Subject Name Solutions

4353202 – Winter 2024

Semester 1 Study Material

Detailed Solutions and Explanations

Question 1(a) [3 marks]

Define software and explain its characteristics.

Software is a collection of computer programs, procedures, and documentation that performs tasks on a computer system.

Table 1: Software Characteristics

Characteristic	Description
Intangible	Cannot be touched, only experienced
Developed	Engineered, not manufactured
Maintainable	Can be modified and updated
Reliable	Should work consistently
Efficient	Uses resources optimally

- **Key point**: Software = Programs + Documentation + Procedures

Solution

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Question 1(b) [4 marks]

Solution

Waterfall Model is a linear sequential software development approach where each phase must be completed before the next begins.

Key Features:

- **Sequential phases**: No overlap between phases
- **Documentation-driven**: Heavy documentation at each phase
- **Simple structure**: Easy to understand and manage
- **Fixed requirements**: Changes are difficult once started

Mnemonic

"Real Systems Include Testing, Deployment, Maintenance"

Question 1(c) [7 marks]

Solution

Software Process Framework provides the foundation for complete software engineering process by identifying key process areas.

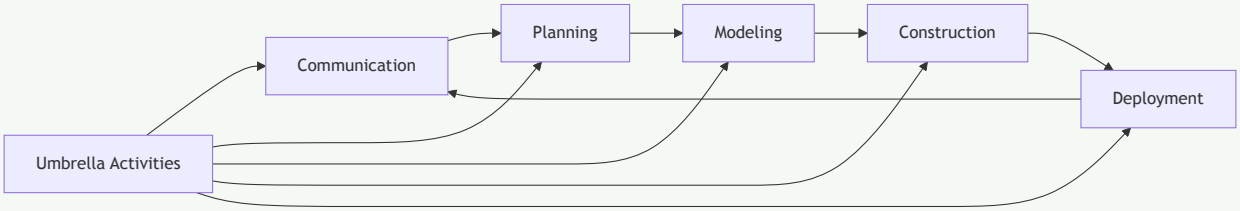


Table 2: Framework Activities vs Umbrella Activities

Framework Activities	Umbrella Activities
Communication	Software project tracking
Planning	Risk management
Modeling	Quality assurance
Construction	Technical reviews
Deployment	Configuration management

Framework Activities:

- **Communication**: Gather requirements from stakeholders
- **Planning**: Create project plan and schedule
- **Modeling**: Create design models
- **Construction**: Code generation and testing
- **Deployment**: Software delivery and feedback

Umbrella Activities run throughout the project:

- **Project tracking**: Monitor progress
- **Risk management**: Identify and control risks
- **Quality assurance**: Ensure quality standards
- **Configuration management**: Control changes

Mnemonic

"Can People Make Construction Deploy" (Communication, Planning, Modeling, Construction, Deployment)

Question 1(c) OR [7 marks]

Solution

SCRUM is an agile framework for managing software development projects using iterative and incremental practices.

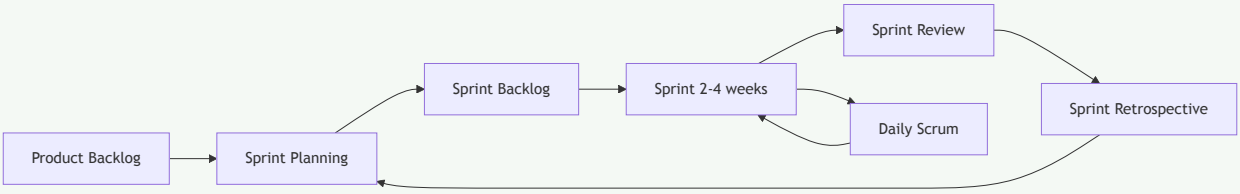


Table 3: SCRUM Roles and Artifacts

Component	Description
Product Owner	Defines requirements and priorities
Scrum Master	Facilitates process and removes obstacles
Development Team	Self-organizing team that builds product
Product Backlog	Prioritized list of features

Sprint Backlog Tasks selected for current sprint

Key Events:
- **Sprint Planning**: Select work for upcoming sprint
- **Daily Scrum**: 15-minute daily synchronization
- **Sprint Review**: Demonstrate completed work
- **Sprint Retrospective**: Reflect and improve process

Benefits: Fast delivery, flexibility, continuous improvement, customer collaboration

Mnemonic

"People Sprint Daily Reviewing Retrospectively"

Question 2(a) [3 marks]

Solution

SRS (Software Requirements Specification) document should have specific qualities to be effective.

