Name:______________________________

ChBE 2120, Numerical Methods, Paravastu Section, Fall 2015
Quiz 1: 20 points possible

1) (9 points) The following code has 3 mistakes in it. Correct them.

```
function [ detM ] = CalculateDeterminant( M )
%in: M is a square matrix
    dimM = size(M);
    if (dimM == 1)
        detM = M(1, 1);
    else
        detM = 0;
        for i = 1:dimM(2)
            detM = (-1)^(i+1) * M(1, i) * CalculateDeterminant(MatrixMinor(M, 1, i));
        end
    end
end
```

Should be dimM(1).

It turns out that the program will work even if this is not "corrected." Grader: please give free points

+3, automatic

detM + (+3)

```
function [ MMinor ] = MatrixMinor( M, i, j )
  dimM = size(M);

  MMinor = M([1:i (i+1):dimM(1)], [1:(j-1) (j+1):dimM(2)]);

End
```

Should be (i-1)

+3

How to calculate a determinant:

$|A| = det(A) = \sum_{k=1}^{n} a_{ik}C_{ik},\ \ i = 1,2,\dots,n$ *(Laplace row expansion)*

$\quad\quad\quad\quad = \sum_{k=1}^{n} a_{kj}C_{kj},\ j = 1,2,\dots,n$ *(Laplace column expansion)*

The Cofactor $C_{ik} = (-1)^{i+k}M_{ik}$. *The minor* M_{ik} *is the determinant of the matrix created by removing the* i^{th} *row and the* k^{th} *column from A. The determinant of a 1x1 matrix (scalar) is the scalar value.*

2) (6 points) Write a Matlab function that accepts a positive integer as input and outputs the sum of the integer's digits. For example, an input of 552 would yield an output of 12. You function should work regardless of the number's magnitude. You may use Matlab's built-in mod function: mod(x, y) outputs the remainder of x/y.

function [DigitSum] = AddDigits(n)

```
DigitSum=0;
m=n;
While m>0
    nextDigit = mod(m,10);
    DigitSum=DigitSum+nextDigit;
    m=(m-nextDigit)/10;
end
```

+3 for approach
+3 for execution

end

3) (5 points) Calculate the inverse of the following matrix, using Gauss-Jordan elimination.

$$\underbrace{\begin{bmatrix}1 & 2\\3 & 4\end{bmatrix}}_{A}\ \underbrace{\left[\begin{array}{cc:cc}1 & 2 & 1 & 0\\3 & 4 & 0 & 1\end{array}\right]}_{}\ \xrightarrow[R_2\to R_2-3R_1]{}\ \left[\begin{array}{cc:cc}1 & 2 & 1 & 0\\0 & -2 & -3 & 1\end{array}\right]\ \xrightarrow[R_2\to -\frac{1}{2}R_2]{R_1\to R_1+R_2}\ \left[\begin{array}{cc:cc}1 & 0 & -2 & 1\\0 & 1 & \frac{3}{2} & -\frac{1}{2}\end{array}\right] \Longrightarrow A^{-1} = \begin{bmatrix}-2 & 1\\ \frac{3}{2} & -\frac{1}{2}\end{bmatrix}$$

+2 for setup

+3 for row operations