CS3081 Assignment 3

Name: Efeosa Louis Eguavoen

Student Number: 17324649

Question 1 (Problem 4.26)

1. (a) = 4, (b)= 7
2. (a)=2.2, (b)=7
3. (a)=4, (b)=2.2
4. (a)=7, (b)=4

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

Question 2 (Problem 6.13)

1. 420W
2. 420KW
3. 530W
4. 580KW

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

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| Fourth-order polynomial: |
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| f(x) = ((x-x2)\*(x-x3)\*(x-x4)\*(x-x5))/((x1-x2)\*(x1-x3)\*(x1-x4)\*(x1-x5)) \* y1 |
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| --- |
| + ((x-x1)\*(x-x3)\*(x-x4)\*(x-x5))/((x2-x1)\*(x2-x3)\*(x2-x4)\*(x2-x5)) \* y2 |
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| + ((x-x1)\*(x-x2)\*(x-x4)\*(x-x5))/((x3-x1)\*(x3-x2)\*(x3-x4)\*(x3-x5)) \* y3 |
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| + ((x-x1)\*(x-x2)\*(x-x3)\*(x-x5))/((x4-x1)\*(x4-x2)\*(x4-x3)\*(x4-x5)) \* y4 |
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| + ((x-x1)\*(x-x2)\*(x-x3)\*(x-x4))/((x5-x1)\*(x5-x2)\*(x5-x3)\*(x5-x4)) \* y5 |
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| f(26) = ((26-22)\*(26-30)\*(26-38)\*(26-46))/((14-22)\*(14-30)\*(14-38)\*(14-46)) \* 320 |
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| + ((26-14)\*(26-30)\*(26-38)\*(26-46))/((22-14)\*(22-30)\*(22-38)\*(22-46)) \* 490 |
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| + ((26-14)\*(26-22)\*(26-38)\*(26-46))/((30-14)\*(30-22)\*(30-38)\*(30-46)) \* 540 |
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| --- |
| + ((26-14)\*(26-22)\*(26-30)\*(26-46))/((38-14)\*(38-22)\*(38-30)\*(38-46)) \* 500 |
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| + ((26-14)\*(26-22)\*(26-30)\*(26-38))/((46-14)\*(46-22)\*(46-30)\*(46-38)) \* 480 |
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| f(26) = (-12.5) |
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| + (229.6875) |
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| + (379.6875) |
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| + (-78.125) |
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| + (11.25) |
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f(26) = 530W

Question 3 (Problem 8.7)

The truncation error is:

1. O(h)
2. O(h^2)
3. O(h^3)
4. O(h^4)

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

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| --- |
| f(xi+1) = f(xi) + f'(xi)((xi+1)-xi) + (f''(xi)/2!)((xi+1)-xi)^2 |
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| Sub h for (xi+1)-xi... |
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| --- |
| f(xi+1) = f(xi) + f'(xi)(h) + (f''(xi)/2!)(h)^2 |
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| Taylor series expansion for point xi-1: |
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| f(xi-1) = f(xi) - f'(xi)(xi-(xi-1)) + (f''(xi)/2!)(xi-(xi-1))^2 |
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| Sub 2h for xi-(xi-1)... |
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| --- |
| f(xi-1) = f(xi) - f'(xi)(2h) + (f''(xi)/2!)(2h)^2 |
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| Add both equations... |
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| f(xi+1) + f(xi-1) = f(xi) + f'(xi)(h) + (f''(xi)/2!)(h)^2 + |
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| --- |
| f(xi) - f'(xi)(2h) + (f''(xi)/2!)(2h)^2 |
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| --- |
| f(xi+1) + f(xi-1) = 2f(xi) - f'(xi)(h) + (5)(f''(xi)/2!)(h)^2 |
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| Solve for f''(xi) and introduce truncation error... |
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| --- |
| f(xi+1) + f(xi-1) = 2f(xi) - f'(xi)(h) + (5)(f''(xi)/2!)(h)^2 |
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| (5)(f''(xi)/2!)(h)^2 = f(xi+1) + f(xi-1) - 2f(xi) + f'(xi)(h) |
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| (5)f''(xi)(h)^2 = 2(f(xi+1) + f(xi-1) - 2f(xi) + f'(xi)(h)) |
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| f''(xi)(h)^2 = 2(f(xi+1) + f(xi-1) - 2f(xi) + f'(xi)(h)) / 5 |
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f''(xi) = (2(f(xi+1) + f(xi-1) - 2f(xi) + f'(xi)(h)) / 5) + O(h^2)

