CS122 Engineering Computation Lab
Lab 3

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Review of Lab 2 Cycle

• Lab 2 – pre lab 2 quizlet, lab 2 and quiz 2
  – Quiz grades to be issued this week
• Pre lab 3 quizlet also completed.
• Major Lab 2 concepts to remember
  – Use of user defined functions to create plots of boxes
  – Daisy-chaining functions to draw plots generated by a user-defined function.
  – Introduction to Maple’s table and for loop features for a simulation
Review of Lab 2 Cycle

• function definition syntax:
  drawBoxB:=(width, height, xlo, ylo ,c) →
  display([ ..... lines involving width, height, xlo, ylo, etc. ], scaling=constrained, color = c);
  #display lines together, with a specified color.

• Drawing several boxes together: use drawBoxB after you define it
  display([drawBoxB(....), drawBoxB(....)]);
  #display a list of boxes (plots).
Review of Lab 2 Cycle

- Maple table and for loop usage in the chemical reaction problem

```maple
Atab := table();
indexTab := table(); # initialize tables
for i from 1 to 50 do
    indexTab[i] := i; # table with 1, 2, 3, 4, in it
    Atab[i] := ……….; # table with concentrations of A at t=1,2,3,….
    etc. # formulas had X, newX, Y, newY, etc.
end do;
aList := convert(A,list);
timeList := convert(indexTab,list); # convert tables to lists
plot(timeList, aList, style=point); # plot data points
```
Administrative Notes

• Please continue to contact your individual instructors with questions and problems

• Will continue to offer lab completion opportunities on Monday afternoon and evening during quiz week
  – Be sure to schedule with instructor at end of lab period if necessary

• Special Accommodations
  – If you are eligible for extended time for the proficiency exam, please provide a copy of the form to your instructor
Lab 3 Overview

• Based on materials from Chapter 14 and 15 readings
  – Chapter 14
    • “while” loop – conditional looping + relational operators
    • Combining “for” and “while” loops
    • Dealing with runaway (infinite) “while” loops
  – Chapter 15 – Conditional execution
    • if .. then .. else .. elif constructs
Lab 3 Maple Concepts: Discussion

• “while” loops - continued
  – “while” and “for” loops can be used in combine when you want to potentially loop over a series of values, but also want to stop when a certain condition is met.
  – “if” statements can selectively execute code.
  – “if then else” statements can selectively choose which code to execute.
Finding the horizontal span of a tilted ladder

```
# calculate the distance from wall
ladderLength := 10;
angle := 45;
theta := evalf(convert(angle, units, degree, radians));
xDistance := cos(theta)*ladderLength;
```
Trying several angles

```c
# print distances for sequence of angles
ladderLength := 10;
distanceFromBase := 7;

thetaFunc := (angle) -> evalf(convert(angle, units, degree, radians));

for angle from 0 to 90 do
    xDistance := cos(thetaFunc(angle)) * ladderLength;
    printf("at %f degrees the distance from the wall = %f
", angle, distanceFromBase - xDistance);
end do:
```

10
7

\[ \text{angle} \rightarrow \text{evalf(convert(\text{angle}, \text{units}, \text{degree}, \text{radians}))} \]

at 0.000000 degrees the distance from the wall = 7.000000
Listing results selectively

```plaintext
ladderLength := 10;
distanceFromBase := 7;
tol := .1;

thetaFunc := (angle) -> evalf(convert(angle, units, degree, radians));

for angle from 0 to 90 do
    xDistance := cos(thetaFunc(angle))*ladderLength;
    if (abs(distanceFromBase-xDistance) < tol) then
        printf("at %f degrees the distance from the wall = %f
\n", angle, distanceFromBase-xDistance);
    end if;
end do:
```
Stopping when you find what you’re looking for

```plaintext
# ladder simulation with stopping condition
restart;
with(plots): with(plottools):
ladderLength := 10;
distanceFromBase := 7;
tol := .1;

thetaFunc := (angle) -> evalf(convert(angle, units, degree, radians));
ladderPlots := [];
angle := 90;
xDistance := cos(thetaFunc(angle))*ladderLength;

for angle from 0 to 90 while (abs(distanceFromBase-xDistance) > tol) do
  xDistance := cos(thetaFunc(angle))*ladderLength;
end do: # silent output while searching

# print an angle where difference in distances is small
printf("angle = %d, xDistance = %f\n", angle, xDistance);
```

```
ladderLength := 10
distanceFromBase := 7
tol := 0.1
thetaFunc := angle -> evalf(convert(angle, units, degree, radians))
ladderPlots := []
angle := 90
xDistance := -2.051033808*10^-9
angle = 46, xDistance = 7.071068
```
Lab 3 Overview

- Lab 3 outline
  - Analysis of trajectory (Blammo) options
    - 1 - Applying a “for” loop to calculate landing distance for a variety of firing angles – starter script provided
    - 2 – Finding the smallest firing angle to achieve a specified landing distance
    - 3 – Find a range of firing angles that hit target
    - 4 – Create a movie (animation) of all trajectories for different firing angles
Lab 3 Maple Concepts: Discussion

• Animation / Movie basics

A new way of producing an animation: give a list L of plots to display, with a special second argument.

\[
\text{with(plots): display(L, insequence=true)}
\]

The special second argument insequence=true causes display to create a movie where each plot in L is a separate frame of the movie.

What would display(L); do (without the second argument)?
Lab 3 Maple Concepts: Part 0 Exercises

• Part 0 will provide practice for some of the Maple features needed for this lab

  – The following concepts are illustrated
    • Example 1 – produce table of sine and cosines functions for angles from 0 to 90 degrees
    • Example 2 – script to find and report the angle between 0 and 90 degrees for which the sine and cosine are equal
    • Example 3 – produce table of sines and cosines for angles between 0 to 90 where cosine is greater than sine
    • Example 4 – Create a movie of sine and cosine values for 0 through 90 degrees
Quiz Week (6) Activities

• Quiz 3 will be released on Friday (2/11) at 6 PM
  – Deadline: Wednesday (2/16) at 4:30 PM
  – Makeup quiz – from Thursday (2/17) at 9 AM through Sunday (2/20) at 11:00 PM
    • 30% penalty
• Pre-lab 4 quizlet
  – From Thursday (2/17 – 9 AM) through Monday (2/21 – 8 AM)
• Be sure to visit the CLC for quiz assistance
• Lab completion sessions on Monday, 2/14 – please schedule if necessary at end of lab