Lab2 - Nikola Uzelac MAT343

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MAT 343 MATLAB Assignment # 2

Question # 1

```
n = 1000

A = floor(10*rand(n));

b = sum(A')';

z = ones(n,1);
```

```
n =

        1000
```

(i)

```
tic, x = A\b; toc

tic, y = inv(A)*b; toc

% x = A\b seems to be faster.
```

```
Elapsed time is 0.052164 seconds.
Elapsed time is 0.121881 seconds.
```

(ii)

```
sum(abs(x-y))
sum(abs(y-z))
% sum(abs(y-z)) is more accurate.
```

```
ans =

   6.3307e-10


ans =

   6.0587e-10
```

(b)

```
n = 2000
A = floor(10*rand(n));
b = sum(A')';
z = ones(n,1);
tic, x = A\b; toc
tic, y = inv(A)*b; toc
% x = A\b seems to be faster.
sum(abs(x-y))
sum(abs(y-z))
% sum(abs(y-z)) seems to be faster.
n = 5000
A = floor(10*rand(n));
b = sum(A')';
z = ones(n,1);
tic, x = A\b; toc
```

```
tic, y = inv(A)*b; toc

% x = A\b is much faster.

sum(abs(x-y))

sum(abs(y-z))

% sum(abs(x-y)) is faster
```

```
n =

        2000

Elapsed time is 0.345601 seconds.
Elapsed time is 0.843040 seconds.

ans =

   7.4214e-09


ans =

   7.3267e-09


n =

        5000

Elapsed time is 3.577107 seconds.
Elapsed time is 8.484186 seconds.

ans =

   2.8792e-07


ans =

   2.8446e-07
```

(c)

```
%  The exact solution of the system of Ax = b is the vector z as x
 acts as
%  an algebreic mean to find b. Where as in the case of Az = b it is z
%  acting as that mean. This manipulation is interchangable between
 the
```

```
%  two.
```

Question 2

```
n = 100

A = eye(n) - triu(ones(n),1);

b = sum(A')';

z = ones(n,1);

x = A\b;
y = inv(A)*b;

sum(abs(x-z))
sum(abs(y-z))

% sum(abs(x-z)) seems to be more accurate displaying a 0 value
```

```
n =

   100

Warning: Matrix is close to singular or badly scaled. Results may be
 inaccurate.
RCOND =  1.577722e-32.

ans =

     0


ans =

    45
```

Question 3

(a)

```
A = floor(10*rand(6));
b = floor(20*rand(6,1))-10;

x = A\b;

x
```

```
x =

   -9.3180
    1.4806
    7.1442
   19.2576
  -12.2840
  -15.0204
```

(b)

```
U = rref([A, b])

U
```

```
U =

    1.0000         0         0         0         0         0   -9.3180
         0    1.0000         0         0         0         0    1.4806
         0         0    1.0000         0         0         0    7.1442
         0         0         0    1.0000         0         0   19.2576
         0         0         0         0    1.0000         0  -12.2840
         0         0         0         0         0    1.0000  -15.0204


U =

    1.0000         0         0         0         0         0   -9.3180
         0    1.0000         0         0         0         0    1.4806
         0         0    1.0000         0         0         0    7.1442
         0         0         0    1.0000         0         0   19.2576
         0         0         0         0    1.0000         0  -12.2840
         0         0         0         0         0    1.0000  -15.0204
```

(c)

```
U(:,7) - x
```

```
ans =

   1.0e-04 *

    0.0097
    0.1607
    0.1993
   -0.4935
    0.2925
    0.2417
```

(d)

```
A(:,3) = 4*A(:,1)+5*A(:,2)

rref([A b])

% No solutions as zero cant equal 1
```

```
A =

     5     4    40     5     4     3
     4     5    41     3     3     3
     0     3    15     7     7     6
     8     1    37     7     5     2
     8     3    47     4     0     4
     9     4    56     7     5     1


ans =

     1     0     4     0     0     0     0
     0     1     5     0     0     0     0
     0     0     0     1     0     0     0
     0     0     0     0     1     0     0
     0     0     0     0     0     1     0
     0     0     0     0     0     0     1
```

(e)

```
y = floor(20*rand(6,1)) - 10;
c = A*y;

% A and y are defined and c is indirectly defined as its multiplying
 the
% two defined values (A and y) so when we carry out the arithmatic we
 are
% guaranteed at least one solution.
```

(f)

```
rref([A c])

% There are an infinite amount of solutions judging from the bottom
 row.
```

```
ans =

     1     0     4     0     0     0   -15
     0     1     5     0     0     0   -32
     0     0     0     1     0     0    -7
     0     0     0     0     1     0     6
     0     0     0     0     0     1    -6
     0     0     0     0     0     0     0
```

