showing the radii for the manufactured disks in column 1 and the corresponding areas (in sq. in.) in column 2.

rad = [2, 2.5, 3, 5, 7]';

disp('------------------------------')

disp(' Radii Area')

disp('------------------------------')

area = 2\*pi .\* rad;

[rad area]

**Results**

------------------------------

Radii Area

------------------------------

ans =

2.0000 12.5664

2.5000 15.7080

3.0000 18.8496

5.0000 31.4159

7.0000 43.9823

**Problem Set 4-13:**

Create a matrix, say H, whose first row lists 0., 1, ...,9, whose second row lists 10, 11, ..., 19, ..., and whose 10th row lists 90, 91, ..., 99.

row = [0:9];

col = [0: 10: 90];

H = row + col'

sum = sum(H)

prod = prod(sum)

**Results**

H =

0 1 2 3 4 5 6 7 8 9

10 11 12 13 14 15 16 17 18 19

20 21 22 23 24 25 26 27 28 29

30 31 32 33 34 35 36 37 38 39

40 41 42 43 44 45 46 47 48 49

50 51 52 53 54 55 56 57 58 59

60 61 62 63 64 65 66 67 68 69

70 71 72 73 74 75 76 77 78 79

80 81 82 83 84 85 86 87 88 89

90 91 92 93 94 95 96 97 98 99

sum =

450 460 470 480 490 500 510 520 530 540

prod =

8.6840e+26

***Problem Set 5***

**Problem Set 5-1:**

For the circuit below, label the bottom left node as “ground”; then

% a. label the unknown nodal voltages

% b. determine (by inspection) the conductance matrix, G;

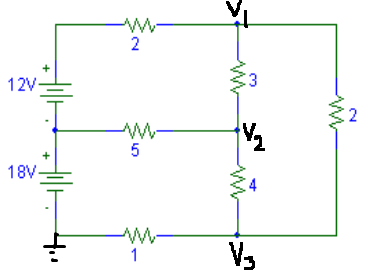
% c. determine (by inspection) the effective source current vector, is;

% d. use MATLAB to solve the equation: Gv= is for the unknown nodal voltages in vector v. find the downward current through the right-most 2W resistor. Ans: 5.2131 A

% Program Name: nodalAnalysis.m

% Author: Juan Silva Last Modified: Feb. 14, 2018

% Description: This program will find the voltages at specified nodes using inspection and Matlab.



clear, clc, close all

format short, format compact

% Define variables

Vs1 = 12 %volts

Vs2 = 18 %volts

R1 = 2; %Ohms

R2 = 3; %Ohms

R3 = 2; %Ohms

R4 = 5; %Ohms

R5 = 4; %Ohms

R6 = 1; %Ohms

G1 = (R1)^-1;

G2 = (R2)^-1;

G3 = (R3)^-1;

G4 = (R4)^-1;

G5 = (R5)^-1;

G6 = (R6)^-1;

% Start Code

% Develop the conductance matrix using inspection

a11 = G1 + G2 + G3;

a12 = -G2;

a13 = -G3;

a21 = -G2;

a22 = G2 + G4 + G5;

a23 = -G5;

a31 = -G3;

a32 = -G5;

a33 = G3 + G5 + G6;

% Create the matrix and current source vector.

G = [a11,a12,a13;a21,a22,a23;a31,a32,a33]

Is = [(Vs1 + Vs2) \* G1; Vs2 \* G4; 0 \* G6]

% Solve for voltage vector

v = inv(G) \* Is

display(' Volts');

% Use Ohm’s Law to solve the current at resistance

downCurrent = (v(1) - v(3)) / R3

**Results**

G =

1.3333 -0.3333 -0.5000

-0.3333 0.7833 -0.2500

-0.5000 -0.2500 1.7500

Is =

15.0000

3.6000

0

v =

17.4492

14.2623

7.0230

Volts

downCurrent =

5.2131

**Problem Set 5-2:**

Notation: In the sketch below, the boxes represent resistors; note that the ground is already labeled.

% a. label the unknownnodal voltages;

% b. determine (by inspection) the conductance matrix, G;

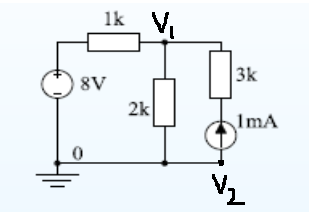
% c. determine (by inspection) the effective source current vector, is;

% d. use MATLAB to solve the equation: Gv= isfor the unknown nodal voltages % in vector v; % Ans: v = [6; 9]e. find the downward current through the 2 KW resistor. % Ans: 3 mA

% Program Name: nodalAnalysis2.m

% Author: Juan Silva Last Modified: Feb. 14, 2018

% Description: This program will find the voltages at specified nodes using inspection and Matlab.



% Define variables

Vs1 = 8; %volts

Is = 1e-3; %amps

R1 = 1e3; %Ohms

R2 = 2e3; %Ohms

R3 = 3e3; %Ohms

G1 = (R1)^-1;

G2 = (R2)^-1;

G3 = (R3)^-1;

% Start Code

% Develop the conductance matrix using inspection

a11 = G1+G2+G3;

a12 = -(G3);

a21 = -(G3);

a22 = G3;

G = [a11,a12;a21,a22]

% Effective current source by inspection

I = [G1 \* Vs1; 1e-3];

% Solve for voltage vector

v = inv(G) \* I

display(' Volts');

% Use Ohm’s Law to solve the current at resistance

downCurrent2 = (v(1) - 0) / R2

**Results**

G =

0.0018 -0.0003

-0.0003 0.0003

w =

6.0000

9.0000

Volts

downCurrent2 =

0.0030