MAT 343 LAB 1 - Jordan Ledbetter

Question 1

Enter the matrices A, B, C

```
A = [-1,2,-4;2,2,3;2,6,-3]
```

```
A = 3×3
    -1     2    -4
     2     2     3
     2     6    -3
```

```
B = [-0.4,1.3,0.8;2.0,2.3,2.3;1.3,2.9,1.1]
```

```
B = 3×3
   -0.4000    1.3000    0.8000
    2.0000    2.3000    2.3000
    1.3000    2.9000    1.1000
```

```
C = [-3,1;1,5;1,-3]
```

```
C = 3×2
    -3     1
     1     5
     1    -3
```

Perform only the operations for which MATLAB does not given an error message.

(i)

```
(5*A)+(5*B)
```

```
ans = 3×3
   -7.0000   16.5000  -16.0000
   20.0000   21.5000   26.5000
   16.5000   44.5000   -9.5000
```

(ii)

```
5*(A+B)
```

```
ans = 3×3
   -7.0000   16.5000  -16.0000
   20.0000   21.5000   26.5000
   16.5000   44.5000   -9.5000
```

(iii)

```
A+B
```

```
ans = 3×3
   -1.4000    3.3000   -3.2000
    4.0000    4.3000    5.3000
    3.3000    8.9000   -1.9000
```

(iv)

```
A*C
```

```
ans = 3×2
     1    21
    -1     3
    -3    41
```

(v)

```
A*B
```

```
ans = 3×3
   -0.8000   -8.3000   -0.6000
    7.1000   15.9000    9.5000
    7.3000    7.7000   12.1000
```

(vi)

```
%A+C
```

(vii)

```
B+A
```

```
ans = 3×3
   -1.4000    3.3000   -3.2000
    4.0000    4.3000    5.3000
    3.3000    8.9000   -1.9000
```

(viii)

```
2+C
```

```
ans = 3×2
    -1     3
     3     7
     3    -1
```

(ix)

```
B*A
```

```
ans = 3×3
    4.6000    6.6000    3.1000
    7.2000   22.4000   -8.0000
    6.7000   15.0000    0.2000
```

(x)

```
%C*A
```

(a)

MATLAB refused to calculate vi and x.

For vi, A+C cannot be calculated due to their incompatiable sizes. A and C's matrix dimensions are 3x3 and 3x2, respectively. Matrix A third column would not be able to compute with Matrix C because Matrix C does not have a third column.

For x, C and A cannot be multiplied together because they are not definable. Matrix C and A's dimensions are 3x2 and 3x3, respectively. To determine the compatiability of matrices, the inner values of the dimensions must be the same. In this example, these values are 2 and 3; therefore, these matrices are incompatiable.

(b)

No, AB = BA.

(c)

Yes, A + B = B + A.

(d)

C+2 added a value of two to every value in Matrix C. For example, row one [-3,1] computed [-1,3].

(e)

Yes, 5(A+B) = 5A + 5B.

Question 2

Enter the matrices A, B, C

```
A = [6,4;−9,−6]
```

```
A = 2×2
     6     4
    −9    −6
```

```
B = [−3,−12;4,16]
```

```
B = 2×2
    −3   −12
     4    16
```

```
C = [−4,16;1,−4]
```

```
C = 2×2
    −4    16
     1    −4
```

Check whether the given rules hold.

Note: *for the rules that involve checking whether an identity holds, you can compute separately the right hand side and the left hand side and visually compare them or you can use the logical operator == to determine whether they are true or false. A==B does element by element comparison between A an dB and returns an array with elements set to 1 (True) where the relation is true and elements set to 0 (False) where it is not.*

(i)

```
A*(B+C) == A*B + A*C
```

```
ans = 2×2 logical array
   1   1
   1   1
```

Comment: Logically true

(ii)

```
(A*B)^2 == (A^2)*(B^2)
```

```
ans = 2×2 logical array
   0   0
   0   0
```

