Lab Parts

- Part 1, Sections 1.1-1.3
  - Due In Class
  - While Loops Continued
  - For Loops
- Part 2, Sections 2.1-2.3
  - 2.1 Due In Class
  - 2.2+ Do in class, or submit it for verification next time (during Lab 4).
  - Movies and Drawing

Your class instructor and TA

- Instructor for this section:
  - Office:
  - Email:
  - Telephone:
- Your TAs are:
Collapsed Code Edit Region

- You can collapse a code edit region.
  - Right Click -> Collapse Code Edit Region
  - Demo

- Hides all text associated with region.

- Clicking the region when collapsed will automatically execute it.

For Loops

- For loops let us repeat a sequence of commands or operations.
- The loop runs for the range specified.

  Sample Syntax:

  ```
  for <var> from <start> to <end> do
      <instruction 1>;
      <instruction 2>;
      ...
      <instruction n>;
  end do;
  ```

While Loop Version

```python
# While loop to add all items in a list
L1 := [1,2,3,4,5]:
listSum := 0;
i := 1;
while i <= nops(L1) do
    # add the current value to the sum
    listSum := listSum + L1[i];
    # increment the current value by 1
    i := i + 1;
end do:
listSum;
```
For Loop Version

```
# For loop to add all items in a list
L1 := [1,2,3,4,5]:
listSum := 0:
for i from 1 to nops(L1) do
    listSum := listSum + L1[i]:
end do:
listSum;
```

For Loop Example Background

$$(1 + x)^a = \binom{a}{0}x^0 + \binom{a}{1}x^1 + \binom{a}{2}x^2 + ...$$

- We can use binomial(a,n)
- printf("%.10f", float)
- Prints decimal to 10 digits

For Loop Version

```
(1 + x)^a = \binom{a}{0}x^0 + \binom{a}{1}x^1 + \binom{a}{2}x^2 + ...$
```

Alternate For Loop Forms

- For loop has many optional forms.
- We can specify a 'step'.
  ```
  for <var> from <start> | to <end> | by <step> do
    <instruction1>;
    <instruction 2>;
    ...
    <instruction n>;
  end do;
  ```
- Instead of going up by 1 each time, we can go up by a step.
For Loop Example (Step)

\[ \sin(x) = 1 - \frac{x^3}{6} + \frac{x^5}{120} - \frac{x^7}{5040} + \ldots \]

Alternate For Loop Forms

• We can mix for loops with while.

```c
for <var> from <start> | to <end> | by <step> | while <cond>
    <instruction 1>
    <instruction 2>
    ...
    <instruction n>
end do;
```

• Increments the variable but stops early if the while condition becomes false.

Alternate For Loop Forms

\[ e^{x} = 1 + x + \frac{1}{2} x^2 + \frac{1}{6} x^3 + \frac{1}{24} x^4 + \frac{1}{120} x^5 + \ldots \]

Final Notes On For Loops

• We can combine any of the forms.
  – ‘To’, ‘By’, ‘While’ statements are all optional
  – We can use all of them together or none at all, in any combination.

• What you chose to use depends on the problem.

```c
# Computations of e^x through sums.
val := -1;
term := 1.0; #next term, initially
s := term; #sum of terms.
tol := 10e-9;

#add on successive terms
for i from 1 while abs(term)>=tol do
    term := term*val/i;
    s := s+term;
end do;
print("sum is ",s, " compared to ", exp(val));
print(i, " terms used");
```
Optimization

• Mathematical optimization involves finding the minimum or maximum value of the objective function over some range.

• Maple provides us with some built-in functions.
  – Exact vs. Approximate solutions
  – solve() vs. fsolve()

Exact vs. Approximate Optimization

• Maple provides two types of optimization functions.
  • Solves for the exact extrema values
    • minimize()
    • maximize()
  • Solves for approximate extrema values
    • Optimization[Minimize]()
    • Optimization[Maximize]()

Exact vs. Approximate Optimization Example

\[ f(x) = \arcsin(x) \]

\[ \text{Optimization[Maximize]}(f(x), x = 0..1) \]
\[ [1.57079632679489656, [x = 0.1]] \]

\[ \text{Optimization[Maximize]}(f(x), x = 0..1) \]
\[ 1.57079632679489656 \]

\[ \text{maximize}(f(x), x = 0..1) \]
\[ \frac{1}{2} \pi \]

Optimization[Maximize]

• Finds the local maxima value in the range
• Returns a list, with first entry the min value

\[ f(x) = x^3 \cos(x) \]

\[ \text{Optimization[Maximize]}(f(x), x = 0..10) \]
\[ [275.015342086353883, [x = 6.70395577569753964]] \]
\[ \text{plot}(f(x), x = 0..10) \]
Optimization [Minimize]

- Finds the local minima value in the range
- Returns a list, with first entry the max value

\[ f = x \rightarrow x^3 \cos(x) \text{;} \]
\[ \text{Optimization}[\text{Minimize}](f(x), x = 0 \ldots 10) \]
\[ = \{-4.34050129540827854, [x = 3.808762209966358225] \} \]
\[ \text{plot}(f(x), x = 0 \ldots 10) \]

What you should do now

- Connect to class web page: [www.cs.drexel.edu/complab](http://www.cs.drexel.edu/complab)
- Start up Maple 12
- Read Lab 3 directions.
- Do the work with your partner(s). Both should try to do the work, but the grader will need to look at only one answer to give you credit for doing the problem.

Finishing up – save files

- Make sure your name/user id/section number/date/time/instructor name are on the verification sheet.
- Get the verification sheet signed and handed in.
- Save worksheet on desktop if you haven’t done so already. You can call the file "MyLab3CS122". This will create a file called MyLab3CS122.mw.
- Submit a copy to Blackboard site.
- Email a copy to yourself and/or your lab partners as an attachment so you can look at what you did for review purposes later.
- .mw file should open correctly on any Maple 12 (Mac, Windows, Linux) – file format is portable across system types.

Next week – Take quiz 3!

- Take the third quiz!
- Go to CLC if you need face-to-face help!
- Don’t wait until the last minute to start the work!