ESc101 : Fundamental of Computing

I Semester 2008-09

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Aim of the course

How to solve problems by computer ?

Prerequisites :

- elementary knowledge of mathematics (high school).
- No background on computers or programming languages C,C++, JAVA is expected.
- Zeal to learn problem solving.

All basics will be covered in the course itself

Computer : physical device

Computer may be considered as an office assistant with the following property

- **capability** : any arithmetic, logical operation, and simple data manipulation.
- **dumb** : detailed instructions required.
- very fast
- very formal : the instructions have to be given in a very very formal manner. You can't afford to make even a single "spelling mistake".
- language : strings of 0 and 1.

Computer : a versatile device

Applications of Computer :

- Banking
- Medical science
- Train reservation
- Academics
- Computer games

Definitions

Computer Algorithm :

A method to solve a problem by computer is called a computer algorithm for that problem.

Computer Program :

an algorithm in some *high level* language like C,C++, JAVA,...

You are already familiar with various algorithms !

Let two numbers to be added are 15176 and 279.

$\begin{array}{c} 1 \ 5 \ 1 \ 7 \ 6 \\ 0 \ 0 \ 2 \ 7 \ 9 \end{array}$

Let two numbers to be added are 15176 and 279.

$1 \\ 15176 \\ 00279 \\ 5$

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 $\begin{array}{r} 0 \ 0 \ 1 \ 1 \\ 1 \ 5 \ 1 \ 7 \ 6 \\ 0 \ 0 \ 2 \ 7 \ 9 \\ \hline 15 \ 4 \ 5 \ 5 \end{array}$

Execute the following steps.

- 1. Align the numbers such that the rightmost digit of one number is right above the rightmost number of the other.
- 2. If the number of digits is different then add extra zeros in front of the smaller number.
- 3. Start from the rightmost digit do the following step and move leftward.
 - (a) Compute the sum of the two digits and the carry if any.
 - (b) If the sum is single digit, then write that out
 - (c) **Else** (the sum is greater than 9) let the sum is xy (for example 21) then write 1 and 2 is the carry for adding the next digits

Salient features of an algorithm

- The entire method consists of a **finite sequence of steps/instructions**.
- Each step/instruction is **precise**, **unambiguous** and can be carried out "mechanically".
- It works for all positive numbers.

Algorithm of a problem : (slightly more formal definition)

A set/sequence of precise and unambiguous steps which solves any given instance of the problem.



- Unknown : the road on which the shop is located ?
- Unknown : the distance of the shop from the crossing ?

Examples of problems to be solved algorithmically

- 1. Given two line segments, determine if they intersect.
- 2. Given a number, calculate all its prime factors.
- 3. Given a name, list all its permutations.
- 4. Given a set of points, find the circle which encloses all the points and is of smallest radius.

Why computer algorithms :

The advantages are for problems of very large size :

- 1. Automation
- 2. Efficiency
- 3. precision

A few important facts

- There are many nontrivial problems for which no computer algorithm can be designed.
- There are many interesting problems for which there are not practical algorithms.
- There are problems for which efficient algorithms exist.

What will we gain/learn from the course ?

- Develop algorithmic skills
- How to use computers
- Expressing algorithm as programs in JAVA : Editor
- How to make these JAVA programs run on a computer : compiling, executing

Caution : Do not expect to become expert in JAVA after the course.





Schedule of Lecture/Tutorial/Labs

• Lectures :

Mon, Wed and Fri: 11:00 AM-12:00 Noon

• Lab :

Mon, Tue, Wed, Thu, Fri : 2:00 PM - 5:00 PM

Computer center - Ist floor

• Tutorial :

Thursday 11:00AM-12:00 Noon

Groups B1 to B10 in TB101 to TB110. (Tutorial block)

Course homepage : http://www.iitk.ac.in/esc101

A few useful tips

- open mind and positive attitude
- Regularity
- NO HESITATION

Lab in this week

Familiarity the the computing environment

- keyboard, mouse
- login/logout, change password
- use an editor like kwrite, gedit or any other text editor
- create/delete file, change file protection
- send/read email
- surf internet





```
class Hello
```

```
public static void main(String args[])
```

```
System.out.println("Welcome to IIT Kanpur")
```