Introduction to Software Engineering

* **Software encompasses**

1. **Instructions – computer programs that when executed provide desired functions, features, and performance**
2. **Data Structures- that enable program to adequately store and manipulate information (data type)**
3. **Documentation- that describes the operation and use of programs. (User manual, specifications, design artifact)**

* **Software Engineering – is an engineering discipline (early stages of system specification to maintaining the system)**
* **Engineering disciple- Appropriate theories and methods to solve problems (considering organization and financial constraints)**
* **All Aspects of software production- Not just technical process rather, project management, development of tools, methods etc**
* **IEEE: Application of systematic, disciplined, quantifiable approach to development, operation, maintenance of software (ie, application of engineering to software)**
* **Software Product Category: (Software can be developed for a particular customer or General Market)**

1. **Generic Software: Developed to be sold to range of customers, Stand-alone systems marketed and sold to any customer who wish to buy them. Examples: PC software (graphic programs, project management tools), CAD, appointment sys for dentists**
2. **Customized Software:** Developed for a single customer acc to their specification. Software commissioned to meet the customers needs. Examples: embedded control systems, air traffic control software, traffic monitoring systems
3. **Software development from scratch:** new software created be developing new programs, configuring generic software, reusing existing software

* **Types of Software:**

1. **Real Time Software:** must react immediately to environment, Safety often a concern, Example: aircraft auto pilot system
2. **Data Processing Software:** Used to run business, Accuracy and security of data are key. Example: QU student system
3. **Some Software have both aspects**

* **Main Phases of software development process:**

**1.** Requirement Elicitation- define what system would do (The Application will display the balance in the users account)

**2.** Analysis -Identify what’s needed

**3.** Design- Specify the system components and how it will work (The design will consist of classes CheckingAccount)

**4.** Implementation- Write the Code (class CheckingAccount {double balance; …}

**5.** Testing- Verify the resulting software meets the requirements (Test cases)

**6.** Maintenance- Repair defects and add enhancements (Defect repair: Application crashes when balance 0, etc)

* **Analysis** vs **Design**

**Analysis:** (**Investigation: What?) –** Includes: 1. Requirements Analysis 2. Domain Analysis

Key Questions: How the System will be used? Finding and describing the key concepts, or objects in the problem, attributes etc

**Design: (Solution: How?) –** Includes: 1. Object Design 2. Database Design 3. User Interface (UI) design

Key Questions: how should the responsibilities be assigned to classes? How should objects interact to fulfill requirements.

* **Software Engineering** vs **Programming**

**Software Engineering:** Focusses on entire system, Interaction among elements, Structural properties, usually static, System level performance, Outside module boundary

**Programming:** Focusses on part of system, Implementations of elements, Computational properties, usually dynamic, Algorithm level performance, Inside module boundary

* **Complexity:** Complexity of software is an essential property and derives from 4 elements:

1. The complexity of problem domain
2. The difficulty of managing the software development process
3. The constantly changing requirements of software
4. The problems of characterizing the behavior of discrete systems

Complexity of software exceeds human intellectual capacity. There are fundamental limiting factors of human cognition

One task in software engineering is to tackle this complexity and engineer the illusion of simplicity

* **Required skills of software engineers:** Technical (knowledge and skills), Business (K & S), People (K & S)
* **Ethical behavior is more simply upholding the law- Confidentiality, Competence, Intellectual property rights, Computer misuse**
* Code of Ethics:

1.Public: act consistently with public interest 2. Client and Employer: best interests of client and employer 3. Product: meet highest professional standards possible 4. Management: ethical approach to management 5. Judgement: Integrity and independence in their professional judgement 6. Profession: advance integrity and reputation of profession 7. Colleagues: fair and supportive to colleagues 8. Self: lifelong learning+ promote ethical approach to practice of profession