Midterm topics

¬Computer arithmetic ¬Root finding ¬Interpolation ¬Integration

Not covered topics -Splines -Adaptive Simpson -Quadrature

**Midterm exam**

**• 5 major problems with subproblems**

**• Some conceptual questions (T/F and multiple choice)**

**• No pseudo code**

**Computer Arithmetic**

Concepts

• Absolute error v.s. Relative error

• Taylor series and Taylor Theorem

• Deflating Text

Description automatically generated (synthetic division)

• Floating point representation • Machine number • Loss of significance

Float-point rep

A picture containing diagram

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Loss of significance

• It occurs in the subtraction of two nearly equal numbers, which produces a result much smaller than either one.

• Theorem

Text

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• How to avoid?

– Double precision – Taylor series – Rationalization – Trigonometric identities – Logarithmic properties – Range reduction

**Root finding** Bisection Newton’s Secant

Algorithms

Chart

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Convergence analysis

<https://www.youtube.com/watch?v=3vrbGFJ7OB0&t=19s>

<https://www.youtube.com/watch?v=dHQVQG8NqR8>

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Convergence rate: Problem 13.a -13.b (3.3)

<https://vi.wikipedia.org/wiki/T%E1%BB%91c_%C4%91%E1%BB%99_h%E1%BB%99i_t%E1%BB%A5>

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**Interpolation** Vandermonde matrix, Lagrange form ,Divided difference

Vandermonde Matrix 4.1.47

<https://www.youtube.com/watch?v=Cov_kLatdlc>

Calendar

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It can be used to prove existence and uniqueness!

Lagrange Form

The Lagrange form of the interpolation polynomial is given by

Text

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Example:

Text

Description automatically generated

Divided Difference

• Concise notation: Text

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• Nested form:

Table

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Example

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Interpolation errors

Graphical user interface, text, application, email

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Runge's phenomenon

<https://www.youtube.com/watch?v=Vfkvb_CoQBE>

Chart

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**Integration** Trapezoid Simpson’s

Formula

Text

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Error analysis

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