Software Engineering

Section – A

Outline

- Nature of software projects
- Engineering approaches

Applications of SE

- Ubiquitous used in variety of applications
  - Business, engineering, scientific applications
- Simple to complex, internal to public, single function to enterprise-wide (Eg. railway reservation system), one location (pay-roll management system) distributed, batch or real-time, informational to mission-critical….

Challenges in large projects

- Developing large/complex software application is very challenging
  - Effort intensive
  - High cost
  - Long development time
  - Changing needs for users
  - High risk of failure, user acceptance, performance, maintainability…
- Quite different from one-time programs where author and user are same !

Successful software system

- Software development projects have not always been successful. (success rate is much lower in comparison to success rate of projects in other engineering domains)
- When do we consider a software application successful?
  - Development completed
  - It is useful
  - It is usable, and
  - It is used.
- Cost-effectiveness, maintainability implied.

Reasons for failure

- Schedule slippage
- Cost over-runs
- Does not solve user’s problem
- Poor quality of software
- Poor maintainability

Reasons for failure…

- Ad hoc software development results in such problems
  - No planning of development work (eg. no milestones defined)
  - Deliverables to user not identified.
  - Poor understanding of user requirements.
  - No control or review
  - Technical incompetence of developers.
  - Poor understanding of cost and effort by both developer & user.

Engineering way of doing things : other disciplines

- Large projects common and successfully done
  - Building, bridges, dams
  - Power plants
  - Air-crafts, missiles…
  - Engineering a solution:
    - To design, develop(build, fabricate) an artifact that meets specifications efficiently, cost effectively and ensure quality.
    - Using scientific principles.

Engineering . ..

- Requires well-defined approach: repeatable, predictable.
- Large projects requires managing the project itself.
  - Manage people, money (cost), equipment, schedule.
  - Scale makes big difference : compare building a hut, 2 – storeyed house or 50-storeyed apartment building.
- Quality extremely important: relates to failures, effieciency, usablity, …
  - People willing to pay for quality !

Large Projects

- Involve different types of people
  - Large building: architect, civil engineer, electrical engineer, workers (masons, carpenters), …
- Continuous supervision for quality assurance
  - On site supervisors (check cement/steel quality, ensuring proper mix of sand & cement….)

Large projects…

- Many deliverables: architecture plan, model, structure diagrams, electrical cabling, layouts,..
- Standards, regulations, conventions need to be followed.
- Steps, milestones defined and reviews are carried out; *progress is visible.*

Software Projects

- Software is different from other products
  - Cost of production concentrated in development.
  - Maintenance consists of making corrections and enhancing or adding functions.
  - Progress in development is difficult to measure. (does not have physical dimension like in case of buildings)

Apply Engineering Approach

- **Hence planning and control even more important in software development -> characteristics of engineering approach:**
  - **Attempt to estimate cost/effort.**
  - **Plan and schedule work**
  - **Involve user in defining requirements.**
  - **Identify stages in development**
  - **Define clear milestones so that progress can be measured.**
  - **Schedule reviews both for control and quality**
  - **Define deliverables.**
  - **Plan extensive testing.**

Job of Software Developer is difficult

Job of Software Developer is difficult

- **Dealing with users**
  - **ill-defined requirements.**
  - **Concern with ease-of-use and response time.**
- **Dealing with technical people**
  - **Concerned with coding, database design, file structure etc..**
- **Dealing with management**
  - **Concerned with return on their investment**
  - **Cost-benefit analysis.**
  - **Schedule**

For success in large software development, it is important to follow an engineering of a well-defined process.

Assignment

- What is Software Engineering & its approaches.
- Discuss the principles of software engineering.