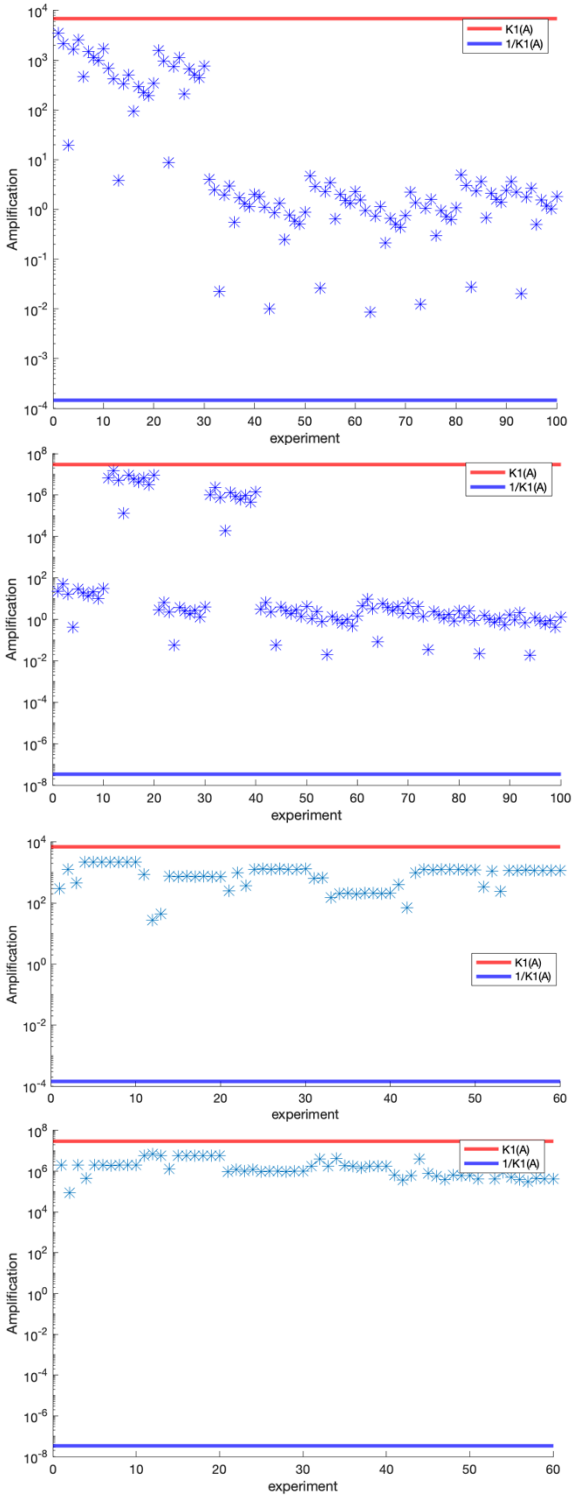

C1 (part 1)

For A = E, the average of amplification factor is 258.2577, and the median is 1.9622. The maximum is 3.4880e+03, which is close to the value of the exact k1(A) = 6.8296e+03. From the graph, we can find that first 30 values are closer to the k1(A), while most values are around 10^0. There are also seven values are around 10^-2. All values are quite far from the reciprocal 1/k1(A) = 1.4642e-04.

For A = H, the average of amplification factor is 7.4294e+05, and the median is 2.5611. The maximum is 1.4951e+07, which is close to the value of the exact k1(A) = 2.9070e+07. From the graph, we can find that 11th to 20th values and 31th to 40th values are closer to the k1(A), while most values are around 10. All values are quite far from the reciprocal 1/k1(A) = 3.4399e-08.

C1 (part 2)

For A = E, the average of amplification factor is 950.4024, and the median is 1.0359e+03. The maximum is 2.1835e+03, which is close to the value of the exact k1(A) = 6.8296e+03. From the graph, we can find that most values are around 10^3. There are also seven values are around 10^-2. All values are quite far from the reciprocal 1/k1(A) = 1.4642e-04.