Comment: Logically false

(iii)

```
(A-B)*(A+B) == (A^2)-(B^2)
```

```
ans = 2×2 logical array
   0   0
   0   0
```

Comment: Logically false

(iv)

```
(A+B)^2 == (A^2)+ 2*A*B + (B^2)
```

```
ans = 2×2 logical array
   0   0
   0   0
```

Comment: Logically false

(v)

```
A*(B+C)== (B*A)+(C*A)
```

```
ans = 2×2 logical array
   0   0
   0   0
```

Comment: Logically false

(vi)

```
B*C == 0
```

```
ans = 2×2 logical array
   1   1
   1   1
```

Comment: True, if BC = 0, then B or C would have to be zero.

(vii)

```
A^2 == 0
```

```
ans = 2×2 logical array
   1   1
   1   1
```

Comment: True, if A^2 = 0, then A would have to be equal to zero.

Question 3

Enter the matrices A, B, C

```
A = [-6,-3;3,-1]
```

```
A = 2×2
    -6    -3
     3    -1
```

```
B = [2,-2;-2,-1]
```

```
B = 2×2
     2    -2
    -2    -1
```

```
C = [2,-1,-2;3,-6,-1]
```

```
C = 2×3
     2    -1    -2
     3    -6    -1
```

Perform only the operations for which MATLAB does not given an error message.

(i)

```
%A*C.'
```

(ii)

```
B'
```

```
ans = 2×2
     2    -2
    -2    -1
```

(iii)

```
(A')*(B')
```

```
ans = 2×2
   -18     9
    -4     7
```

(iv)

```
(A')'
```

```
ans = 2×2
    -6    -3
     3    -1
```

(v)

```
(B')*(A')
```

```
ans = 2×2
    -6     8
    15    -5
```

(vi)

```
(C')*A
```

```
ans = 3×2
    -3    -9
   -12     9
     9     7
```

(vii)

```
(A*B)'
```

```
ans = 2×2
    -6     8
    15    -5
```

(a)

MATLAB only refused AC^T due to incompatible matrix dimensions. A and C's dimensions are 2x2 and 3x2, respectively. Since the inner values are not the same, the matrices are not definable.

(b)

(A^T)^T is equivalent to A.

(c)

No, (AB)^T is not equivalent to A^T*B^T; however, (AB)^T is equivalent to B^T*A^T.

(d)

Yes, Matrix B is symmetric because B and its transpose matrix have the same values.

Question 4

Enter the matrices R and S

```
R = round(10*rand(3)), S = round(10*rand(3))
```

```
R = 3×3
     9    10     7
     0     3     9
     7     1     6
S = 3×3
     9     3     8
     2     4     6
     8     2     7
```

(i)

```
[R*S(:,1), R*S(:,2), R*S(:,3)]
```

```
ans = 3×3
   157    81   181
    78    30    81
   113    37   104
```

(ii)

```
[R(1,:)*S; R(2,:)*S; R(3,:)*S]
```

```
ans = 3×3
```

```
   157    81   181
    78    30    81
   113    37   104
```

(iii)

Compute the product RS.

```
R*S
```

```
ans = 3×3
   157    81   181
    78    30    81
   113    37   104
```

How does RS compare to the answers to questions (i) and (ii)?

RS creates the same output as the computations in (i) and (ii).

(iv)

Explanation:

For (i), matrix R is multiplied to every value in column one, two, and three of S separately.

For (ii), matrix S is multipled to every value in row one, two, and three of S separately.

Since matrices R and S have 3x3 dimensions, this is the same as multiplying all of R and S together, at once.

