LAB REPORT 6

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Q1.

we get the following residual norms from the 3 methods given in the assignment.

$||r_1||_2$ = 8.186805781443002e-13

$||r_2||_2$ = 1.109739905876262e-09

$||r_3||_2$ = 8.182146459590739e-13

Both methods 1 and 3 give comparable error so either can be used.

Q2.

k	Compression Ratio	Error $= \frac{\sigma_{k+1}}{\sigma_1}$
50	0.40625	0.019189
60	0.4875	0.016704
70	0.56875	0.014684
80	0.65	0.013315
90	0.73125	0.011749
100	0.8125	0.010434
110	0.89375	0.009444
120	0.975	0.008323
130	1.05625	0.00732
140	1.1375	0.006384
150	1.21875	0.005482
160	1.3	0.004699
170	1.38125	0.00385
180	1.4625	0.003091
190	1.54375	0.002352

Q3.
We get the following output upon running the matlab code q3.m

Original Matrix
sigma(1,1) = 8.789335e+00
sigma(89,89) = 2.384233e-03
sigma(90,90) = 3.960644e-15
Rank of Original Matrix: 89

Perturbed Matrix
sigma(1,1) = 8.789335e+00
sigma(89,89) = 2.384233e-03
sigma(90,90) = 3.960653e-15
Rank of Perturbed Matrix: 89

Using QR decomposition
|| I - E||: 0.000000e+00
R(90,90) = 1.903869e-03

According to this output SVD gives the numerical rank = 89 both for normal and perturbed matrix case. For QR we get E = I. But QR produces R with $R_{90,90} \sim 2 \times 10^{-3}$, so the matlab gives the numerical rank as 90, which is infact wrong. This shows that QR-method failed to detect rank correctly