CS3081 Assignment 3

Name: _Patrick Dillon Ryan_____

Student Number: _17340382_____

Question 1 (Problem 4.26)

(i) (a) = 4, (b)= 7
(ii) (a)=2.2, (b)=7
(iii) (a)=4, (b)=2.2
(iv) (a)=7, (b)=4

Your Answer ((i)-(iv)): (i)

```
threeXthree = [ -2, 1, 0; 1, -2, 1; 0, 1, -1.5];
fourXfour = [4, -1, 0, 1, 0;-1, 4, -1, 0, 1;0, -1, 4, -1, 0;1, 0, -1, 4, -
1;0, 1, 0, -1, 4];

threeXthree = InfinityNorm(threeXthree);
fourXfour = InfinityNorm(fourXfour);

disp(threeXthree);
disp(fourXfour);

function [max] = InfinityNorm(A)
    [m, n] = size(A);
    max = 0;
    for i = 1:m
        temp = 0;
        for j = 1:n
            temp = temp + abs(A(i,j));
        end
        if temp > max
            max = temp;
        end
    end
end
```

Question 2 (Problem 6.13)

(i) 420W
(ii) 420KW
(iii) 530W
(iv) 580KW

Your Answer ((i)-(iv)): (iii)

General formula:
f(x) = sumof(n)(i=1) yi * Li(x).. where Li(x) = productof(n)(j=1)(j!=i) (x-xj)/(xi-xj)

fourth:
f(x) =
((x-x2)*(x-x3)*(x-x4)*(x-x5))/((x1-x2)*(x1-x3)*(x1-x4)*(x1-x5)) * y1
+ ((x-x1)*(x-x3)*(x-x4)*(x-x5))/((x2-x1)*(x2-x3)*(x2-x4)*(x2-x5)) * y2
+ ((x-x1)*(x-x2)*(x-x4)*(x-x5))/((x3-x1)*(x3-x2)*(x3-x4)*(x3-x5)) * y3
+ ((x-x1)*(x-x2)*(x-x3)*(x-x5))/((x4-x1)*(x4-x2)*(x4-x3)*(x4-x5)) * y4
+ ((x-x1)*(x-x2)*(x-x3)*(x-x4))/((x5-x1)*(x5-x2)*(x5-x3)*(x5-x4)) * y5

X1 =14, x2=22, x3=30, x4=38, x5=46 (from the question)
y1 = 320, y2 = 490, y3 = 540, y4 = 500, y5 = 480 (from the question)

f(26) = ((26-22)*(26-30)*(26-38)*(26-46))/((14-22)*(14-30)*(14-38)*(14-46)) * 320
+ ((26-14)*(26-30)*(26-38)*(26-46))/((22-14)*(22-30)*(22-38)*(22-46)) * 490
+ ((26-14)*(26-22)*(26-38)*(26-46))/((30-14)*(30-22)*(30-38)*(30-46)) * 540
+ ((26-14)*(26-22)*(26-30)*(26-46))/((38-14)*(38-22)*(38-30)*(38-46)) * 500
+ ((26-14)*(26-22)*(26-30)*(26-38))/((46-14)*(46-22)*(46-30)*(46-38)) * 480

f(26) = (-12.5) + (229.6875) + (379.6875) + (-78.125) + (11.25)
f(26) = 530KW

Question 3 (Problem 8.7)

The truncation error is:

(i) O(h)
(ii) O(h^2)
(iii) O(h^3)
(iv) O(h^4)

Your Answer ((i)-(iv)): (ii)

$$f(x_{i+1}) =$$

$$f(x_i) + f'(x_i)h + \frac{f''(x_i)}{2!}h^2 + \frac{f'''(x_i)}{3!}h^3 + \frac{f''''(\xi_1)}{4!}h^4$$

$$f(x_{i-1}) =$$

$$f(x_i) - f'(x_i)(2h) + \frac{f''(x_i)}{2!}(2h)^2 - \frac{f'''(x_i)}{3!}(2h)^3 + \frac{f''''(\xi_2)}{4!}(2h)^4$$

$$2f(x_{i+1}) + f(x_{i-1}) =$$

$$3f(x_i) + 6\frac{f''(x_i)}{2!}h^2 - 8\frac{f'''(x_i)}{3!}h^3 + \frac{f''''(\xi_1)}{4!}h^4 + 16\frac{f''''(\xi_2)}{4!}h^4$$

$$f''(x_i) =$$

$$2\frac{f(x_{i-1}) - 3f(x_i) + 2f(x_{i+1})}{6h^2} + O(h^2)$$

$$Answer = O(h^2)$$

Question 4 (Problem 8.9)

(i) f'_male(2006)=4965;
f'_female(2006)=10681;
Predicted_Males(2008)=673601;
Error_Males=0.62%;
Predicted_Females(2008)=277990;
Error_Females=0.58%

(ii) f'_male(2006)=4940;
f'_female(2006)=10681;
Predicted_Males(2008)=673601;
Error_Males=0.62%;
Predicted_Females(2008)=277987;
Error_Females=0.57%

(iii) f'_male(2006)=4940;
f'_female(2006)=10681;
Predicted_Males(2008)=673601;
Error_Males=0.68%;
Predicted_Females(2008)=277987;
Error_Females=0.42%

(iv) f'_male(2006)=4965;
f'_female(2006)=10670;
Predicted_Males(2008)=673601;
Error_Males=0.68%;
Predicted_Females(2008)=277987;
Error_Females=0.52%

Your Answer ((i)-(iv)): (ii)

$$f'(x_{i+2}) = \frac{x_{i+2} - x_{i+1}}{(x_i - x_{i+1})(x_i - x_{i+2})} y_i +$$
$$\frac{x_{i+2} - x_i}{(x_{i+1} - x_i)(x_{i+1} - x_{i+2})} y_{i+1} +$$
$$\frac{2x_{i+2} - x_i - x_{i+1}}{(x_{i+2} - x_i)(x_{i+2} - x_{i+1})} y_{i+2}$$
$$x_i = 2002$$
$$x_{i+1} = 2003$$
$$x_{i+2} = 2006$$
$$f'(2006) = \frac{3}{4} y_i - \frac{4}{3} y_{i+1} + \frac{7}{12} y_{i+2}$$
$$male(2006) = 4940$$
$$female(2006) = 10681$$

We can then substitute our answers back in from a. This allows us to solve for y1 + 2.
This gives us the values
673601 male doctors
277987 female doctors
Error is the difference between the predicated and the actual values. – Values gotten from previous part and from the question
|673601 – 677807| / 677807 = .62%

|277987 – 276417| / 276417 = .57%

f'_male(2006)=4940;
f'_female(2006)=10681;
Predicted_Males(2008)=673601;
Error_Males=0.62%;
Predicted_Females(2008)=277987;
Error_Females=0.57%