Question 5

Note: *Use `eye`, `ones`, `diag` and `triu`. Do not enter the matrices explicitely. Each matrix shold be generated with a single command.*

Create the matrix M

```
M = diag(9:11)
```

```
M = 3×3
     9     0     0
     0    10     0
     0     0    11
```

Create the matrix N

```
N = ones(3,3)*8, triu(N)
```

```
N = 3×3
     8     8     8
     8     8     8
     8     8     8
ans = 3×3
     8     8     8
     0     8     8
     0     0     8
```

Create the matrix P

```
P = eye(3)*7
```

```
P = 3×3
     7     0     0
     0     7     0
     0     0     7
```

Create the matrix Q

```
Q = ones(3,2)*5
```

```
Q = 3×2
     5     5
     5     5
     5     5
```

Question 6

Create the matrix G

```
G = [eye(2),zeros(2,3),B;A,C,eye(2)]
```

```
G = 4×7
     1     0     0     0     0     2    -2
     0     1     0     0     0    -2    -1
    -6    -3     2    -1    -2     1     0
     3    -1     3    -6    -1     0     1
```

Question 7

(a)

```
H = G(1:3,4:6)
```

```
H = 3×3
     0     0     2
     0     0    -2
    -1    -2     1
```

(b)

```
H(1,1) = 5
```

```
H = 3×3
     5     0     2
     0     0    -2
    -1    -2     1
```

(c)

```
H(:,3) = []
```

```
H = 3×2
     5     0
     0     0
    -1    -2
```

(d)

Enter the given command, examine the output and then write a comment describing it.

Do not include the output in your lab report.

```
G(:,:)
```

```
ans = 4×7
     1     0     0     0     0     2    -2
     0     1     0     0     0    -2    -1
    -6    -3     2    -1    -2     1     0
     3    -1     3    -6    -1     0     1
```

```
G(:)
```

```
ans = 28×1
     1
     0
    -6
     3
     0
     1
    -3
    -1
     0
     0
     ⋮
```

Comment:

The command G(:,:) prints all whole matrix by defining all rows and all columns with ":". Moreover, the command G(:) prints all values in a single row as a matrix with a 28x1 dimension, printing row by row. For example, all values in row one are printed first, then row two, and so on.

(e)

```
%G(5,6)
```

Explanation:

G(5,6) will return an error, indicating that the index in position 1 exceeds array bounds; however, if Matrix G had 6 columns, then the command would return the value positioned at row 5 and column 6.

(f)

```
max(G)
```

```
ans = 1×7
     3     1     3     0     0     2     1
```

```
sum(G)
```

```
ans = 1×7
    -2    -3     5    -7    -3     1    -2
```

Explanation:

The command max(G) returns the value with the greatest value for each column. The command sum(G) will return the sum of each column.

(g)

```
G(G>0)
```

```
ans = 8×1
     1
     3
     1
     2
     3
     2
     1
     1
```

```
G(G>0) = 400
```

```
G = 4×7
   400     0     0     0     0   400    -2
     0   400     0     0     0    -2    -1
    -6    -3   400    -1    -2   400     0
   400    -1   400    -6    -1     0   400
```

What does the first command do?

This command returns all values in matrix G that are greater than zero. It returns the values row by row.

What does the second command do?

This command replaces all values greater than zero with 400.

Question 8

```
format rat
```

Enter the matrix A

```
A = [7,5,4;-21,-16,-10;21,10,27]
```

```
A =
       7            5            4
     -21          -16          -10
      21           10           27
```

Perform row operations that reduce the matrix to Row Echelon Form.

```
A(1,:) = (1/7)*A(1,:)
```

```
A =
       1          5/7          4/7
     -21          -16          -10
      21           10           27
```

```
A(2,:) = A(2,:) + 21*A(1,:)
```

```
A =
       1          5/7          4/7
       0           -1            2
      21           10           27
```

```
A(3,:) = A(3,:)-21*A(1,:)
```

```
A =
       1              5/7            4/7
       0             -1              2
       0             -5             15
```

```
A(2,:) = -1*A(2,:)
```

```
A =
       1              5/7            4/7
       0              1             -2
       0             -5             15
```

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

```
A =
       1              5/7            4/7
       0              1             -2
       0              *              5
```

```
A(3,:) = (1/5)*A(3,:)
```

```
A =
       1              5/7            4/7
       0              1             -2
       0              *              1
```

```
format short
```