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MATH446

**Project 4: Gaussian Elimination**

1.) Attached as MATLAB session

2.) Elements of A defined as: a(i,j) = cos(1 / (cos(i+j) + sin(j)));

|  |  |  |  |
| --- | --- | --- | --- |
| **Good Matrix** | **N=8** | **N=12** | **N=16** |
| **RFE\*\*** | 4.440892098500626e-15 | 3.360645095540349e-13 | 1.690869666504113e-13 |
| **RBE** | 3.486710584460253e-16 | 1.118046192763224e-15 | 3.185518018837390e-15 |
| **EMF** | 12.736623791756669 | 3.005819542423910e+02 | 53.079896472261233 |
| **Condition #\*\*\*** | 2.353581355840004e+02 | 2.176503843700892e+03 | 1.258530700403742e+04 |

3.) Elements of A defined as: a(i,j) = cos(cos(i+j) + sin(j))

|  |  |  |  |
| --- | --- | --- | --- |
| **Bad Matrix** | **N=8** | **N=12** | **N=16** |
| **RFE\*\*** | 1.610546207508889e-08 | 1.761978272507569e-05 | 65.404443420716220 |
| **RBE** | 1.115312642889253e-16 | 2.975704592961443e-16 | 1.115500872302822e-15 |
| **EMF** | 1.444031158238033e+08 | 5.921213673814430e+10 | 5.863235524477568e+16 |
| **Condition #\*\*\*** | 7.302085025055508e+07 | 1.217841528184670e+09 | 4.067013422984426e+16 |

4.) Comparison of results:

|  |  |  |
| --- | --- | --- |
| **Good Matrix** | **Success/Failure to Solve\*** | **Largest Solvable System** |
| N=8 | Success | For all N>1 |
| N=12 | Success |
| N=16 | Success |
|  | | |
| **Bad Matrix** | **Success/Failure to Solve\*** | **Largest Solvable System** |
| N=8 | Failure w/ Acceptable RFE | N=3 or N<=13; See conclusion. |
| N=12 | Failure w/ Acceptable RFE |
| N=16 | Total Failure |

\*A Failure is due to Cond(A) < EMF; A Success is Cond(A) >= EMF, and has some correct digits.

\*\*RFE indicates the amount of correct digits.

\*\*\*Condition # indicates how large the error will get

**Conclusion:**   
When evaluating the "Bad Matrix" there seems to be a solution provided for the matrices N<=13 indicated by the RFE being within an acceptable range; however, the test of Cond(A)>=EMF fails. In the case of N=3 the "Bad Matrix" passes this test.