ECOR 1010 – INTRODUCTION TO ENGINEERING

[redacted]

ASSIGNMENT #7

Assignment Title: Using MATLAB to Solve Matrices

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INTRODUCTION

Linear systems and equations are very important in engineering and applied science, as well as in other disciplines of science. The number of equations in a system can sometimes be astronomically high, in which case it is very impractical for an engineer to do the calculations by hand. Computer software such as MATLAB (Matrix Laboratory) is very useful in speeding up this process.

MATERIALS AND METHODS

In this experiment, MATLAB was used along with the given information to solve a series of problems and equations. IntelliCAD was also used to generate a circuit diagram. Given information included vectors, circuit information (voltage and resistance), and directions.

RESULTS

Various operations such as multiplication were performed on matrices with expected results (1.1, 2.1, 2.2, 2.3, 2.4, 2.5, 2.6). The final location of the CCGS Panda was 4km east and 9km north of its initial position (1.2). The expected curve was generated in 1.3.

DISCUSSION

MATLAB is a fairly useful software program and was very user friendly for solving the problems in this experiment and it worked very well. Some advantages are that it is easy to figure out how to use, and it makes solving large systems of equations quite effortless. A disadvantage is that all of the information still has to be inputted, which in some cases can be time consuming, however it would be still less time consuming than doing the full calculations by hand. All of the results in this experiment were what was expected. For example, the matrices in 1.1 that couldn't be multiplied were because the sizes of them wouldn't allow for them to be multiplied, as they weren't *m*x*n* and *n*x*m* matrices. The navigation system in the CCGS Panda was inaccurate, as it didn't return to its original location. In 2.4, 4.2250 tonnes of A was burned and 1.6428 tonnes of B was burned. The currents were -2.8144 A, -3.1480 A, -1.2300 A. The currents are negative because the flow of current is actually in the opposite direction of what is indicated in the circuit diagram.

CONCLUSIONS

In conclusion, MATLAB is a very useful software program for engineers to solve large systems of linear equations, among other various problems.

Appendix A – MATLAB Scripts

Part One Question One

There is an error because both matrices are 3x1 matrices. In order to be able to multiply two matrices, one must be *m*x*n* and the other must be *n*x*m*.

p*K	ans = 1.9200 0.9600 0 0.3200

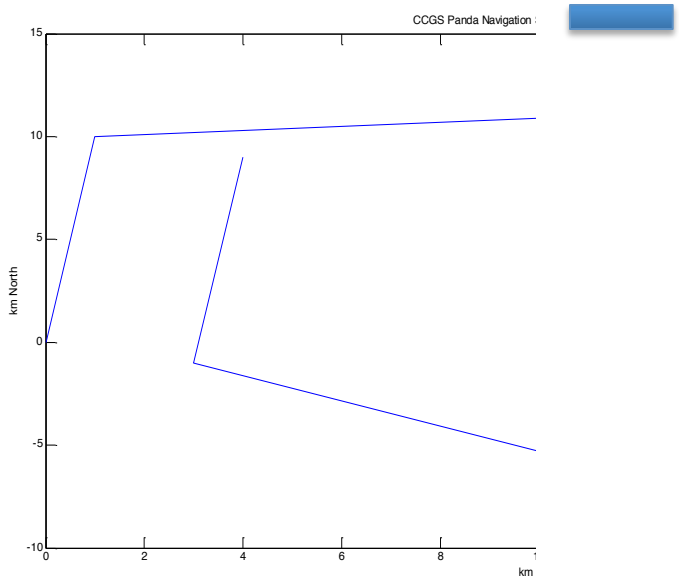
L*H	Error using * Inner matrix dimensions must agree.

There is an error because one matrix is a 2x1 matrix, and the other is a 3x1 matrix. In order to be able to multiply two matrices, one must be *m*x*n* and the other must be *n*x*k*.

J'-K	Error using - Matrix dimensions must agree.

