CS20202: Software Engineering - Introduction

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Slides taken from NPTEL course on Programming in C++

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Software Engineering

- A crucial component of Software Engineering is software development – writing programs.
- Programming paradigms help in writing programs:
  - Procedural programming: Data and procedures are separate. Procedures act on data to achieve functionality.
  - Functional programming: Functions are first class members, and are composed with each other to achieve a desired function which is then applied on the input data.
  - Object-oriented programming: Data and related functions are grouped into objects. Objects interact with each other to achieve the desired functionality.

Object-oriented programming

- Most suited for development of large and complex software systems.
- Many popular programming e.g. C++, Java, Python, etc support this style.
  - These languages also support procedural, and functional programming to some extent.
- C++ is popular for:
  - System programming.
  - Writing high performance programs.
  - Feature rich – good for learning tools.
  - (Negative) Programs can be large.

OOP concepts

- Objects and Classes – user defined data types.
- Encapsulation – Data hiding – Data is hidden inside objects and accessed through member functions or methods.
- Composition – objects can contain other objects
- Inheritance – objects can borrow properties of other objects
- Polymorphism – the function executed depends on the type of objects.

OOP with C++

- Tentative list of features and their applicability:
  - Procedural enhancements in c++ over c
  - Classes
  - Overloading
  - Inheritance
  - Type casting
  - Exceptions
  - Templates

List of Topics

- Procedural Extensions over C in C++
  - Constants and inline functions
  - Reference and pointers
  - Default Parameters Function Overloading
  - Operator overloading
  - Dynamic Memory Management
- Object-oriented Programming in C++
  - Classes and objects
  - Access specifiers
  - Constructor, destructor, object lifetime
  - Copy Constructor and Copy Assignment Operator
  - Const-ness
  - Static Members
  - Friend Function and friend Class
  - Operator overloading for user defined types

List of Topics

- Advanced OOP
  - Inheritance
  - Polymorphism
  - Virtual Functions
  - Type casting
  - Exceptions
  - Function template, Class template
  - Standard Template Library
- Software development life cycle
  - SDLC: Goals, Benefits, Stages
  - SDLC: Models - waterfall, v-shaped, Spiral, Agile
  - SDLC: Testing
- Software Testing
  - Testing: Fundamentals, Black-box, White box
  - Testing: Debugging, Regression, Unit,Integration,
  - Testing / Design Pattern

List of Topics

If time permits:

- Design Pattern
  - Design Pattern: Iterator, Command, Singleton
  - Design Pattern: Factory, Abstract, Visitor
- Software Project Management
- Smart Software Engineering
- Summarisation

Marks Distribution and Logistics

- Class tests - 20% marks
  - Tentative Dates: 17^{th} Jan, 7^{th} Feb, and 4^{th} April
- Mid-sem - 30% marks
- End-sem - 50% marks
- No graded Assignments, but practise problems - important to solve yourself

Logistics

- Course website will provide announcements and course materials
- Class tests will be held physically.

References

- Roger S Pressman, **Software Engineering: A Practitioner's Approach**, 7th Edition, McGraw Hill Education, 2009.
- Rajib Mall, **Fundamentals of Software Engineering**, Prentice Hall India, 2014
- Bjarne Stroustrup, **The C++ Programming Language**, 4th Edition, Addison-Wesley, 2013
- Erich Gamma, Richard Helm, Ralph Johnson, John Vlissides, **Design Patterns: Elements of Reusable Object-Oriented Software**, Addison Wesley, 1994

Thanks !
Questions ?