For A = E, the average of amplification factor is 2.1144e+06, and the median is 1.2282e+06. The maximum is 9.4726e+06, which is close to the value of the exact k1(A) = 2.9070e+07. From the graph, we can find that most values are around 10^6, which are all quite close to the exact k1(A). All values are quite far from the reciprocal 1/k1(A) = 3.4399e-08.

C2

1. For A = E, $||A * AINV - I||_1 = 1.5632e-13$, and $||AC - A||_1 = 1.8803e-12$. It is shown that error is becoming larger as we use more inverse, for the value of using one inverse is smaller than that of using two inverses.
2. For A = H, $||A * AINV - I||_1 = 6.1118e-10$, and $||AC - A||_1 = 5.8995e-11$. Surprisingly, it is shown that error is getting smaller as we use more inverses. $||AINV - HI||_1 = 0.00047445$, which is the largest error.
3. For A = H8, $||A * AINV - I||_1 = 3.6515e-06$, and $||AC - A||_1 = 8.7919e-09$, which verifies the conclusion in question 1. However, $||AINV - HI||_1 = 730.3153$, which is much larger than the two errors above. K1(A) = 3.3873e+10, which is greater than 1.0. Hence, it is ill-conditioned.

C1 (part 1)

```
clear
clc
gendata

arr = [];
A = H;

for j = 1:10
    for k =1:10
        b = B(:,j);
        d = D(:,k);
        x = A\b;
        y = A\(b+epsilon*d);
        e = norm((y-x),1)/(epsilon*norm(x,1));
        arr = [arr, e];
    end
end

% get the average, median, and maximum
average = mean(arr);
median = median(arr);
maximum = max(arr);

scatter(linspace(1,100), arr, 100, 'b*');
set(gca, 'YScale', 'log');
xlabel('experiment');
ylabel('Amplification');

aline = yline(cond(A,1), 'color', 'r', 'LineWidth', 3);
bline = yline(rcond(A), 'color', 'b', 'LineWidth', 3);
legend([aline, bline], {'K1(A)','1/K1(A)'});
```

C1 (part 2)

```
clear
clc
gendata

arr = [];
A = H;
cond = cond(A,1);
for k = 1:6
    for j = 1:10
        c = BIGC(:,:,k);
        b = B(:,j);
        x = A\b;
        z = (A+epsilon*c)\b;
        e = norm(A,1)*norm(z-x,1)/(epsilon*norm(x,1));
        arr = [arr, e];
    end
end

% get the average, median, and maximum
average = mean(arr);
median = median(arr);
maximum = max(arr);

scatter(1:60, arr, 100, '*');
set(gca, 'YScale', 'log');
xlabel('experiment');
ylabel('Amplification');

aline = yline(cond, 'color', 'r', 'LineWidth', 3);
bline = yline(rcond(A), 'color', 'b', 'LineWidth', 3);
legend([aline, bline], {'K1(A)','1/K1(A)'});
```

C2

```
clear
clc
gendata
A = E;
AINV = inv(A);
AC = inv(AINV);
norma = norm(A*AINV-eye(6),1);
normb = norm(AC-A,1);
disp("The first norm is "+norma);
disp("The second norm is "+normb);

A = H;
AINV = inv(A);
AC = inv(AINV);
norma = norm(A*AINV-eye(6),1);
normb = norm(AC-A,1);
normc = norm(AINV-HI,1);
disp("The first norm is "+norma);
disp("The second norm is "+normb);
disp("The third norm is "+normc);

A = H8;
AINV = inv(A);
AC = inv(AINV);
norma = norm(A*AINV-eye(8),1);
normb = norm(AC-A,1);
normc = norm(AINV-HI8,1);
disp("The first norm is "+norma);
disp("The second norm is "+normb);
disp("The third norm is "+normc);
disp("k1(A) = "+cond(H8,1));
```