Table 4: Good SRS Characteristics

Characteristic	Meaning
Complete	All requirements included
Consistent	No contradictory requirements
Unambiguous	Clear and single interpretation
Verifiable	Can be tested and validated
Modifiable	Easy to change when needed

- **Complete**: Contains all functional and non-functional requirements
- **Consistent**: No conflicts between different requirements
- **Unambiguous**: Each requirement has only one interpretation

Mnemonic

"Complete Computers Use Verified Modifications"

Question 2(b) [4 marks]

Solution

Prototype Model creates a working model of software to understand requirements better.

Table 5: Prototype Model - Pros and Cons

Advantages	Disadvantages
Better requirement understanding	**Time consuming**
User involvement	**Cost increase**
Early error detection	**Incomplete analysis**
User satisfaction	**Prototype confusion**

Advantages:
- **Clear requirements**: Users see working model
- **Early feedback**: Reduces final product risks
- **User involvement**: Better user acceptance

Disadvantages:
- **Extra time**: Building prototype takes time
- **Additional cost**: Resources needed for prototype
- **Scope creep**: Users may expect prototype features

Mnemonic

"Better Users Experience" vs "Time Costs Increase"

Question 2(c) [7 marks]

Solution

Spiral Model combines iterative development with systematic risk management through repeated cycles.

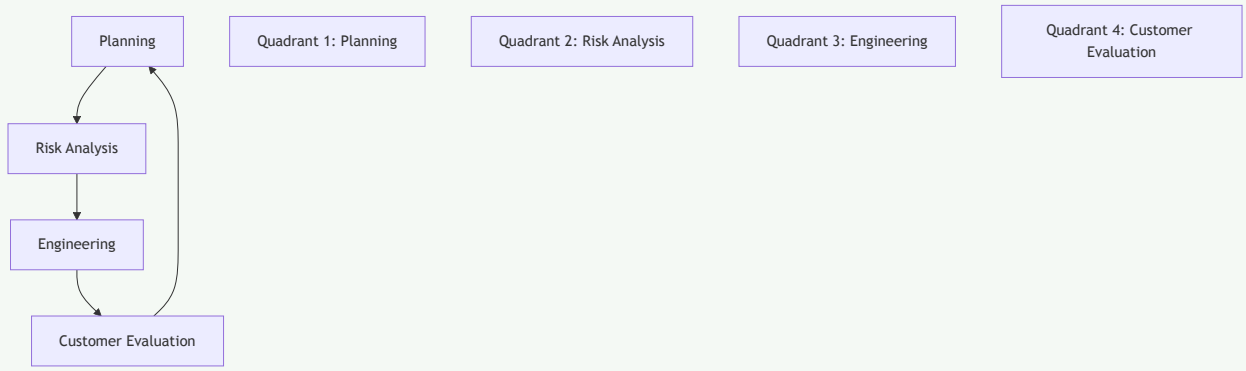


Table 6: Spiral Model Phases

Phase	Activities
Planning	Requirements gathering, resource planning
Risk Analysis	Identify and resolve risks
Engineering	Development and testing
Customer Evaluation	Customer reviews and feedback

Advantages:
- **Risk management**: Early risk identification
- **Flexibility**: Accommodates changes easily
- **Customer involvement**: Regular customer feedback
- **Quality focus**: Continuous testing and validation

Disadvantages:
- **Complex management**: Difficult to manage
- **High cost**: Expensive due to risk analysis
- **Time consuming**: Long development cycles
- **Risk expertise needed**: Requires risk assessment skills

Best for: Large, complex, high-risk projects

Mnemonic

"Plan Risks Engineering Customer" for phases

Question 2(a) OR [3 marks]

Solution

Incremental Model delivers software in small, functional pieces called increments.

