

Unit 9 - Week 7: Interpolation

Course outline

How to access the portal?

Course Pre-requisites and Introduction

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Week 2 - Linear Systems and Equations

Week 3 - Linear Equations - 2

Week 4: Nonlinear Equations in Single Variable

Week 5: Nonlinear equations in Single and Multiple Variables

Week 6: Regression (Curve Fitting)

Week 7: Interpolation

Interpolation: Introduction & A Naïve Extension

Bonus: MS-Excel for Naïve Interpolation

Lagrange Interpolating Polynomials

Newton's Forward Difference Polynomial

Newton's Divided Differences: Derivation

Interpolation Examples

Bonus: MS-Excel for Newton's Polynomial

Summary: Regression and Interpolation

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Numerical Methods for Engineers : Week 7 Feedback form

Solutions to Assignment-7

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Week 9: Numerical Integration

Week 10: Ordinary Differential Equations – Initial Value Problems (ODE-IVP)

Week 11: ODE-IVP (Part-2)

Week 12: ODE - Boundary Value Problems

Video Download, Live Session and Other Information

Info about our Final Exam

Assignment 7

The due date for submitting this assignment has passed.
As per our records you have not submitted this assignment.

Due on 2019-09-18, 23:59 IST.

Problem 1: Newton's Divided Difference Formula

Consider the following data:

$x = 0.2 \quad 0.3 \quad 0.4 \quad 0.5$
 $y = 0.83 \quad 1.15 \quad 1.42 \quad 1.7$

In this problem, use the Newton's Divided Difference method to compute the value $f(0.325)$. In order to do this, please set up the divided difference table and answer the following questions:

- 1) Compute and report the value of $y[2, 1]$. Recall that

$$y[2, 1] = \frac{y_2 - y_1}{x_2 - x_1}$$

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Range) 3.19,3.21

0.15 points

- 2) In the similar manner, compute and report the value of $y[3, 2]$

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Range) 2.69,2.71

0.15 points

- 3) In the similar manner, compute and report the value of $y[4, 3]$

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Range) 2.79,2.81

0.15 points

- 4) Compute and report the value of $y[3, 2, 1]$

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Range) -2.51,-2.49

0.15 points

- 5) Compute and report the value of $y[4, 3, 2, 1]$

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Range) 9.9,10.1

0.15 points

- 6) Hence, compute the interpolated value, $f(0.325)$

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Range) 1.20,1.24

0.25 points

Problem 2: Lagrange Interpolation

For the data given in the previous problem, implement Lagrange interpolation to compute $f(0.325)$. Recall that Lagrange Interpolation formula is:

$$y = \sum_{i=1}^4 y_i L_i, \quad \text{where } L_i = \prod_{j \neq i} \frac{(x - x_j)}{(x_i - x_j)}$$

(Please refer to the lectures for more details on how to use the Lagrange formula)

- 7) Please report the value of L_1

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Range) -0.06,-0.05

0.2 points

- 8) Please report the value of L_2

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Range) 0.8,0.85

0.2 points

- 9) Please report the value of L_3

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Range) 0.26,0.28

0.2 points

- 10) Please report the value of L_4

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Range) -0.045,-0.035

0.2 points

- 11) Please report the value of $f(0.325)$

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Range) 1.20,1.24

0.2 points

Problem 3: Effect of Order of Polynomial in Interpolation

Consider the data in Problem 2. The value $f(0.325)$ can be computed using first-order polynomial using simply the data at $x = 0.3$ and $x = 0.4$. In other words, use only the two data points: (0.3, 1.15) and (0.4, 1.42) to compute the interpolated value

- 12) Please report the calculated value using only these two data points

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Range) 1.20,1.24

0.5 points

- 13) Please report the difference between the value calculated in Problem-2 above and the value calculated here (i.e., in Problem-3)

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Range) 0.002,0.0025
(Type: Range) -0.0025,-0.002

0.5 points

Problem 4: Polynomial Fitting

Fit a third-order polynomial of the type: $y = a_0 + a_1x + a_2x^2 + a_3x^3$ to the data in Problem-1. Please answer the following questions:

- 14) Please report the value of a_0

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Range) -0.21,-0.19

0.25 points

- 15) Please report the value of a_1

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Range) 7,7.1

0.25 points

- 16) Please report the value of a_2

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Range) -11.7,-11.3

0.25 points

- 17) Please report the value of a_3

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Range) 9.9,10.1

0.25 points

We have not asked you to calculate the value of $f(0.325)$. However, you could check that you will get the same result as in Problem-1

Problem 5: Application: Thermoelectric

Consider the following data, which is generated for a thermoelectric device at various temperatures:

$T = 25, 50, 75, 100$

%Increase = 2.5, 3.6, 5, 6.3

Please use an appropriate interpolation technique to obtain the value at temperature of 60. Use all the data-points given above.

- 18) Please report the result accurate to three digits after the decimal

No, the answer is incorrect.
Score: 0

Accepted Answers:
(Type: Range) 4.14,4.15

1 point