

MatLab code for Q1, Q2c, Q4:

Question1a.m

```
function Question1a(~)
    warning('off');
    b = [1 1]';
    x = [1 -1]';
    fprintf('%s\t\t%s\t%s\n', 'gamma', 'error(1)', 'error(2)');
    for k = 1:10
        gam = 10 ^ (- 2*k);
        %A = [gam -1+gam; 2 1];

        L = [1 0; 2/gam 1];
        U = [gam -1+gam ;0 -1+2/gam];

        y = L\b;
        hat_x= U\y;

        err = hat_x - x;

        fprintf('%e\t%e\t%e\n', gam, err(1), err(2));
    end
end
```

Question1b.m

```
function Question1b(~)
    b = [1 1]';
    x = [1 -1]';
    P = [0 1; 1 0];
    tilde_b = P*b;
    fprintf('%s\t\t%s\t%s\n', 'gamma', 'error(1)', 'error(2)');
    for k = 1:10
        gam = 10 ^ (- 2*k);
        %A = [gam -1+gam; 2 1];
        L = [1 0; gam/2 1];
        U = [2 1; 0 -1+gam/2];

        y = L\tilde_b;
        hat_x= U\y;

        err = hat_x - x;

        fprintf('%e\t%e\t%e\n', gam, err(1), err(2));
    end
end
```

Question1c.m

```
function Question1c(~)
    b = [1 1]';
    x = [1 -1]';
    fprintf('%s\t\t%s\t%s\n', 'gamma', 'error(1)', 'error(2)');
    for k = 1:10
        gam = 10 ^ (- 2*k);
        A = [gam -1+gam; 2 1];
        L = [1 0; 2/gam 1];
        U = [gam -1+gam ;0 -1+2/gam];

        y = L\b;
        hat_x= U\y;
```

```

        r = b - A*hat_x;

        z = L\r;
        e = U\z;
        tilde_x = hat_x + e;

        err = tilde_x - x;

        fprintf('%e\t%e\t%e\n', gam, err(1), err(2));
    end
end

```

Question2c.m

```

function Question2c(~)
    n = 60;
    A = ones(n,n);
    A = A - triu(A);
    A = eye(n) - A;
    A = A + [ones(n-1,1); 0] * [zeros(1,n-1), 1];

    Q = diag(ones(n-1,1),1);
    Q(n,1) = 1;

    [L1, U1, P1] = lu(A);

    [L2, U2] = lu(A*Q);

    fprintf('%s %d.\n', 'The element with largest absolute value in U2 is',
max(max(abs(U2))));

    x = ones(n,1);
    b = A*x;

    y = L1\b;
    x1 = U1\y;

    fprintf('%s %d\n', 'norm(x-x1, inf) =', norm(x-x1, inf));
    y = L2\b;
    z = U2\y;
    x2 = Q * z;
    fprintf('%s %d\n', 'norm(x-x2, inf) =', norm(x-x2, inf));

end

```

Question4.m

```

function Question4(~)
    p = [3 5 9 4 10 8 7 9 10];
    x = [1:10]';

    y1 = perm_a(p,x)
    q = perm_b(p)
    y2 = perm_c(q,x)
end

```

perm\_a.m

```

function y = perm_a(p, x)

```

```

    n = length(x);
    y = x;
    for i = 1:n-1
        y([i p(i)]) = y([p(i) i]);
    end
end

```

```

perm_b.m
function q = perm_b(p)
    n = length(p) + 1;
    q = 1:n;
    for i = 1:n-1
        q([i p(i)]) = q([p(i) i]);
    end
end

```

```

perm_c.m
function y = perm_c(q,x)
    n = length(q);
    y = zeros(n,1);
    for i = 1:n
        y(i) = x(q(i));
    end
end

```