*Lab Assignment 2: Q3*

*Group Number: 14*

*Q3.*

For kappa=1e5 and n=100

|  |  |  |  |
| --- | --- | --- | --- |
| Method | Forward Error |  | Time |
| Cholesky's Method | 2.986478692173045e-12 | 5.644668650022756e-16 | 5.896952619105380e-04 |
| Cramer's Method | 2.981083603804854e-12 | 1.957725033336529e-12 | 1.835286543378058e-02 |

For kappa=1e7 and n=85

|  |  |  |  |
| --- | --- | --- | --- |
| Method | Forward Error |  | Time |
| Cholesky's Method | 1.197107549745914e-10 | 7.697688302053563e-16 | 1.520424729878515e-03 |
| Cramer's Method | 1.559743192646518e-10 | 6.813987270237562e-11 | 1.955138373112882e-02 |

*a)*

The Rule-of-thumb of ill-conditioning says that if cond(A) = 10t; and the entries of A and

b are correct to s decimal places, then one should expect an agreement of at least s - t significant digits in the corresponding entries of the exact solution and computed solution of Ax = b if it has been obtained from a backward stable algorithm.

Since the experiments are performed on randomly generated data and there is no error other than rounding error, s =16.

For case 1,

t=5, s-t=11

Forward Error for Cholesky Method<= 0.5e-11, so x and x1 agree to at least 11 significant digits.

Forward Error for Cramer’s Rule<= 0.5e-11, so x and x1 agree to at least 11 significant digits.

For case 2,

t=7, s-t=9

Forward Error for Cholesky Method<= 0.5e-9, so x and x1 agree to at least 9 significant digits.

Forward Error for Cramer’s Rule<= 0.5e-9, so x and x1 agree to at least 9 significant digits.

The Rule-of-thumb of ill-conditioning is satisfied in all the cases.

*b)*

The value of is quite small for both the methods and the Rule-of-thumb of ill-conditioning is also satisfied in all the cases. Hence, both the methods have good backward stability.

*c)*

Cramer’s Method is definitely more expensive because the time taken by it is much larger than the time taken by Cholesky’s Method in both the cases.

Cramer’s Method involves O(n4) flops, while Cholesky’s Method involves O(n3) flops.