Section 1

MANE 3351

Subsection 1

Lecture 17, October 18

Classroom Management

Agenda

- Lecture
- Homework 4 Assignment

Subsection 2

Resources

Handouts

- Lecture 17 Slides
- Lecture 17 Marked Slides

Calendar

Lecture	Date	Content
1	August 23	Welcome to Class, Syllabus
2	August 25	Error Analysis
3	August 30	Introduction to Jupyter Notebook
4	September 1	Markdown
5	September 6	Labor Day Holiday
6	September 8	Taylor Polynomials, Homework 1
7	September 13	Roots of Equations, Bisection Method
8	September 15	Bisection Error Analysis
9	September 20	False Position Algorithm
10	September 22	Newton Raphson Algorithm
11	September 27	Secant Method
12	September 29	Numerical Integration
13	October 4	Simpson's Rule
14	October 6	Romberg Integration

Assignments

- Homework 4 (assigned 10/18/2021, due 10/26/2021)

Looking Ahead

Lecture	Date	Content
17	October 18	Gaussian Quadrature (end of material for Test 1)
18	October 20	Vectors
19	October 25	Vector Operations

- Tentative, schedule! I will update soon

Lecture 17 Content

Today's topic is Gaussian Quadrature

- $\int_{-1}^{1} f(x)dx \approx \sum_{i=1}^{n} w_i f(x_i) + R_n$
- $x_i $ is the abscissa is the i-th zero of $P_n(x)$ (Legendre polynomial)
- w_i is the weight associate with x_i
- $R_n = \frac{2^{2n+1}(n!)^4}{(2n+1)[(2n)!]^3} f^{(2n)}(\xi)$
- Abscissas and weights are commonly tabled[a]

[a] Abramowitz, M., and Stegun, I. (1972), *Handbook of Mathematical Functions with Formulas, Graphs, and Mathematical Tables*

Jupyter Notebook, part 1

Gauss' Formula, Arbitrary Interval

- $\int_a^b f(y)dy \approx \frac{b-a}{2} \sum_{i=1}^{n} w_i f(y_i) + R_n$
- $y_i = \left(\frac{b-a}{2}\right) x_i + \left(\frac{b+a}{2}\right)$
- $R_n = \frac{(b-a)^{2n+1}(n!)^4}{(2n+1)[(2n)!]^3} f^{(2n)}(\xi)$
- Note that x_i and w_i are the points and weights of Gaussian quadrature

Jupyter Notebook, part 2