Contents


```
% Zain Bhaila
% Math 240 Fall 2018 Project 2
clc
```

Problem 0

```
format rat
clock
```

```
ans =

  Columns 1 through 5

    2018            10             6            18            37

  Column 6

   11459/194
```

Problem 1

```
format rat
A = [1 7 2; 3 3 5; 2 5 3]

% Problem 1(a)
M = [A eye(3)]
N = rref(M)
X = N(:,4:6)

% Problem 1(b)
inv(A)
```

```
A =

       1             7             2
       3             3             5
       2             5             3


M =

  Columns 1 through 5

       1             7             2             1             0
       3             3             5             0             1
       2             5             3             0             0

  Column 6

       0
       0
       1


N =

  Columns 1 through 5

       1             0             0          -16/9         -11/9
       0             1             0            1/9          -1/9
       0             0             1             1             1

  Column 6

      29/9
       1/9
      -2
```

```
X =

    -16/9          -11/9          29/9
      1/9           -1/9           1/9
      1              1             -2


ans =

    -16/9          -11/9          29/9
      1/9           -1/9           1/9
      1              1             -2
```

Problem 2

```
format rat

% Problem 2(a)
A = [1 40 19 -6; 0 2 0 8; 0 0 -5 71; 0 0 0 -1]
B = [2 -1 3 1; 2 0 1 -1; 2 3 3 3; 1 -1 -1 -1]
det(A)
det(B)

% Problem 2(b)
% the determinent of an upper triangular matrix is
% the product of its diagonal values

% Problem 2(c)
C = A*B
det(C)

% Problem 2(d)
% det(C) = det(A*B) = det(A)*det(B)
% and we know det(A) and det(B)
```

```
A =

       1             40             19             -6
       0              2              0              8
       0              0             -5             71
       0              0              0             -1


B =

       2             -1              3              1
       2              0              1             -1
       2              3              3              3
       1             -1             -1             -1


ans =

      10


ans =

      30


C =

     114             62            106             24
      12             -8             -6            -10
      61            -86            -86            -86
      -1              1              1              1


ans =

     300
```

Problem 3

```
format rat
A = [2 -2 2 3; 5 1 -2 6; -3 3 1 -6; 0 -1 1 1]

% Problem 3(a)
det(A)

% Problem 3(b)
% i -> 33
```

```
% ii -> -1 * 33 = -33
% iii -> 33 * 1/5 = 33/5

% Problem 3(c)
B = A;
B(4,:) = B(4,:) + 7 * B(2,:)
C = A;
temp = C(1,:);
C(1,:) = C(3,:);
C(3,:) = temp
D = A;
D(2,:) = 1/5 * D(2,:)

% Problem 3(d)
det(B)
det(C)
det(D)
```

```
A =

     2    -2     2     3
     5     1    -2     6
    -3     3     1    -6
     0    -1     1     1


ans =

    33


B =

     2    -2     2     3
     5     1    -2     6
    -3     3     1    -6
    35     6   -13    43


C =

    -3     3     1    -6
     5     1    -2     6
     2    -2     2     3
     0    -1     1     1


D =

     2    -2     2     3
     1   1/5  -2/5   6/5
    -3     3     1    -6
     0    -1     1     1


ans =

    33


ans =

   -33


ans =

    33/5
```

Problem 4

```
% Problem 4(a)
syms a b c d
A = [a b; c d]

% Problem 4(b)
inv(A)

% Problem 4(c)
syms e f g h i
B = [a b c; d e f; g h i] %#ok
inv(B)

% Problem 4(d)
inv(B)*det(B) %#ok
```

```
A =

[ a, b]
[ c, d]


ans =

[  d/(a*d - b*c), -b/(a*d - b*c)]
[ -c/(a*d - b*c),  a/(a*d - b*c)]


B =

[ a, b, c]
[ d, e, f]
[ g, h, i]


ans =

[  (e*i - f*h)/(a*e*i - a*f*h - b*d*i + b*f*g + c*d*h - c*e*g), -(b*i - c*h)/(a*e*i - a*f*h - b*d*i + b*f*g + c*d*h - c*e*g),  (b*f - c*e)/(a*e*i - a*f*h - b*d
[ -(d*i - f*g)/(a*e*i - a*f*h - b*d*i + b*f*g + c*d*h - c*e*g),  (a*i - c*g)/(a*e*i - a*f*h - b*d*i + b*f*g + c*d*h - c*e*g), -(a*f - c*d)/(a*e*i - a*f*h - b*d
[  (d*h - e*g)/(a*e*i - a*f*h - b*d*i + b*f*g + c*d*h - c*e*g), -(a*h - b*g)/(a*e*i - a*f*h - b*d*i + b*f*g + c*d*h - c*e*g),  (a*e - b*d)/(a*e*i - a*f*h - b*d


ans =

[ e*i - f*h, c*h - b*i, b*f - c*e]
[ f*g - d*i, a*i - c*g, c*d - a*f]
[ d*h - e*g, b*g - a*h, a*e - b*d]
```

Problem 5

```
format short

% Problem 5(a)
A = [cos(pi/9) -sin(pi/9); sin(pi/9) cos(pi/9)]
v = [2 ; -7]
A*v

% Problem 5(b)
B = [cos(pi/13) -sin(pi/13); sin(pi/13) cos(pi/13)]
A*B == B*A %#ok
if A*B == B*A
    disp ('the two matrices are equivalent')
else
    disp('the two matrices are not equivalent')
end

% Problem 5(c)
% it shows that they do the same thing regardless of
% the order they are performed

% Problem 5(d)
C = A*B
t = acos(C(1,1))
format rat
t/pi

% Problem 5(e)
format short
R = [cos(-pi/9) -sin(-pi/9); sin(-pi/9) cos(-pi/9)]
inv(A)
% they are the same, computer approximated sin values
% give an incorrect result for boolean expressions

% Problem 5(f)
L_0 = [1 0; 0 -1]
L = A * L_0 * inv(A) %#ok

% Problem 5(g)
L*L_0 == L_0*L %#ok
if L*L_0 == L_0*L
    disp('the two matrices are equivalent')
else
    disp('the two matrices are not equivalent')
end

% Problem 5(h)
R = L*L_0
t = acos(R(1,1))
format rat
t/pi
```

```
A =

    0.9397   -0.3420
    0.3420    0.9397


v =

     2
    -7


ans =

    4.2735
   -5.8938


B =

    0.9709   -0.2393
    0.2393    0.9709


ans =

  2×2 logical array

   1   1
   1   1

the two matrices are equivalent

C =

    0.8305   -0.5570
    0.5570    0.8305


t =

    0.5907


ans =

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R =

    0.9397    0.3420
   -0.3420    0.9397


ans =

    0.9397    0.3420
   -0.3420    0.9397


L_0 =

     1     0
     0    -1


L =

    0.7660    0.6428
    0.6428   -0.7660


ans =

  2×2 logical array

   1   0
   0   1

the two matrices are not equivalent

R =

    0.7660   -0.6428
    0.6428    0.7660


t =
```

```
    0.6981
```

```
ans =

    2/9
```

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