MATLAB Assignment 3

Graded

Student

Miles Levine

View or edit group

Total Points

53 / 56 pts

Question 1

Question 1

10 / 10 pts

✔ **+ 10 pts** Correct

+ 6 pts Both spaces have a correct basis for part a

+ 4 pts Correct solutions for part b

– 3 pts The basis for the Nullspace is incorrect

– 3 pts Basis for ColA is incorrect

– 2 pts Missing/Incorrect parametric form in part b

+ 0 pts Click here to replace this description.

+ 0 pts Part b is incorrect

– 3 pts Matrix is different, making it easier

Question 2

Question 2

7 / 10 pts

+ 10 pts Correct

✔ **+ 3 pts** Part a is correct

✔ **+ 3 pts** Part b is correct

✔ **+ 1 pt** Part c is correct

+ 3 pts Part d is correct

✔ **+ 0 pts** Part d is incorrect

– 1 pt Incorrect explanation for part d

+ 0 pts Click here to replace this description.

Question 3

Question 3

8 / 8 pts

✔ **+ 8 pts** Correct

+ 4 pts (a)

+ 4 pts (b)

+ 4 pts Correct, with (a) and (b) switched

+ 2 pts Used the given vectors as rows of the matrix.

+ 0 pts Empty/incorrect

– 5 pts No output

Question 4

Question 4

12 / 12 pts

✔ **+ 12 pts** Correct

+ 2 pts (a)

+ 6 pts (c)

+ 4 pts (d)

+ 2 pts (c): correct idea (calculating RREF) but incorrect basis

+ 3 pts (c) Correct coordinates for the basis vectors, but not written as polynomials.

+ 1 pt (d) Correct that the set if linearly dependent, but no/incorrect explicit dependence relation.

– 6 pts No output

Question 5

Question 5

16 / 16 pts

✔ **+ 16 pts** All correct. See itemized rubrics below.

+ 3 pts 5a) Correct matrix $A = \begin{bmatrix} 1 & \cos(0.1) & (\cos(0.1))^2 & (\cos(0.1))^3 & (\cos(0.1))^4 \\ 1 & \cos(0.2) & (\cos(0.2))^2 & (\cos(0.2))^3 & (\cos(0.2))^4 \\ 1 & \cos(0.3) & (\cos(0.3))^2 & (\cos(0.3))^3 & (\cos(0.3))^4 \\ 1 & \cos(0.4) & (\cos(0.4))^2 & (\cos(0.4))^3 & (\cos(0.4))^4 \\ 1 & \cos(0.5) & (\cos(0.5))^2 & (\cos(0.5))^3 & (\cos(0.5))^4 \end{bmatrix}$

+ 2 pts 5a) Correct idea.

+ 3 pts 5b) Correct. Used the command rref(A)
Observed all columns are pivot columns.
Or correct answer and reasoning based on your answer of part a)

+ 4 pts 5c) Correct. $u1 = [1; 0; 0; 0; 0]; u2 = [0; 1; 0; 0; 0]; u3 = [-1; 0; 2; 0; 0]; u4 = [0; -3; 0; 4; 0]; u5 = [1; 0; -8; 0; 8]$
-1pt per incorrect vector

+ 2 pts 5c) Correct direction, but defined vector u_j as the j-th components of the 5 vectors.

+ 4 pts 5d) Correct. The matrix could be $\begin{bmatrix} u1 & u2 & u3 & u4 & u5 \end{bmatrix}$. The vectors are linearly independent since all columns in the matrix are pivot columns.
Or correct answer and reasoning based on your answer of part c)

+ 2 pts 5e) Correct.
The set $\mathcal{C}$ is a basis for Span(B). (1pt)
Because there's a pivot every row for the matrix $\begin{bmatrix} u1 & u2 & u3 & u4 & u5 \end{bmatrix}$;
OR
Because the set $\mathcal{C}$ is a basis for a 5 dimensional subspace of Span(B), but Span(B) itself is 5 dimensional. (1pt)
Or correct answer and reasoning based on your answer of part c) and d)

+ 1 pt 5e) Correct conclusion with invalid reason.

− 1 pt 5e) Incorrect reason. (paired with the rubric "all correct")

