# COSC/MATH 303
# Midterm Exam Review

# Technicals

DATE: Feb 13th
TIME: 3:30pm
LOCATION: ART 110

- Arrive early
- Bring ID
- Calculators are permitted.
- Phones, laptops, etc. are not permitted.
- Backpacks and Phones should be left at the front of the class

# Topic 1: Error Analysis

- New notation ($f \in \mathcal{C}^k[a, b]$)
- Taylor's Theorem
- * Big Oh notation
- * Taylor's Theorem 2.0
- Absolute and Relative Errors
- * Significant Digits ($RE < 5 \cdot 10^{-d}$)
- * Rates of Convergence (Linear, Quadratic)

# Topic 2: Linear Systems

- Review Linear Algebra
- * Triangular Systems, Backward Substitution
- * Complexity of Backward Substitution ($O(n^2)$)
- * Gaussian Elimination
- Complexity of Gaussian Elimination ($O(n^3)$)
- * $LU$ Decomposition and its value
- $PLU$ Decompositions when pivoting is required
- * Jacobi Iterative Method
- * Gauss-Seidel Iterative Method

# Topic 3: Non-Linear Equations

- * Bisection Method
- * Rate of Convergence of Bisection
- * False Position Method
- * Fixed Point Methods
- Existence and Uniqueness of Fixed Points
- * Fixed Point Point Theorem
- * Newton-Raphson Method
- * Newton-Raphson Quadratically Converges (when $f'(\bar{x}) \neq 0$)
- Hybrid Methods

# Advice

- Some questions (about 1/3) are taken from assignments (with functions changed)
- Some questions (about 1/3) are taken from lecture examples
- Some questions (about 1/6) check general understanding of when specific algorithms are used
- One question is a 'proof' question
  - Taylor 2.0
  - Complexity of Back Substitution
  - Convergence of Newton-Raphson via Fixed Point Point Theorem

# GOOD LUCK