Documentation

Question 1
Part a.
Out put:

info : 0
matrix solving is successful
The l-infinite error norm is: 4.63091141118166982E+084

The output have been stored in file: question1a1b2a.txt

Question 1
Part b.
output:

info : 0
matrix solving is successful
info : 0
matrix solving is successful
The solution to Ax=b is(in the form x1 x2):
3.9398815872109596 0.49017208181081900
The solution to Ay=c is(in the form y1 y2):
2.8999901054443131 2.0000144245925258

The output have been stored in file: question1a1b2a.txt

The result of x and y are varies a lot but the right hand side(b and c) only have a very small difference. The theoretical result of Ax=b is x_1=3.94, x_2=0.49 which is very close to the numerical solution of the result we got. The theoretical solution of Ay=c is x_1=2.9, x_2=2, which is also close to the numerical solution. The reason why x and y is so different is that the matrix A is ill conditioned, if a small change happened to the right hand side of the system, the solution will change a lot, which ,in this case, makes significance between x and y even though b and c only have very small difference.

Question 2
Part a.
info : 0
matrix solving is successful
info : 0
matrix solving is successful
The l2 error norm is: 1.04148151432413399E-015

The output have been stored in file: question1a1b2a.txt

Question 2

Part b.

The output of b1, b2, b3, b4 and b5 have been stored in txt file in the folder.

My strategy to write this routine is to use dgbtrf to factorize the banded matrix A, then the factorization result can be used to solve multiple system which share the same coefficient matrix A, using routine dgbtrs. So I introduce a for loop and let dgbtrs run multiple times, each time solving a linear system. As to the complexity, the dgbtrf have upper bound operation count: $O(n^3)$ which run one time, the dgbtrs have operation count: $O(q^2n)$, which run k times, each for one solving. So the total operation count is: $O(n^3)+k*O(q^2n)$