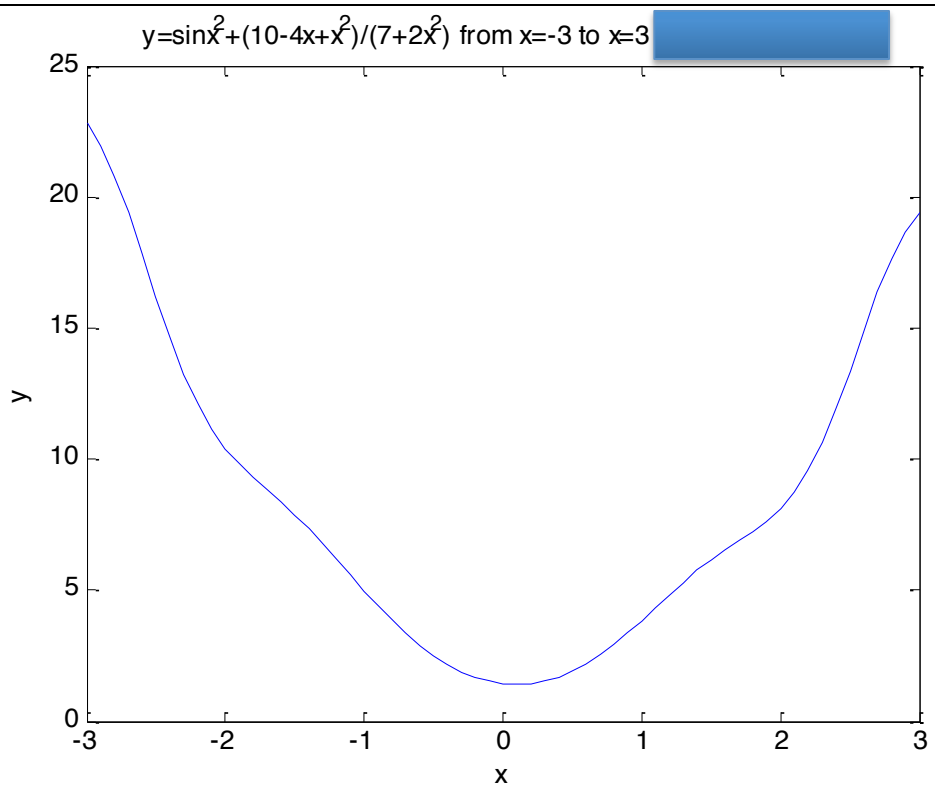
There is an error because these matrices cannot be subtracted from each other, as they are not both *m*x*n*.

Part One Question Two



The final position of the boat was 4km east and 9 km north of the original position, and therefore the navigation system didn't work as expected. The total distance travelled by the boat was 64.5613km.

Part One Question Three

>> x=[-3:0.1:3]	*x = -3 -2 -1 0 1 2 3
>> plot(x,sin(x.^2)+(10-4*x+(x.^2))/7+2*(x.^2))	

**Note: output given is for x=[-3:3], not x=[-3:0.1:3]*

Part Two Question One

a)

>> F*G	ans = 36 0 6 96 24 33 -70 22 58 26 -10 11 -27 9 24 15 -3 6 2 10 32 102 18 36 -46 22 62 90 6 33 -31 13 36 43 1 16

