# Advanced Programming Lab
# CS6150

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# Class Timings

- Theory (M2 slot):

  Monday 3.30PM-4.45PM in CS15

- Lab (T slot):

  Friday 2.00PM-4.45PM in DCF

# Course Instructors


- Anantha Padmanabha
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- Meghana Nasre
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# TA Team

- Dinesh Kumar S — cs24m017@smail.iitm.ac.in
- Sai Rajesh Karapa — cs24m040@smail.iitm.ac.in
- Santhi Raj Kumar Seelam — cs24m042@smail.iitm.ac.in
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- Sirigineedi Dhanush Tata Phani Srikar — cs24m047@smail.iitm.ac.in
- Surender M — cs24m050@smail.iitm.ac.in
- Sanket Tarafder — cs24s018@cse.iitm.ac.in

# TA Team

- Each of you will be assigned to a particular TA for the entire semester
- You can reach out to them for all your queries

# Course Expectations

- On Monday we will discuss the concepts on which the lab on Friday of that week will be based on

- Attend All the Labs and Theory Classes
  - If you miss a lab, you will not be evaluated for that lab

- CS6150 and CS5800 are core courses for CSE MTech
  - Programs in the second half of this course will cover the topics discussed in CS5800

- We assume that you are familiar with C programming
  - C++ we will start from basics

# Course Overview

- First half of the course will be on the concepts of Object Oriented Programming in C++
  - Class, Objects, Abstraction, Polymorphism, Inheritance, Templates…

- Second half of the course will be on Algorithms to be coded in C++
  - Based on the topics you learn in CS5800

# Grading Policy (Subject to DCC approval)

- In Lab Assessment
  - Total 11 Labs (excluding the exams)
  - Except 1st Lab all other labs (10 labs) will be graded for 7% (Total 70%)
  - In each lab there will be in-lab component for at least 3%
- Mid-Semester Exam on 19-09-25
- End-Semester Exam on 07-11-25
- Each Exam will be evaluated for 15%
- If you have missed a lab for some genuine reason, these exams will be scaled accordingly

# How to submit?

- Labs will run on Hackerrank
- You need to submit your code on Hackerrank and also on Moodle
  - On Moodle you might be asked to submit additional things like code design etc, depending on the lab
- In-lab component should be submitted as soon as the lab ends
  - Late submissions will not be evaluated
- For the rest of the lab, the deadline will be the next day (Saturday) at 12.00PM (noon)
  - Late submissions will be allowed until (8.00PM on Saturday) with a penalty of 30%
- In the first lab we will follow all these procedures but it will not be graded

# Lab Evaluation Policy

- Evaluation for the lab will be uploaded on moodle before the next week week's lab

- If you have queries, contact your TAs
  - Within three weeks of the lab, after that the marks will be freezed

# Academic Honesty

- No sharing (willing, unwilling, knowing, unknowing) of codes.
- Submission of downloaded code (from the Internet, Campus LAN, or anywhere else) is not allowed.
- Academic violations will be handled by IITM Senate Discipline and Welfare (DISCO) Committee.
  - First violation instance will result in ZERO marks for the corresponding lab and a drop of one- penalty in overall course grade.
  - The second instance of code copying will result in a 'U' Course Grade and/or other penalties. The DISCO Committee can also impose additional penalties.
- Please protect your Moodle account password.
  - Do not share it with ANYONE. Do not share your academic disk drive space on the Campus LAN.

# Compensation Lab

- 05-09-2025 (Friday) is a holiday

- Is 04-09-2025 (Thursday) ok for the alternative lab?
    - To be finalized by next week Monday

# Advanced Programming Lab
# CS6150

Week 1

(Slides Courtesy : Rupesh Nasre)

# Procedural vs. Object Oriented (OO)

- Procedural is often top-down (from programs to functions); OO resembles bottom-up design (from classes to programs).

- OO allows us to build a program in application's vocabulary.
  - e.g., student, teacher, lecture, exam, question, …
  - e.g., car, brake, accelerator, wheel, seat, key, …

- Instead of concentrating on tasks, OOP allows us to concentrate on concepts.

- The two approaches differ in how they provide the interface

# Interface

- Behavior visible to the outside world.
- Hides implementation details.
- Allows changing implementation without changing the behavior.

