Computational Maths: Assignment 2

Rvail Naveed: 17321983

March 19, 2020

1 Question 4.23

My answer: **(ii)** L = $\begin{bmatrix} 1 & 0 & 0 & 0 \\ -2 & 1 & 0 & 0 \\ 0.5 & 1.5 & 1 & 0 \\ -2 & 3 & -0.5 & 1 \end{bmatrix}$ U = $\begin{bmatrix} 4 & -1 & 3 & 2 \\ 0 & -2 & 3 & 0.5 \\ 0 & 0 & 4 & 2 \\ 0 & 0 & 0 & 3 \end{bmatrix}$

1.1 Matlab code

```
function [L, U] = LUdecompgauss(A)
% Get m * n dimensions
[m, n] = size(A);

if (m~=n)
    disp("Matrix is not square!");
end
% Set up for LU decomposition
L = zeros(m);
for i = 1:m
    L(i, i) = 1;
end
U = A;

d = 1;
for i = 1:m
    for j = 1:n
        if i == j
            tmp = d
            while tmp < m
                tmp = tmp + 1;
                const = U(tmp, j) / U(i, j);
                for x = 1:m
                    U(tmp, x) = U(tmp, x) - (const * U(i, x));
                end
                L(tmp, j) = const
            end
        end
    end
    d = d + 1
end

disp(L);
disp(U);
```

2 Question 5.17

Best: **Team 2** Worst: **Team1**

2.1 Matlab code

```
A = [
      0,0,0,1,0,0;
      1,0,1,0,1,1;
      0,1,0,0,1,0;
      1,1,0,0,1,0;
      1,1,1,0,0,1;
      1,0,0,0,1,0
];

[X, Y] = eig(A);
disp(X);
disp(Y);
```

3 Question 6.3

Linear form of $p = be^{mx}$ is:

$$ln(p) = mx + ln(b) \tag{1}$$

$$S_x = \sum_{i=1}^{7} = 1900 + 1950 + 1970 + 1980 + 1990 + 2000 + 2010 = \mathbf{13{,}800} \tag{2}$$

$$S_y = \sum_{i=1}^{7} = 400 + 557 + 825 + 981 + 1135 + 1266 + 1370 = \mathbf{6{,}534} \tag{3}$$

$$S_{xx} = \sum_{i=1}^{7} = 1900^2 + 1950^2 + 1970^2 + 1980^2 + 1990^2 + 2000^2 + 2010^2 = \mathbf{27{,}214{,}000} \tag{4}$$

$$\begin{aligned} S_{xy} = \sum_{i=1}^{7} &= 1900 * 400 + 1950 * 557 + 1970 * 825 + 1980 * 981 \\ &+ 1990 * 1135 + 2000 * 1266 + 2010 * 1370 \\ &= \mathbf{12{,}958{,}130} \end{aligned} \tag{5}$$

$$a_0 = \frac{S_{xx}S_y - S_{xy}S_x}{nS_{xx} - S_x^2} = \frac{(27,214,000 * 6534) - (12,958,130 - 13,800)}{(7 * 27,214,000) - 13,800^2} \tag{6}$$

$$a_0 = -17343.41379 \tag{7}$$

$$a_1 = \frac{S_{xy}S_y - S_{xy}S_x}{nS_{xx} - S_x^2} = \frac{(7 * 12,958,130) - (13,800 * 6534)}{(7 * 27,214,000) - 13,800^2} \tag{8}$$

$$a_1 = 3.137\,343 \times 10^{-3} \tag{9}$$