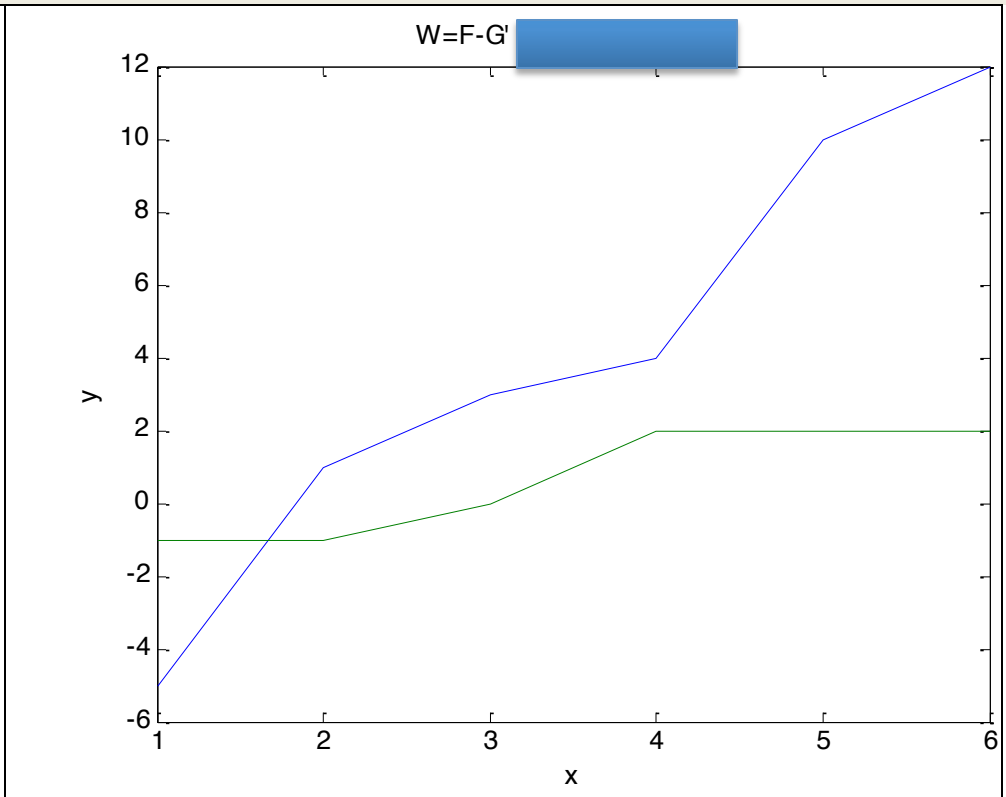
>> ans*r	ans = -14.4000 0 -2.4000 -38.4000 -9.6000 -13.2000 28.0000 -8.8000 -23.2000 -10.4000 4.0000 -4.4000 10.8000 -3.6000 -9.6000 -6.0000 1.2000 -2.4000 -0.8000 -4.0000 -12.8000 -40.8000 -7.2000 -14.4000 18.4000 -8.8000 -24.8000 -36.0000 -2.4000 -13.2000 12.4000 -5.2000 -14.4000 -17.2000 -0.4000 -6.4000

b)

>> W=F-G'	W = 12 2 4 0 -5 2 1 -1 10 2 3 -1

c)

>> A=sort(W)	A = -5 -1 1 -1 3 0 4 2 10 2 12 2

>> plot([1,2,3,4,5,6]',A)	

d)

>> U*G	ans = -9 3 8 5 -1 2 7 -1 -2 9 3 3

e)

>> F*U	ans = 3 9 7 -1 3 0 6 8 9 5 5 2

f)

>> Q*H	ans = -31 -34 -55

g)

>> (q*G')+(p*F')	Error using + Matrix dimensions must agree.

Part Two Question Two

>> A=[9,2,5;6,4,1;2,7,2]	A = 9 2 5 6 4 1 2 7 2
>> b=[5;1;3]	b = 5 1 3
>> x=inv(A)*b	x = -0.1132 0.1321 1.1509

Part Two Question Three

>> T=[1,-1,0,0,0,0;0,1,-1,0,0,0;0,0,1,-1,0,0;0,0,0,1,-1,0;0,0,0,0,1,-1;-1,0,0,0,0,1]	T = 1 -1 0 0 0 0 0 1 -1 0 0 0 0 0 1 -1 0 0 0 0 0 1 -1 0 0 0 0 0 1 -1 -1 0 0 0 0 1
>> S=[75;-60;115;-120;55;-65]	S = 75 -60 115 -120 55 -65
>> pinv(T)/pinv(S)	ans = 49.1667 -25.8333 34.1667 -80.8333 39.1667 -15.8333

Part Two Question Four

>> A=[26600000,30200000;3100,6400;240,340]	A = 26600000 30200000 3100 6400 240 340
>> B=[162000000;23612;1566]	B = 162000000 23612 1566
>> x=A\B	x = 4.2250 1.6428

Part Two Question Five

>> A=[11,-6,-5;-6,7,-1;-5,-1,14]	A = 11 -6 -5 -6 7 -1 -5 -1 14
>> x=[-5.92;-3.92;0]	x = -5.9200 -3.9200 0
>> i=A\x	i = -2.8144 -3.1480 -1.2300

All of the currents calculated are negative, which means that the current actually flows in the opposite direction than is shown in the circuit diagram.

Part Two Question Six

>> A=[1,0,0;9,7,4;3,9,2]	A = 1 0 0 9 7 4 3 9 2
>> b=[1,2,3]	b = 1 2 3
>> c=b*A*b'	c = 152
>> E=c/pi	E = 48.3831

Appendix B – Circuit Diagram