**Interface** University:

AddStudent(Name, RollN)

UpdateMarks(RollNo, Course, Grade)

…..

- We need not know how Student Data is stored internally
- A client can continue to call UpdateMarks even if the internal representation changes.
- Interfaces help in **data hiding**.

# Why C++? Why not C?

- One can write procedural programs in C++;  one can write object-oriented programs in C.
- If one can write object-oriented programs in C, why design a new language?
- C++ allows us to provide Interface to users and hides unnecessary details (Abstraction)
- C++ allows us to store data and functionalities of a concept together (Encapsulation)
- C++ also supports other useful mechanisms.
  - code reuse with inheritance, operator overloading with polymorphism, generic programming with templates, support for exceptions

# This week

- Get used to basic differences in the syntax of C and C++
- Get used to Hackerrank / how to submit / ….
- This lab will not be graded
- We will look at the Object oriented Concepts from next week

# Hello World!

```c
#include<stdio.h>

int main()
{
    printf("Hello world\n");
}
```

```
$ gcc hello.c
$ ./a.out
Hello World

$ cp hello.c hello.cpp
$ g++ hello.cpp
$ ./a.out
Hello World
```

```cpp
#include<iostream>

int main()
{
    std::cout<<"Hello world"<<"\n";
}
```

```
$ g++ hello2.cpp
$ ./a.out
Hello World!
```

# Input and Output : C vs C++

```c
#include <stdio.h>

int main() {
    int age;
    float salary;
    char name[50];

    printf("Enter your age: ");
    scanf("%d", &age);

    printf("Enter your salary: ");
    scanf("%f", &salary);

    printf("Enter your name: ");
    scanf("%s", name);

    printf("Your age: %d\n", age);
    printf("Your salary: %.2f\n", salary);
    printf("Your name: %s\n", name);

    return 0;
}
```

```cpp
#include <iostream>
using namespace std;

int main() {
    int age;
    float salary;
    char name[50];


    cout << "Enter your age: ";
    cin >> age;

    cout << "Enter your salary: ";
    cin >> salary;

    cout << "Enter your name: ";
    cin >> name;

    cout << "Your age: " << age << "\n";
    cout << "Your salary: " << salary << endl;
    cout << "Your name: " << name << "\n";

    return 0;
}
```

# C vs C++ : Example 2

```c
#include <stdio.h>

int main() {
    int n, number, count_even = 0, count_odd = 0;
    printf("How many numbers will you enter? ");
    scanf("%d", &n);

    for (int i = 0; i < n; i++) {
        printf("Enter number %d: ", i+1);
        scanf("%d", &number);

        if (number % 2 == 0) {
            printf("%d is even.\n", number);
            count_even++;
        } else {
            printf("%d is odd.\n", number);
            count_odd++;
        }
    }

    printf("Total even numbers: %d\n", count_even);
    printf("Total odd numbers: %d\n", count_odd);

    return 0;
}
```

```cpp
#include <iostream>
using namespace std;

int main() {
    int n, number, count_even = 0, count_odd = 0;
    cout << "How many numbers will you enter? ";
    cin >> n;

    for (int i = 0; i < n; i++) {
        cout << "Enter number " << i+1 << ": ";
        cin >> number;

        if (number % 2 == 0) {
            cout << number << " is even." << endl;
            count_even++;
        } else {
            cout << number << " is odd." << endl;
            count_odd++;
        }
    }

    cout << "Total even numbers: " << count_even << endl;
    cout << "Total odd numbers: " << count_odd << endl;

    return 0;
}
```

# What remains same?

- Conditionals : If / Else,  Switch-Case …
- Loops :  For / While
- Data types : Int / Float …

- Anything that you can use in C can be (mostly) used in C++
  - You can write a C code, save it as .cpp and it should work!

# In the lab on Friday

- Refresh concepts in C like loops, arrays, struct etc
- Recall how to use Declare basic data types (Int, Float, …)
- Recall how to use conditions (If-Else..)
- Recall how to use Arrays (Declaring, taking input .. )
- Recall how to declare Struct

# SEE YOU IN THE LAB ON FRIDAY IN DCF

(Those who are not from CS25 MTech batch please stay back)