CS 101: Computer Programming and Utilization

Shivaram Kalyanakrishnan
(Abhiram Ranade's slides, borrowed and edited)

Lecture 1

This Lecture

- Introduction to the topic
- Administrative details
- A simple program

Computers are everywhere!

- Cars, phones, laptops, game consoles, cameras, televisions contain a computer
- Computers used to:
  - Book train/plane/bus tickets
  - Search the internet
  - Predict the weather
  - …
- Goal of the course: Learn how to make computers do things such as the above

What is a computer?

A computer is a giant electrical circuit that can do the following:

- Receive data from the external world
  - data = numbers,
    - images, sounds can be represented using numbers and fed to a computer
- Perform calculations on the data it receives
- Send the results back to the external world

What calculations are performed?

- Determined by a program loaded in the computer

Programs

- Program = a precise description of the calculations we want the computer to perform
- By feeding different programs to a computer you can make it do different calculations.
- This course tells you how to construct (“write”) programs.
- Special notation is to be used to write programs: “Programming Language”

The C++ programming language

- Designed by Bjarne Stroustrup, 1980s.
- Evolved out of the C programming language.
- C++ is a powerful, complex language.
- We will not study all of it.
- What we study will still be more convenient and safer than C.
- We will lay the foundation for learning advanced features later.

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Personnel

- Instructor: Shivaram Kalyanakrishnan.
- shivaram@cse.iitb.ac.in

- Course managers: Firuza Aibara, Nagesh Karmali.
- firuza@cse.iitb.ac.in
- nags@cse.iitb.ac.in

- Teaching Assistants: Will be published early next week.

Meetings

Classes in LA 201

- D1: slot 6 (Wednesdays and Fridays 11.05 a.m. - 12.30 p.m.).
- D2: slot 10 (Tuesdays and Fridays 2.00 p.m. - 3.25 p.m.).

Labs in CC Building (SL1, SL2, SL3, Basement)

- D1: 8.30 p.m. - 10.30 p.m. Wednesdays
- D2: 8.30 p.m. - 10.30 p.m. Tuesdays

Attendance

- Requirements as per institute policy.
- In class, use SAFE for marking attendance.
- In labs, TAs will mark attendance.
- If absent due to medical reasons, send us e-mail with documentation.

Communication, Material

Moodle: announcements, gradebook.
Bodhitree: weekly labs, lab tests.
Google Drive Link with lectures, example code, etc. (login using IITB SSO)

- Slides will be uploaded *before* the lecture.
- To reach instructor, course managers: after class, during lab, e-mail.

Evaluation

- Theory quiz 1: 7%
- Lab quiz 1: 13%
- Mid-semester exam: 20%
- Theory quiz 2: 7%
- Lab quiz 2: 13%
- End-semester exam: 30%
- Weekly lab exercises: 10% (2/1/0.2/0 marks per week)
- Make-up Test for evaluations missed due to medical reasons: mix of Theory and Lab, to be held after end-semester exam.

Academic Honesty

Do not copy code from any source (classmates, Internet, ChatGPT, …); do not send code to each other.

- Every line of submitted code must be written by yourself.
- Okay to consult references for syntax, formats, etc.
- Okay to discuss code, concepts with friends.
- When in doubt about taking some action, ask TA, course managers, instructor.

Do not copy in the tests and exams

Suspected academic malpractice will be reported to D-ADAC

Resources

Textbook: “An introduction to programming through C++”, Abhiram Ranade, McGraw Hill Education, 2014.

- www.cse.iitb.ac.in/~ranade/book.html
- Available in physical and on-line bookstores
- Integrated with use of simplecpp

- Abhiram Ranade’s **NPTEL course**
- https://archive.nptel.ac.in/noc/courses/noc21/SEM1/noc21-cs38/

Give us Feedback!

Initial survey (will be shared)

Link for ongoing feedback (will be shared)

TALK to me, course managers, TAs.

- We want you to enjoy this course, learn from it, apply your learning to future courses and projects.

Prerequisites

- Science and math of standard XII
- No knowledge of computers expected
- Enthusiasm!

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The programming environment

Initial weeks: C++ augmented with Simplecpp

Simplecpp is a C++ library developed in IITB

- Provides facilities convenient to learners
  - Graphics programming – more fun!
  - Easy to understand “repeat” statement
  - “main_program” keyword
- Download from www.cse.iitb.ac.in/~ranade/simplecpp
  - Available as Linux/Mac OS library or as IDE for windows and Linux

Later weeks: Only C++

- We may continue to use Simplecpp graphics

Let us write some Simple C++ programs

- The programs will draw pictures on the screen.
- Use "Turtle Simulator" contained in simplecpp
  - Based on Logo: A language invented for teaching programming to children by Seymour Pappert et al.
  - We "drive" a "turtle" on the screen!
  - To drive the turtle you write a C++ program.
  - Turtle has a pen, so it draws as it moves.

Drawing pictures seems too much fun?

"You master picture drawing, you master programming!"

The first program

```
#include <simplecpp>
main_program{
  turtleSim();
  forward(100);  right(90);
  forward(100);  right(90);
  forward(100);  right(90);
  forward(100);
  wait(5);
}
```

- "Use simplecpp facilities"
- Main program begins
- Start turtle simulator
  - Creates window + turtle at center, facing right
- `forward(n)` :
  - Move the turtle `n` pixels in the direction it is currently facing.
- `right(d)` :
  - Make turtle turn `d` degrees to the right.
- `wait(t)` :
  - Do nothing for `t` seconds.
- } : End of main program

How to run this program

- Install simplecpp on your computer,
  - See instructions at www.cse.iitb.ac.in/~ranade/simplecpp
- Type in the program into a file/IDE. Call it square.cpp
- "Compile" it:
  - If you installed library on unix run: `s++ square.cpp`
  - If you installed code blocks IDE: use compile button
- Execute it:
  - On unix, run: `./a.out`
  - On code blocks: use run button

Exercises

- Write a program that draws a smaller square.
- Write a program that draws an equilateral triangle.
  - Remember that the external angles of a polygon add up to 360 degrees.
  - Also remember that all the external angles of an equilateral triangle are equal.

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