VLSI DSP HW1

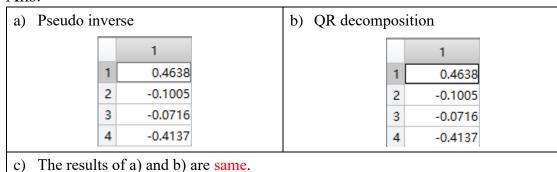
4108064101 杜冠廷

Q1

Matlab code:

```
clear all %clear workspace
        %clear command window
clc
%clf %clear figure
A = [15 -13 20 -8;
     -5 -15 -4 -4;
    -17 16 -2 9;
     10 -19 -14 -15;
     -7 8 -7 15;
     14 10 -8 -17;
     -5 -3 16 -2;
     13 -5 -10 -19];
b = [13; 10; -15; 9; 3; 18; 3; 20];
A plus = pinv(A);
x a = A plus * b;
[Q, R] = qr(A);
Ru = R([1 2 3 4], :);
y = Q' * b; % Q' = Q transpose
y u = y([1 2 3 4], :);
x_b = inv(R_u) * y_u; % x_b = R \setminus y = R \setminus (Q \setminus b)
```

Ans:



Matlab code:

```
clear all %clear workspace
    %clear command window
 M = [-2 \ 16 \ -6 \ -16 \ 3 \ 15 \ -6 \ -19;
      16 -17 10 -2 7 8 3 5;
      -6 10 15 -1 -15 -18 9 -8;
     -16 -2 -1 9 0 0 18;
       3 7 -15 0 14 19 -12 11;
      15 8 -18 0 19 10 -8 -17;
      -6 3 9 0 -12 -8 15 20;
     -19 5 -8 18 11 -17 20 201;
[V, D] = eig(M);
for i = 1:2000
   [Q_mat, R_mat] = QR_decomposition_func(M);
   M = R \text{ mat * } Q \text{ mat;}
end
function [Q, R] = QR decomposition func(M)
   s = 2; % start row, adding by 1 at each round
beginning
   R = M;
   Q = eye(8, 8); % eye(8, 8) = identity matrix 8*8
   % QR decomposition
   for j = 1:8
      for i = s:8
          rotation param = R(:, j);
          cos = rotation_param(j) / (rotation_param(j)^2
+ rotation param(i)^2)^0.5;
          sin = rotation param(i) / (rotation param(j)^2
+ rotation param(i)^2)^0.5;
          % creat unitary matrix q
         q = eye(8, 8);
         q(i, i) = cos;
         q(j, i) = sin;
         q(i, j) = -\sin;
```

```
q(j, j) = cos;
% cal & update R
R = q * R;
Q = q * Q;
end
s = s + 1;
end
Q = Q';
end
```

Ans:

Eig		e de	composit	ion using	a QR dec	ompositio	n based i	terative a	lgorithm	
	1		2	3	4	5	6	7	8	
	1 67	7.1862	9.2886e-15	-4.9782e-15	6.6778e-15	5.0235e-15	5.8378e-15	-7.1189e-15	-8.0300e-15	
	2 1.1924	e-313	46.8129	7.2839e-15	-8.1839e-15	-3.2820e-15	-1.2214e-15	2.4889e-15	2.9071e-16	
	3 -5.100	0e-3	-1.0442e-2	-36.9137	-2.5404e-15	3.9674e-15	-1.1017e-14	1.6999e-15	1.4317e-16	
	4 7.9000	e-323	-1.4300e-3	-1.9330e-3	-26.0043	9.7076e-15	1.2770e-15	-1.4281e-15	-3.4904e-15	
	5 -1.000	0e-3	7.4000e-323	-1.5000e-3	3.5000e-323	16.4684	5.3828e-15	-3.9886e-15	1.0991e-15	
	6 -1.630	0e-3	1.2000e-322	8.9000e-323	0	1.3300e-322	-11.0351	1.3230e-15	-1.9814e-15	
	7 4.9000	e-324	-8.4000e-3	2.0000e-323	-3.0000e-3	2.5000e-323	-2.0000e-3	6.0581	1.1911e-15	
	8 -7.900	0e-3	-5.4000e-3	0	2.0000e-323	4.0000e-323	-2.0000e-3	4.9000e-324	1.4275	
Usi	ing the	func	tion [V,D]	= eig(M)						
	1		2	3	4	5	6	7	8	
1	-36.91	37	0	0	0	C)	0	0	0
2		0	-26.0043	0	0	C)	0	0	0
3		0	0	-11.0351	0	C)	0	0	0
4		0	0	0	1.4275	C)	0	0	0
5		0	0	0	0	6.0581		0	0	0
6		0	0	0	0	C	16.468	14	0	0
		0	0	0	0	0		0 46.81	20	0
7		•	•							

Refence

Q2

Panju, Maysum. "Iterative methods for computing eigenvalues and eigenvectors." *arXiv* preprint arXiv:1105.1185 (2011).