Key Features:

- **Partial implementation**: Each increment adds functionality
- **Early delivery**: Core features delivered first
- **Parallel development**: Multiple increments can be developed simultaneously

Table 7: Incremental Model Characteristics

Aspect	Description
Delivery	Multiple releases
Functionality	Grows with each increment
Risk	Reduced through early delivery
Feedback	Continuous user feedback

Mnemonic

"Deliver Functionality Reducing Feedback"

Question 2(b) OR [4 marks]

Solution

RAD (Rapid Application Development) emphasizes rapid prototyping and quick feedback over extensive planning.

Table 8: RAD Model Phases

Phase	Duration	Activities
Business Modeling	Short	Define business functions
Data Modeling	Short	Define data requirements
Process Modeling	Short	Convert data to business info
Application Generation	Short	Use tools to create software
Testing & Turnover	Short	Test and deploy

Key Concepts:

- **Reusable components**: Pre-built components speed development
- **Powerful tools**: CASE tools and code generators
- **Small teams**: 2-6 people per team
- **Time-boxed**: Strict time limits (60-90 days)

Requirements for RAD:

- **Well-defined business requirements**
- **User involvement** throughout process
- **Skilled developers** familiar with RAD tools

Mnemonic

"Business Data Process Application Testing"

Question 2(c) OR [7 marks]

Solution

SDLC (Software Development Life Cycle) is a systematic process for building software through well-defined phases.

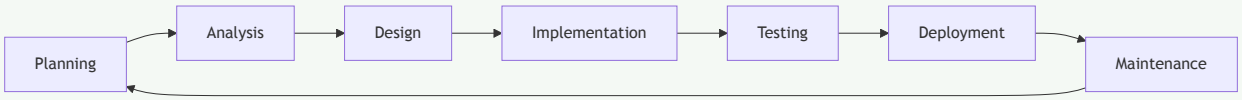


Table 9: SDLC Phases Detailed

Phase	Activities	Deliverables
Planning	Project planning, feasibility study	Project plan
Analysis	Requirement gathering	SRS document
Design	System architecture, UI design	Design document
Implementation	Coding, unit testing	Source code
Testing	System testing, integration	Test reports
Deployment	Installation, user training	Live system
Maintenance	Bug fixes, enhancements	Updated system

Phase Descriptions:

- **Planning**: Define project scope and resources
- **Analysis**: Understand what system should do
- **Design**: Plan how system will work
- **Implementation**: Build the actual system
- **Testing**: Verify system works correctly
- **Deployment**: Release system to users
- **Maintenance**: Ongoing support and updates

Mnemonic

"People Always Design Implementation, Test Deployment, Maintain"

Question 3(a) [3 marks]

Solution

Software Project Management requires combination of technical and soft skills.

Table 10: Essential Project Management Skills

Skill Category	Specific Skills
Technical	Understanding SDLC, tools, technologies
Leadership	Team motivation, decision making
Communication	Clear communication with team and clients
Planning	Resource allocation, scheduling
Problem-solving	Risk management, conflict resolution

Key Skills:

- **People management**: Lead and motivate team members
- **Technical knowledge**: Understand development process and tools
- **Communication**: Bridge between technical team and stakeholders

Mnemonic

"Technical Leaders Communicate Planning Problems"

Question 3(b) [4 marks]

Solution

Software Project Manager oversees entire project from initiation to completion.

Table 11: Project Manager Responsibilities

Area	Responsibilities
Planning	Create project plans, schedules, budgets
Team Management	Hire, train, and manage team members
Communication	Regular updates to stakeholders
Quality Control	Ensure deliverables meet quality standards
Risk Management	Identify and mitigate project risks

Primary Responsibilities:

- **Project Planning**: Define scope, timeline, and resources
- **Team Leadership**: Guide and support development team
- **Stakeholder Communication**: Keep everyone informed of progress
- **Quality Assurance**: Ensure project meets requirements
- **Risk Management**: Handle project risks and issues

Success Factors: On-time delivery, within budget, meeting requirements

Mnemonic

"Plan Team Communication Quality Risk"

Question 3(c) [7 marks]

Solution

Requirements Classification helps organize and understand different types of system needs.