Question assigned to the following page: 1

Contents


```
%Miles Levine
%Section 0412
%Matlab Project 3
```

Problem 1

```
%%a
format rat;
A=[3 -8 22 -8 2; 6 -8 -2 -8 44; -3 3 15 3 -27; -1 1 6 1 -9; 0 5 -7 5 25; 4 2 -3 2 66];
disp(A);
rrefA = rref(A);
disp(rrefA);
disp("The basis of a coloum space of matrix A are pivot columns of rrefA,");
disp("{[3; 6; -3; -1; 0; 4], [-8; -8; 3; 1; 5; 2], [22; -2; 15; 6; -7; -3]}");
disp("The basis of a kernel of A is the pivot vectors put into the ");
disp("parametric form:");

disp("Ker ={[14; 5; 0; 0], [0; -1; 0; 1]}");
%%b
disp("The solution to this system is x1 = 14. x2 = -x4 +5. x3 = 0, x4 ");
disp("is a free variable. There are infinite solutions since there");
disp("are more variables than non-zero rows. The parametric form discribes");
disp("that there can be infinite solutions because pluging in values for");
disp("the free variable will yield infinite solutions. ");
disp("parametric form:");
disp("x1 = 14");
disp("x2 = -x4 + 5");
disp("x3 = 0");
disp("x4, is free");
disp("[14; 5; 0; 0] + x4[0; -1; 0; 1] ");
```

```
     3     -8     22     -8      2
     6     -8     -2     -8     44
    -3      3     15      3    -27
    -1      1      6      1     -9
     0      5     -7      5     25
     4      2     -3      2     66

     1      0      0      0     14
     0      1      0      1      5
     0      0      1      0      0
     0      0      0      0      0
     0      0      0      0      0
     0      0      0      0      0
```

Questions assigned to the following page: 1 and 2

```
The basis of a coloum space of matrix A are pivot columns of rrefA,
{[3; 6; -3; -1; 0; 4], [-8; -8; 3; 1; 5; 2], [22; -2; 15; 6; -7; -3]}
The basis of a kernel of A is the pivot vectors put into the
parametric form:
Ker ={[14; 5; 0; 0], [0; -1; 0; 1]}
The solution to this system is x1 = 14. x2 = -x4 +5. x3 = 0, x4
is a free variable. There are infinite solutions since there
are more variables than non-zero rows. The parametric form discribes
that there can be infinite solutions because pluging in values for
the free variable will yield infinite solutions.
parametric form:
x1 = 14
x2 = -x4 + 5
x3 = 0
x4, is free
[14; 5; 0; 0] + x4[0; -1; 0; 1]
```

Problem 2

```
format rat;
%%a correct?
A = [5 -3 6 7; 0 0 0 1; 7 -5 3 -7; 4 0 3 -7];
disp(A);
rrefA= rref(A);
disp(rrefA);
disp("Basis for Row space of A =")
fprintf("{[5 -3 6 7], [0 0 0 1], [ 7 -5 3 -7], [4 0 3 -7]}\n");
%%b
disp("Basis for column space of A = all colums of Matrix A, since every");
disp("column is a pivot:");
disp("{[5; 0; 7; 4;], [-3; 0; -5; 0], [6; 0; 3; 3], [7; 1; -7; -7]}");
%%c
disp("yes, dim(Row(A)) is equal the dim(Col(A)).");
disp("dim(Row(A)) = number of linearly independent rows which is 4.");
disp("dim(Col(A)) = number of linearly independent columns which is 4.");
%%d
disp("no, row(a) and col(a) are not equal sets. row(a) is the transpose ");
disp("of col(a) and in this case the transpose of the column space of A");
disp("is not equal to the row space of A");
```

```
       5            -3             6             7
       0             0             0             1
       7            -5             3            -7
       4             0             3            -7

       1             0             0             0
       0             1             0             0
       0             0             1             0
       0             0             0             1

Basis for Row space of A =
{[5 -3 6 7], [0 0 0 1], [ 7 -5 3 -7], [4 0 3 -7]}
Basis for column space of A = all colums of Matrix A, since every
column is a pivot:
```

Questions assigned to the following page: 2 and 3

```
{[5; 0; 7; 4;], [-3; 0; -5; 0], [6; 0; 3; 3], [7; 1; -7; -7]}
yes, dim(Row(A)) is equal the dim(Col(A)).
dim(Row(A)) = number of linearly independent rows which is 4.
dim(Col(A)) = number of linearly independent columns which is 4.
no, row(a) and col(a) are not equal sets. row(a) is the transpose
of col(a) and in this case the transpose of the column space of A
is not equal to the row space of A
```

Problem 3

```
format rat;
%%a
%b times v
B = [4 2 4 -8; 1 6 3 6; -5 4 0 7; 5 -7 1 7];
v = [2; -30; 13; -10];
u = (B*v);
disp(B);
disp(v);
disp("to map from non-canonical to canonical multiply B and v");

disp("u = ");
disp(u);


%%b take inverse of B then multiply by v
invB = inv(B);
disp("inverse of B =");
w = (B\v); %
disp(invB);
disp("to map from canonical to non-canonical take inverse of B, then ");
disp("multiply by v");
disp("w =")
disp(w);
```

```
       4             2             4            -8
       1             6             3             6
      -5             4             0             7
       5            -7             1             7

       2
     -30
      13
     -10

to map from non-canonical to canonical multiply B and v
u =
      80
    -199
    -200
     163

inverse of B =
     -83/546         59/273        -29/91         -11/273
    -173/1638       146/819        -44/273        -92/819
     587/1638      -164/819        113/273        137/819
```

