Introduction to Programming

Lecture 3 : Problem Solving using C

MTech CS – First Year
Indian Statistical Institute

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About this course

Introduction to Programming (A1)

Target audience : MTech (CS) First Year
Instructor : Sourav Sen Gupta (sg.sourav@gmail.com)

- Lectures : Monday and Thursday (11:15-13:00)
- Venue : CSSC Lab, 4th Floor, Library Building
- Assign : Mid-Sem : End-Sem = 20 : 30 : 50

`www.souravsengupta.com/int2pro2014/`

Coding environment

Server : 192.168.54.156

Login : `ssh -X mtc14{RR}@192.168.54.156`
where `mtc14{RR}` is your MTech roll number.

- Create working directory : `mkdir int2pro2014`
- Go to working directory : `cd int2pro2014`
- Create daywise directory : `mkdir lecture{MM}{DD}`
- Go to daywise directory : `cd lecture{MM}{DD}`
- Create file : `gedit mtc14{RR}-{MM}{DD}-prog{NN}.c &`

Problem Solving using C

Solving a Problem

1. Clearly understand and *define* the given problem in own words.
2. Take a few examples, if necessary, to clarify the problem better.
3. Create an *implementation-independent* solution first!
4. Look at the problem from *every* possible point-of-view.
5. Try to find similarities with other problems, and devise a strategy.
6. Identify sub-problems and choose appropriate data structure(s).
7. Identify iterative and conditional relationships to connect pieces.

"the sooner you start coding, the longer it is going to take"

Example Problems : Basics

- Given two variables a, b, exchange/swap their values.
  - □ What is the best algorithm if you have a temporary storage?
  - □ What if you do not have a temporary storage?
- Given n positive integers $\{a_i\}_{i=1,\dots,n}$, find $\sum_{i=1}^{n} a_i$.
  - □ What is the complexity of a naive repeated addition algorithm?
  - □ Can you do any better than the simple repeated addition?
- Given positive integers x, n, compute x^n.
  - □ What is the complexity of a naive repeated multiplication algorithm?
  - □ Can you do any better than the simple repeated multiplication?
- Given a positive integer n, compute $n!$.
  - □ What is the complexity for a naive repeated multiplication algorithm?
  - □ Can you do any better than the simple repeated multiplication?

Example Problems : Computations

- Given a positive integer x, compute an approximate value of e^x.

$$e^x = \sum_{n=0}^{\infty} \frac{x^n}{n!} = 1 + x + \frac{x^2}{2!} + \frac{x^3}{3!} + \cdots$$

- Given x in radians, compute an approximate value of $\sin(x)$.

$$\sin(x) = \sum_{n=0}^{\infty} (-1)^n \frac{x^{2n+1}}{(2n+1)!} = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \cdots$$

- Given a positive integer n, compute an approximate value of $\sqrt{n}$.

Assignment 1 : Solve the above problems!

Thank You

for your kind attention

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