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**Q1.****i) Differences between Defect, Error, and Failure:**

- **Error** is a human mistake made during software development (e.g., a typo in code).
- **Defect** is the flaw in the software caused by an error (e.g., the misspelled function name in the code).
- **Failure** is the observable incorrect behavior in the application when a defect is executed (e.g., the invoice is not generated when the button is clicked).

**ii) Identification and Resolution:**

- **Error** can be identified during code reviews or static analysis. It should be corrected by developers during development.
  - **Defect** is found during testing. Once detected, it is logged, analyzed, and fixed by developers.
  - **Failure** is observed in the user environment or during system testing. It requires root cause analysis to trace it back to the defect and the originating error.
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**Q2.****a) Definition of Software Quality Assurance:**

Software Quality Assurance (SQA) is a set of systematic activities and planned processes that ensure the quality of software by monitoring and improving the software development process, standards, and procedures.

**b) i) SQA vs. QC Activities:**

- **SQA** involves process-oriented tasks like SDLC planning, process audits, setting coding standards, and training programs.
- **QC** involves product-oriented tasks such as executing tests, using automated tools, finding defects, and validating outputs.

**ii) Contribution to Quality:**

- **SQA** ensures that processes are mature and capable of delivering quality products, preventing defects early.
  - **QC** detects and removes defects in the developed product, ensuring that the delivered application is reliable and meets requirements.
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**Q3.****a) Importance of Investing in SQA:**

Investing in SQA minimizes software defects early, reducing costly post-release fixes and improving reliability. It lowers project risk, increases customer satisfaction, and enhances the company's brand. Long-term benefits include reduced maintenance costs, improved development efficiency, and faster time to market due to early defect prevention and continuous process improvement.

**b) Impact of Reducing Prevention Costs on Cost of Quality:**

Reducing prevention costs (like training or process improvement) leads to higher failure and appraisal costs later. Without proper prevention, defects increase, raising rework, testing, and customer support expenses. Hence, investing in prevention ultimately lowers the total cost of quality.

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**Q4.****a) Primary Focus of McCall Model:**

The McCall Model focuses on assessing software quality based on operational characteristics, revision capabilities, and transition abilities.

**b) Three Major Dimensions of McCall Model:**

1. **Product Operation** – factors like reliability, efficiency, and usability.
2. **Product Revision** – maintainability and testability.
3. **Product Transition** – portability and reusability.

**c) Quality Factor Concerned with Security:**

**Integrity** is the McCall quality factor concerned with preventing unauthorized access to software or data.

**d) Five Maturity Levels of CMMI-DEV Model:**

1. Initial
2. Managed
3. Defined
4. Quantitatively Managed
5. Optimizing

**e) Need for ITIL Framework (2 Sentences):**

ITIL helps organizations align IT services with business needs by implementing best practices in service management. It improves service delivery, efficiency, and customer satisfaction.

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**Q5.**

**a) Verification vs. Validation:**

- **Verification** checks if the software is built correctly (e.g., reviews, inspections, walkthroughs).
- **Validation** checks if the right software is built to meet user needs (e.g., testing activities).

**b) Boundary Value Analysis Test Cases for Age (18–65):**

**Test Case Input Expected Outcome**

17	Invalid (Below boundary)
18	Valid (Lower boundary)
19	Valid (Just above lower)
64	Valid (Just below upper)
65	Valid (Upper boundary)
66	Invalid (Above boundary)

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**Q6.**

**a) Automated vs. Manual Testing + 4 Advantages:**

- **Automated Testing** uses tools/scripts to execute tests, while **Manual Testing** is performed by human testers.
- **Advantages of Automated Testing:**
  1. Faster execution and feedback
  2. Reusability of test scripts
  3. Higher accuracy and consistency
  4. Supports continuous integration and delivery

**b) Purpose and Key Components of a Test Plan:**

- **Purpose:** A test plan outlines the scope, approach, resources, and schedule for testing activities.
- **Key Components:**
  1. Test objectives
  2. Scope
  3. Test strategy
  4. Resources and responsibilities
  5. Schedule
  6. Risk and contingency plan