Question 4 (Problem 8.9)

1. f’\_male(2006)=4965;

f’\_female(2006)=10681;

Predicted\_Males(2008)=673601;

Error\_Males=0.62%;

Predicted\_Females(2008)=277990;

Error\_Females=0.58%

1. f’\_male(2006)=4940;

f’\_female(2006)=10681;

Predicted\_Males(2008)=673601;

Error\_Males=0.62%;

Predicted\_Females(2008)=277987;

Error\_Females=0.57%

1. f’\_male(2006)=4940;

f’\_female(2006)=10681;

Predicted\_Males(2008)=673601;

Error\_Males=0.68%;

Predicted\_Females(2008)=277987;

Error\_Females=0.42%

1. 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)

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| --- |
| f'(xi+2) = ((xi+2)-(xi+1) / (xi-xi+1)(xi-xi+2))\*yi + |
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| --- |
| ((xi+2)-(xi) / (xi+1-xi)(xi+1-xi+2))\*yi+1 + |
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| ((2xi+2)-(xi)-(xi+1) / (xi+2-xi)(xi+2-xi+1))\*yi+2 |
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| f'\_male(2006) = ((2006-2003) / ((2002-2003)\*(2002-2006)))\*(638,182) + |
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| ((2006-2002) / ((2003-2002)\*(2003-2006)))\*(646,493) + |
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| --- | --- |
| (((2\*2006)-2002-2003) / ((2006-2002)\*(2006-2003)))\*(665,647) | |
| f'\_male(2006) = 4939.916666   |  | | --- | | f'\_female(2006) = ((2006-2003) / ((2002-2003)\*(2002-2006)))\*(215,005) + | |  |  |  | | --- | | ((2006-2002) / ((2003-2002)\*(2003-2006)))\*(225,042) + | |  |  |  |  | | --- | --- | | (((2\*2006)-2002-2003) / ((2006-2002)\*(2006-2003)))\*(256,257) | | |  | | |  | |  |   f'\_female(2006) = 10,681 | |
|  | |
| f'(xi+1) = ((xi+1)-(xi+2) / (xi-xi+1)(xi-xi+2))\*yi + |
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| --- |
| ((2xi+1)-(xi)-(xi+2) / (xi+1-xi)(xi+1-xi+2))\*yi+1 + |
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| ((xi+1)-(xi) / (xi+2-xi)(xi+2-xi+1))\*yi+2 |
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| Male: |
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| 4939.916666 = ((2006-2008) / ((2003-2006)\*(2003-2008)))\*(646,493) + |
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| --- |
| (((2\*2006)-2003-2008) / ((2006-2003)\*(2006-2008)))\*(665,647) + |
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| ((2006-2003) / ((2008-2003)\*(2008-2006)))\*(X) |
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| 4939.916666 = (-86199.0666667) + (-110941.166667) + (0.3X) |
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| X = ((4949.916666) + (86199.0666667) + (110941.166667)) / 0.3 |
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| X = 673600.499979 |
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| ERROR: |1 - (677,807 / 673600.499979)| = 0.006244 = 0.6244% |
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| Female: |
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| 10,681 = ((2006-2008) / ((2003-2006)\*(2003-2008)))\*(225,042) + |
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| --- |
| (((2\*2006)-2003-2008) / ((2006-2003)\*(2006-2008)))\*(256,257) + |
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| --- |
| ((2006-2003) / ((2008-2003)\*(2008-2006)))\*(X) |
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| 10,681 = (-30005.6) + (-42709.5) + (0.3X) |
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| X = ((10,681) + (30005.6) + (42709.5)) / 0.3 |
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| X = 277,987 |
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ERROR: |1 - (276,419 / 277,987)| = 0.00564 = 0.564%