Table 12: Functional vs Non-Functional Requirements

Aspect	Functional Requirements	Non-Functional Requirements
Definition	What system should do	How system should perform
Focus	System functionality	System quality attributes
Examples	Login, search, calculate	Performance, security, usability
Testing	Functional testing	Performance testing

Functional Requirements:

- **User interactions**: Login, registration, data entry
- **Business rules**: Validation rules, calculations
- **System features**: Reports, notifications, workflows
- **Data processing**: CRUD operations

Examples:

- User can login with username/password
- System calculates tax automatically
- Generate monthly sales report

Non-Functional Requirements:

Table 13: Non-Functional Requirement Types

Type	Description	Example
Performance	Speed and responsiveness	Response time < 2 seconds
Security	Data protection	Encrypted data transmission
Usability	User experience	Easy to learn interface
Reliability	System dependability	99.9% uptime
Scalability	Growth handling	Support 1000+ users

Quality Attributes:

- **Performance**: Response time, throughput
- **Security**: Authentication, authorization, encryption
- **Usability**: User-friendly interface, accessibility
- **Reliability**: Uptime, error handling
- **Maintainability**: Code quality, documentation

Mnemonic

"Performance Security Usability Reliability Maintainability"

Question 3(a) OR [3 marks]

Solution

SRS (Software Requirements Specification) is crucial document that defines what software should do.

Table 14: SRS Importance

Aspect	Benefit
Clear Communication	All stakeholders understand requirements
Project Planning	Basis for estimation and scheduling
Quality Assurance	Foundation for testing
Change Management	Controlled requirement changes
Legal Protection	Contract reference document

Key Importance:

- **Communication tool**: Bridge between clients and developers
- **Planning foundation**: Helps estimate time, cost, and resources
- **Testing basis**: Test cases derived from SRS requirements

Mnemonic

"Clear Planning Quality Change Legal"

Question 3(b) OR [4 marks]

Solution

Gantt Chart is a visual project management tool showing tasks, timelines, and dependencies.

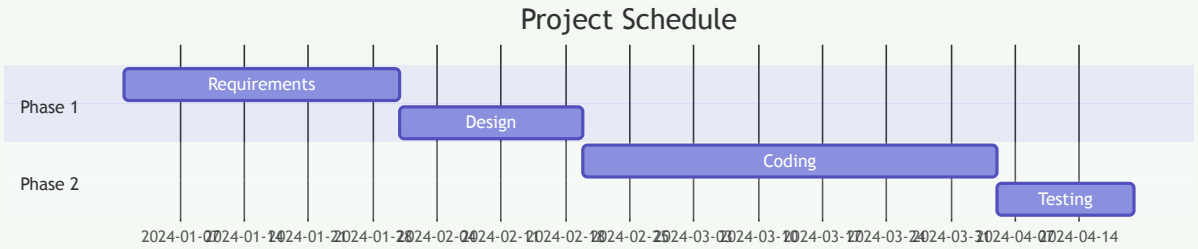


Table 15: Gantt Chart Components

Component	Description
Tasks	Work items to be completed
Timeline	Horizontal time scale
Bars	Task duration and progress
Dependencies	Task relationships
Milestones	Important project events

Benefits:

- **Visual timeline**: Easy to see project schedule
- **Progress tracking**: Monitor task completion
- **Resource planning**: Allocate resources effectively
- **Dependency management**: Understand task relationships

Mnemonic

"Tasks Timeline Bars Dependencies Milestones"

Question 3(c) OR [7 marks]

Solution

Risk Management is systematic process of identifying, analyzing, and controlling project risks.

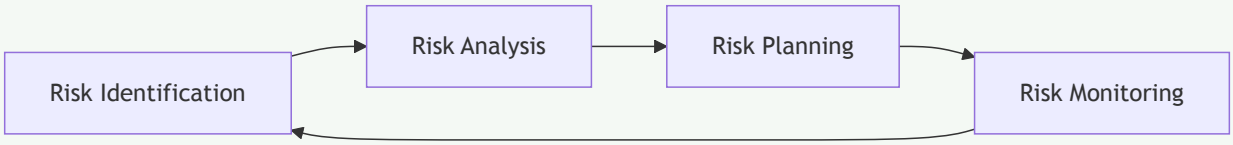


Table 16: Risk Management Process

Phase	Activities	Output
Identification	Find potential risks	Risk list
Analysis	Assess probability and impact	Risk priority
Planning	Develop response strategies	Risk response plan
Monitoring	Track and control risks	Updated risk status