Questions assigned to the following page: 3 and 4

```
     -79/1638        43/819          2/273         29/819

to map from canonical to non-canonical take inverse of B, then
multiply by v
w =
    -958/91
   -1783/273
    2848/273
    -527/273
```

Problem 4

```
format rat;
%%a

v1 = [7; -3; 1; 7; 2];
v2 = [9; -3; -9; -5; -6];
v3 = [1; -1; 3; 4; 3];
v4 = [5; -3; -1; 0; 1];

%%b
A = [v1 v2 v3 v4];
disp("Vectors of the polynomial functions v1-v4:")
disp(A);
%%c

rrefA = rref(A);
disp("rref of A =");
disp(rrefA);
disp("polynomials 1, 2 and 3 are a basis S for W since they are pivot");
disp(" polynomials");
disp("f1(x) = 7 - 3x + x^2 + 7x^3 + 2x^4");
disp("f2(x) = 9 - 3x - 9x^2 - 5x^3 - 6x^4");
disp("f3(x) = 1 - x + 3x^2 + 4x^3 + 3x^4");


%%d
disp("The set of polynomials are linearly dependent since the last ");
disp("column is a linear combination of the other vectors and A is also");
disp("linearly dependent since not all columns are pivit columns.");
disp("The explicit dependent relationship is as follows:");
disp("from rref we can see: f4(x) = -f1(x) + f2(x) + f3(x)");
```

```
Vectors of the polynomial functions v1-v4:
       7             9             1             5
      -3            -3            -1            -3
       1            -9             3            -1
       7            -5             4             0
       2            -6             3             1

rref of A =
       1             0             0            -1
       0             1             0             1
       0             0             1             3
```

Questions assigned to the following page: 4 and 5

```
       0             0             0             0
       0             0             0             0

polynomials 1, 2 and 3 are a basis S for W since they are pivot
 polynomials
f1(x) = 7 - 3x + x^2 + 7x^3 + 2x^4
f2(x) = 9 - 3x - 9x^2 - 5x^3 - 6x^4
f3(x) = 1 - x + 3x^2 + 4x^3 + 3x^4
The set of polynomials are linearly dependent since the last
column is a linear combination of the other vectors and A is also
linearly dependent since not all columns are pivit columns.
The explicit dependent relationship is as follows:
from rref we can see: f4(x) = -f1(x) + f2(x) + f3(x)
```

Problem 5

```
format short;
%%a correct?
x1 = 0.1;
x2 = .2;
x3 = .3;
x4 = .4;
x5 = .5;
A1 = [1, cos(x1), cos(x1).^2, cos(x1).^3, cos(x1).^4];
A2 = [1, cos(x2), cos(x2).^2, cos(x2).^3, cos(x2).^4];
A3 = [1, cos(x3), cos(x3).^2, cos(x3).^3, cos(x3).^4];
A4 = [1, cos(x4), cos(x4).^2, cos(x4).^3, cos(x4).^4];
A5 = [1, cos(x5), cos(x5).^2, cos(x5).^3, cos(x5).^4];
A = [A1; A2; A3; A4; A5];

disp(A);


%%b
rrefA = rref(A);
disp(rrefA);
disp("The rref(A) shows a trivial solution and also shows a pivot in every");
disp("column therefore matrix A is linearly independent");

%%c
u1 = [1; 0; 0; 0; 0];
u2 = [0; 1; 0; 0; 0];
u3 = [-1; 0; 2; 0; 0];
u4 = [0; -3; 0; 4; 0];
u5 = [1; 0; -8; 0; 8];


%%d
B = [u1, u2, u3, u4, u5];
rrefB = rref(B);
disp(B);
disp(rrefB);
disp("The rref(A) shows a trivial solution and also shows a pivot in every");
disp("column therefor matrix A is linearly independent");
%%e
```

Question assigned to the following page: 5

```
disp("since c is a linearly independent set, it spans the same subspace ");
disp("as B, and any vector in D can be a linear combination of the ");
disp("vectors in C ");
disp("since matrix B and matrix A both have 5 dimentions (same dimention),");
disp(" we can conclude that matrix B is a basis for D");
```

```
    1.0000    0.9950    0.9900    0.9851    0.9802
    1.0000    0.9801    0.9605    0.9414    0.9226
    1.0000    0.9553    0.9127    0.8719    0.8330
    1.0000    0.9211    0.8484    0.7814    0.7197
    1.0000    0.8776    0.7702    0.6759    0.5931

     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

The rref(A) shows a trivial solution and also shows a pivot in every
column therefore matrix A is linearly independent
     1     0    -1     0     1
     0     1     0    -3     0
     0     0     2     0    -8
     0     0     0     4     0
     0     0     0     0     8

     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

The rref(A) shows a trivial solution and also shows a pivot in every
column therefor matrix A is linearly independent
since c is a linearly independent set, it spans the same subspace
as B, and any vector in D can be a linear combination of the
vectors in C
since matrix B and matrix A both have 5 dimentions (same dimention),
 we can conclude that matrix B is a basis for D
```

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