Question 4

```
%{

function [ y ] = myrowproduct( A, x )

% Evaluate matrix A row by row
%   Detailed explanation goes here
[m,n] = size(A);

[p,q] = size(x);

if (n == p && q == 1)
    y = zeros(m,1);
    for i = 1:m
        y(i) = A(i,:)*x;
    end
else
    disp('Dimensions do not match')
    y = [];
end
end

%}

A = rand(2,3)
x = rand(3,1)
myrowproduct(A, x)

A = rand(3,4)
x = rand(4,1)
myrowproduct(A, x)

A = rand(3,4)
x = rand(1,4)
myrowproduct(A, x)
```

```

A =

    0.5325    0.6318    0.8799
    0.5671    0.1266    0.2178


x =

    0.2133
    0.5898
    0.1744


ans =

    0.6397
    0.2336


A =

    0.2918    0.6058    0.5181    0.0144
    0.1507    0.7583    0.1512    0.9047
    0.0703    0.7783    0.8896    0.7010


x =

    0.7008
    0.8527
    0.2199
    0.7079


ans =

    0.8451
    1.4259
    1.4048


A =

    0.1683    0.7258    0.4412    0.0655
    0.3728    0.4075    0.8653    0.8115
    0.4907    0.8537    0.0868    0.6181


x =

    0.8296    0.5454    0.6202    0.2724

Dimensions do not match

ans =

     []
```

Question 5

(a)

```
%{

function [ C ] = columnproduct( A, B )

% Evaluate matrix A row by row
%   Detailed explanation goes here
[m,n] = size(A);
[p,q] = size(B);
if (n == p)
    C = zeros(m,q);
    for i = 1:q
        C(:,i) = A*B(:,i);
    end
else
    disp('Dimensions do not match')
    C = []
end
end

%}
A = rand(2, 3)
B = rand(3, 2)
A*B
columnproduct(A,B)

A = rand(3, 4)
B = rand(4, 2)
A*B
columnproduct(A,B)

A = rand(3, 4)
B = rand(2, 4)
columnproduct(A,B)
```

```
A =

    0.4985    0.3532    0.3869
    0.1431    0.5825    0.7865


B =

    0.2069    0.0115
    0.5169    0.1964
    0.1364    0.8768
```

```
ans =

    0.3385    0.4144
    0.4380    0.8057


ans =

    0.3385    0.4144
    0.4380    0.8057


A =

    0.3004    0.5425    0.3182    0.7418
    0.9736    0.7334    0.9880    0.9722
    0.5035    0.7104    0.1456    0.6282


B =

    0.5552    0.0172
    0.2277    0.5638
    0.5423    0.5784
    0.4062    0.4817


ans =

    0.7642    0.8525
    1.6383    1.4700
    0.7755    0.7960


ans =

    0.7642    0.8525
    1.6383    1.4700
    0.7755    0.7960


A =

    0.8973    0.2181    0.4560    0.0461
    0.2278    0.4689    0.7094    0.0663
    0.6645    0.8150    0.0468    0.4909


B =

    0.7295    0.2576    0.8975    0.9059
    0.7105    0.0330    0.4113    0.8276

Dimensions do not match
```

```
C =

     []


ans =

     []
```

(b)

```
%{

function [ C ] = rowproduct( A, B )

% Evaluate matrix A row by row
%   Detailed explanation goes here
[m,n] = size(A);
[p,q] = size(B);
if (n == p)
    C = zeros(m,q);
    for i = 1:m
        C(i,:) = A(i,:)*B;
    end
else
    disp('Dimensions do not match')
    C = []
end
end

%}
A = rand(2, 3)
B = rand(3, 2)
A*B
rowproduct(A,B)

A = rand(3, 4)
B = rand(4, 2)
A*B
rowproduct(A,B)

A = rand(3, 4)
B = rand(2, 4)
rowproduct(A,B)


A =

    0.2537    0.3771    0.9644
    0.6635    0.5799    0.0680
```

```
B =

    0.6878    0.7019
    0.1882    0.8325
    0.9725    0.0458


ans =

    1.1834    0.5362
    0.6316    0.9517


ans =

    1.1834    0.5362
    0.6316    0.9517


A =

    0.3642    0.0778    0.6748    0.2171
    0.2646    0.5434    0.2901    0.3881
    0.2039    0.6142    0.1062    0.9328


B =

    0.5958    0.9669
    0.0005    0.2283
    0.1233    0.2755
    0.4171    0.8403


ans =

    0.3908    0.7382
    0.3556    0.7860
    0.5240    1.1505


ans =

    0.3908    0.7382
    0.3556    0.7860
    0.5240    1.1505


A =

    0.9711    0.6578    0.4758    0.9716
    0.2231    0.6669    0.1058    0.0939
    0.0835    0.6405    0.2354    0.6739
```

```
B =

    0.1853    0.6028    0.9802    0.2113
    0.4193    0.0232    0.2460    0.8787

Dimensions do not match

C =

     []


ans =

     []
```

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