Risk Categories:

Table 17: Types of Software Risks

Category	Examples
Technical	Technology changes, complexity
Project	Schedule delays, resource shortage
Business	Market changes, funding issues
External	Vendor problems, regulatory changes

Risk Response Strategies:

- **Avoid**: Eliminate risk source
- **Mitigate**: Reduce probability or impact
- **Transfer**: Share risk with others
- **Accept**: Live with the risk

Risk Assessment: Probability $\times Impact = RiskExposure$
Benefits: Proactive problem solving, better project success rate, stakeholder confidence

Mnemonic

"Identify Analyze Plan Monitor" for process, "Avoid Mitigate Transfer Accept" for strategies

Question 4(a) [3 marks]

Solution

Size Estimation Metrics help predict software project size and effort.

Table 18: Size Estimation Metrics

Metric	Description
LOC	Lines of Code
Function Points	Functionality-based measurement
Object Points	For object-oriented systems
Feature Points	Enhanced function points

Function Points (FP) measure software size based on user functionality.
FP Components:

- **External Inputs**: Data entry screens
- **External Outputs**: Reports, messages
- **External Queries**: Database queries
- **Internal Files**: Data stores
- **External Interfaces**: System connections

FP Calculation Example: For a Library Management System:

- External Inputs: 5 (Book entry, Member entry, etc.)
- External Outputs: 3 (Reports)
- External Queries: 4 (Search functions)
- Internal Files: 2 (Book DB, Member DB)
- External Interfaces: 1 (Online catalog)

Simple FP = 5 + 3 + 4 + 2 + 1 = 15 Function Points

Mnemonic

"Inputs Outputs Queries Files Interfaces"

Question 4(b) [4 marks]

Solution

COCOMO (COnstructive COst MOdel) estimates software development effort and schedule.

Table 19: COCOMO Model Types

Type	Description	Accuracy
Basic	Simple size-based estimation	±75%
Intermediate	Includes cost drivers	±25%
Detailed	Phase-level estimation	±10%

Basic COCOMO Formula:

- **Effort** = a $\times(KLOC)\hat{}b person - months$
- **Time** = c $\times(Effort)\hat{}d months$
- **People** = Effort / Time

Table 20: COCOMO Constants

Project Type	a	b	c	d
Organic	2.4	1.05	2.5	0.38
Semi-detached	3.0	1.12	2.5	0.35
Embedded	3.6	1.20	2.5	0.32

Example: For 10 KLOC organic project

- Effort = 2.4 $\times(10)\hat{}1.05 = 25.47 person - months$
- Time = 2.5 $\times(25.47)\hat{}0.38 = 8.64 months$
- People = 25.47 / 8.64 = 3 people

Mnemonic

"Organic Semi Embedded" for project types

Question 4(c) [7 marks]

Solution

Sprint Burn Down Chart tracks remaining work during a sprint for **Online Shopping System**.

Sprint Goal: User Authentication Module
Sprint Duration: 2 weeks
Total Story Points: 40

Sprint Backlog:

Table 21: Sprint Tasks

Task	Story Points	Day Assigned
User Registration	8	Day 1-2
User Login	6	Day 3-4
Password Reset	5	Day 5-6
Profile Management	8	Day 7-8
Session Management	6	Day 9-10
Testing & Bug Fixes	7	Day 11-14

Burn Down Chart Data:

Table 22: Daily Progress

Day	Ideal Remaining	Actual Remaining	Work Completed
Day 0	40	40	Sprint Start
Day 2	36	38	Registration delay
Day 4	32	32	Login completed
Day 6	28	27	Password reset done early
Day 8	24	26	Profile management issues
Day 10	20	20	Back on track
Day 12	16	15	Testing progressing well
Day 14	0	0	Sprint completed

Chart Analysis:

- **Green line**: Ideal burn down
- **Red line**: Actual progress

- **Variations**: Show challenges and recoveries
- **Completion**: Sprint finished on time

Benefits: Visual progress tracking, early problem identification, team motivation

Mnemonic

"Track Progress Daily, Identify Issues Early"

Question 4(a) OR [3 marks]

Solution

Use Case Diagram shows system functionality from user perspective.

Table 23: Use Case Diagram Components

Component	Symbol	Description
Actor	Stick figure	External entity interacting with system
Use Case	Oval	System functionality
System Boundary	Rectangle	System scope
Association	Line	Actor-Use Case relationship
Generalization	Arrow	Inheritance relationship

Relationships:

- **Include**: One use case includes another (mandatory)
- **Extend**: Optional use case extension
- **Generalization**: Parent-child relationship

Example Components:

- **Primary Actor**: Customer, Admin
- **Use Cases**: Login, Search Products, Place Order
- **System**: Online Shopping System

Mnemonic

"Actors Use Systems, Associate Generally"

Question 4(b) OR [4 marks]

Solution

Cohesion and Coupling are important software design principles affecting maintainability.

Table 24: Cohesion vs Coupling Comparison

Aspect	Cohesion	Coupling
Definition	Unity within module	Dependency between modules
Desirable Level	High cohesion preferred	Low coupling preferred
Focus	Internal module unity	Inter-module relationships
Impact	Module reliability	System flexibility
Measurement	How related are module elements	How dependent modules are

Cohesion Types (Low to High):
- **Coincidental**: Random grouping
- **Logical**: Similar logic
- **Temporal**: Same time execution
- **Procedural**: Sequential steps
- **Communicational**: Same data
- **Sequential**: Output of one is input of next
- **Functional**: Single purpose

Coupling Types (High to Low):
- **Content**: Direct access to module internals
- **Common**: Shared global data
- **External**: Shared external interface
- **Control**: Control information passed
- **Stamp**: Data structure passed
- **Data**: Simple data passed

Goal: **High Cohesion + Low Coupling = Good Design**

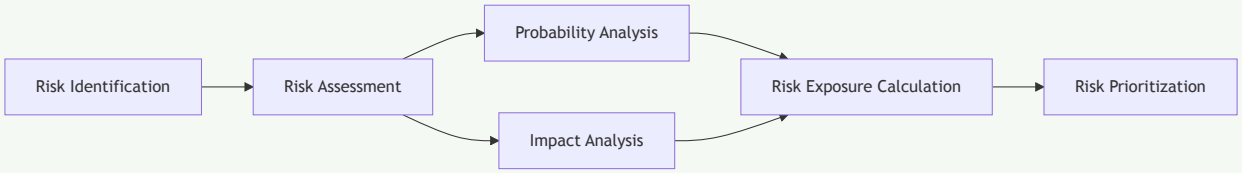
Mnemonic

"High Cohesion, Low Coupling" for good design

Question 4(c) OR [7 marks]

Solution

Risk Assessment evaluates identified risks to prioritize management efforts.



Risk Assessment Components:

Table 25: Risk Assessment Elements

Element	Description	Scale
Probability	Likelihood of risk occurring	0.1 to 1.0
Impact	Consequences if risk occurs	1 to 10
Risk Exposure	Probability $\times Impact$	Calculated value
Risk Level	Priority classification	High/Medium/Low

Assessment Process:
1. Probability Assessment:
- **Very Low (0.1)**: Unlikely to happen
- **Low (0.3)**: Possible but not probable
- **Medium (0.5)**: May or may not happen
- **High (0.7)**: Likely to happen
- **Very High (0.9)**: Almost certain

2. Impact Assessment:
- **Catastrophic (9-10)**: Project failure
- **Critical (7-8)**: Major delays/cost overrun
- **Marginal (4-6)**: Some impact on schedule/budget
- **Negligible (1-3)**: Little impact

3. Risk Exposure Calculation: **Risk Exposure = Probability** $\times Impact$
Example Risk Assessment:

Table 26: Sample Risk Analysis

Risk	Probability	Impact	Exposure	Priority
Key developer leaves	**0.3**	**8**	**2.4**	**Medium**
Requirements change	**0.7**	**6**	**4.2**	**High**
Technology failure	**0.2**	**9**	**1.8**	**Low**
Budget cuts	**0.4**	**7**	**2.8**	**Medium**

Risk Matrix:
- **High Priority: Exposure $>$ 4.0**
- **Medium Priority: Exposure 2.0-4.0**
- **Low Priority: Exposure $<$ 2.0**

Assessment Benefits:
- **Objective prioritization: Data-driven decisions**
- **Resource allocation: Focus on high-risk items**
- **Communication tool: Clear risk communication**
- **Planning input: Influences project planning**

Mnemonic

"Probability Impact Exposure Priority"

Question 5(a) [3 marks]

Solution

Code Inspection is formal, systematic examination of code to find defects.

Table 27: Code Inspection Process

Phase	Participants	Activities
Planning	Moderator	Schedule inspection, distribute code
Overview	Author, Team	Author explains code
Preparation	Individual	Each reviewer studies code
Inspection	All reviewers	Find defects systematically
Rework	Author	Fix identified defects
Follow-up	Moderator	Verify fixes

Key Features:
- **Formal process**: Structured approach with defined roles
- **Systematic review**: Line-by-line examination
- **Defect focused**: Find errors, not solutions
- **No author criticism**: Focus on code, not coder

Benefits: Early defect detection, knowledge sharing, improved code quality

Mnemonic

"Plan Overview Prepare Inspect Rework Follow-up"

Question 5(b) [4 marks]

Solution

ATM Test Cases verify automated teller machine functionality.

Table 28: ATM Test Cases

Test Case ID	Test Scenario	Input	Expected Output	Result
TC001	Valid PIN Entry	Correct 4-digit PIN	Access granted, main menu displayed	Pass/Fail
TC002	Invalid PIN Entry	Wrong PIN (3 attempts)	Card blocked, error message	Pass/Fail
TC003	Cash Withdrawal	Amount $\leq Accountbalance$	Cash dispensed, receipt printed	Pass/Fail
TC004	Insufficient Balance	Amount > Account balance	Transaction declined, balance shown	Pass/Fail

Detailed Test Cases:

Test Case 1: Valid Login
- **Precondition**: ATM is operational, card inserted
- **Steps**: Enter correct PIN $\rightarrow PressEnter$
- **Expected**: Main menu with options displayed

Test Case 2: Cash Withdrawal
- **Precondition**: User logged in, sufficient balance
- **Steps**: Select Withdrawal $\rightarrow Enteramount \rightarrow Confirm$
- **Expected**: Cash dispensed, balance updated

Test Case 3: Balance Inquiry
- **Precondition**: User logged in
- **Steps**: Select Balance Inquiry
- **Expected**: Current balance displayed on screen

Test Case 4: PIN Change
- **Precondition**: User logged in
- **Steps**: Select Change PIN $\rightarrow EnteroldPIN \rightarrow EnternewPIN \rightarrow Confirm$
- **Expected**: PIN changed successfully, confirmation message

Mnemonic

"Login Withdraw Inquiry Change"

Question 5(c) [7 marks]

Solution

White Box Testing examines internal code structure and logic paths.

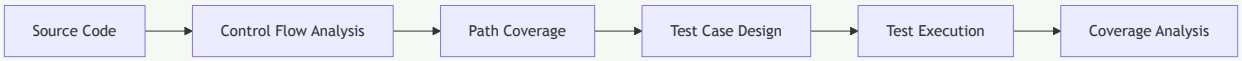


Table 29: White Box Testing Characteristics

Aspect	Description
Focus	Internal code structure
Knowledge	Code implementation details
Coverage	Statements, branches, paths
Techniques	Basis path, loop testing
Tools	Code coverage analyzers

Coverage Criteria:

Table 30: Coverage Types

Coverage Type	Description	Goal
Statement Coverage	Execute every statement	100% statements
Branch Coverage	Execute every branch	All if-else paths
Path Coverage	Execute every path	All possible paths
Condition Coverage	Test all conditions	True/false for each condition

White Box Testing Techniques:

1. **Basis Path Testing**:
   - Calculate **Cyclomatic Complexity**: V(G) = E - N + 2
   - E = Edges,
     N = Nodes in control flow graph
   - Generate independent paths equal to V(G)
2. **Loop Testing**:
   - **Simple loops**: Test 0, 1, 2, typical, max iterations
   - **Nested loops**: Test inner loop first, then outer
   - **Concatenated loops**: Test as separate loops
3. **Condition Testing**:
   - Test all logical conditions (AND, OR, NOT)
   - