CS122 Engineering Computation Lab
Lab 1

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CS122
Computation Lab II

• CS122 is the 2\textsuperscript{nd} in a sequence of 3 Computation Lab courses (along with CS121 and CS123)
  – The sequence uses MapleSoft’s Maple software to demonstrate how a wide variety of both routine and complex engineering and math problems can be efficiently solved and analyzed using a typical technical computation tool.

• Where appropriate, the Computation Lab sequence is integrated with the engr101, 102 and 103 offerings
Why do engineers need to learn technical computing?

• Computing with math is pervasive in the field
• Get answers to routine problems
  – Use programming from experts (more accurate, faster)
  – Routine problems may still require millions of calculation steps – calculators can’t handle them.
• Working on the leading edge
  – “mash up” features to create new value
  – design and develop their own software, because it hasn’t been written yet.
• Correct derivation, calculation, and graphing with technical word processing
  – Results worth having are worth communicating to others in a permanent record.
What do engineers get out of a course on computing?

• Fuller understanding of the potential and limits of current software technology

• How to work with a computer
  – Knowing how and when to trust a computer’s answer.
  – Efficient ways of getting help and diagnosing what’s wrong.
  – Good, bad, and better ways of writing and using software.
  – Software development: Incremental development, testing, experimentation.
What we learned in CS121

• Last term we studied a variety of basic Maple software features and concepts:

  – Arithmetic operations, expression evaluation and equation solving, plotting and animation, (least squares) data curve fitting, Maple function usage along with development of user defined functions and script writing

  to enable us to solve and analyze a variety of engineering and math based problems
What we Learned in CS121

• Problems evaluated in cs121 labs:
  – Analysis of free falling objects (Lab 2)
  – Automobile engine speed analysis from door panel vibration correlation (Lab 2)
  – Analysis of capacitor charge profile (Lab 3)
  – Ideal Gas Law analysis from curve fitting experimental data (temperature versus pressure) (Lab 3)
  – Trajectory analysis of a projectile fired from a cannon (Lab 4)
Welcome Back to CS122

• This term, we will continue to learn and utilize Maple software features to increase our abilities to develop more sophisticated programs to solve more complex problems:
  – Script development and troubleshooting using Code Edit Regions (Lab 1)
  – Additional plotting / animation features to visually represent the results of our analyses (Lab 2)
  – Programming constructs to enhance our ability to develop complex scripts to conduct a wider variety of analyses (Lab 3 and 4):
    • Iterative and conditional loops
    • Maple tables for storage of multiple related values
    • Decision statements (if and if-else constructs)
Welcome Back to CS122

• Using these new concepts, we will construct programs to analyze the following problems:
  
  – Lab 1 – extending the cannon ball trajectory analysis to account for wind resistance
  – Lab 2 – developing timed staged simulations
    • Animation of a particle moving within a box
    • Chemical reaction simulation
  – Lab 3 – extending the trajectory analysis to compare and contrast a number of parameter (firing angle and muzzle velocity) variations
  – Lab 4 – Time staged simulation of a bouncing ball impacted by the forces of friction and gravity
What’s New for CS122

• Special extra consultation session
  – During quiz weeks
  – Details to be announced shortly

• Lab completion session
  – To be offered at start of quiz week
  – Purpose is to enable students to complete labs not finished during scheduled lab
    • Details to be announced shortly
  – Not an alternative for Makeup Lab session (odd Mondays at 6 PM)
    • For missed labs only
    • Requires valid excuse and permission of instructor to attend

• New (hands on) format for lecture portion of lab – Part 0
CS122 – Basic Schedule

• 4 labs in even numbered weeks (2, 4, 6 and 8)
• 4 quizzes odd numbered weeks (3, 5, 7 and 9)
• 4 pre-lab quizlets in weeks (1, 3, 5 and 7)
• Proficiency Exam in week 10
• Flow of course similar to CS121
• Be sure to review contents of course web site for details
Administrative Notes

- Please contact your individual instructors with questions and problems
- CLC (room 147 UC) will be staffed at same times as for cs121 in Fall (odd weeks – starting week 3)
- Missed work policies – same as in cs121
  - Makeup labs to be held on Monday at 6 PM (odd weeks). Must receive explicit approval from your instructor in order to attend!
    - Lab 1 makeup is on Tuesday (1/18) due to MLK holiday
  - Makeup quiz offered (30% penalty) – Thursday through Sunday after completion of regular quiz
  - No makeup quizlets
- Pre-Lab 1 quizlet – unusual schedule
  - Due on Friday, 1/14 (5 PM)
  - All others on Thursday to Monday (8 AM) cycle prior to lab
Lab 1 Overview

• Based on materials from Chapter 10 readings

  – Development of longer scripts using Maple’s Code Edit Region feature and “outline” approach
    • The code edit region enables us to create and execute a series of Maple actions at once in “development friendly” environment
      – Utilizes the execution trace feature
      – Facilitates step by step troubleshooting / debugging
  – Use of print, printf and sprintf functions to enhance display of script information and results
    • print – basic text and variable output
    • printf – formatted, more user controlled output
    • sprintf – creates output as a string for downstream usage
  – Code troubleshooting / debugging techniques
Lab 1 Overview

• Lab 1 outline
  – Part 0 – Some initial exercises to become familiar with key lab concepts
  – Part 1 – design and implement a user defined function from specifications
  – Part 2 – working with code edit regions
    • A. execute a code edit region obtained from a starter file that simulates Blammo’s flight trajectory
    • B. Revise this script to produce a result in metric units
    • C. Suppress intermediate result traces for 1.B script
  – Part 3 – adding wind resistance calculations to the Blammo script
    • A. Revise script from Part 2.B to incorporate impact of wind resistance
    • B. From a starter file outline, create a script in a code edit region to compute and compare the flight trajectories with and without wind resistance
    • C. Use the script from 3.B to analyze a variety of cases
Lab 1 Overview
Part 0 Concepts to Practice

• Example 1 – Working with Maple’s Code Edit Region
  – Includes code troubleshooting / debugging
• Example 2 – Create and execute a Maple user defined function
• Example 3 – Multi-plot graphs using Maple’s display function
Quiz Week (3) Activities

• Don’t forget to take the pre-lab 1 quizlet during this week (available until 1/14 (5 PM)– even if you have already taken lab)
• Quiz 1 will be released on Friday (1/14) at 6 PM
  – Deadline: Wednesday (1/19) at 4:30 PM)
• Makeup quiz – from Thursday (1/20) at 9 AM through Sunday (1/23) at 11:00 PM
  – 30% penalty
• Pre-lab 2 quizlet
  – From Thursday (1/20 – 9 AM) through Monday (1/24 – 8 AM)
• Be sure to visit the CLC for quiz assistance
  – Note : CLC will not be staffed on 1/17 (MLK holiday)
  – Also, the makeup lab will be held on Tuesday, 1/18 instead of 1/17
• Be on alert for information regarding lab completion and extra consultation initiatives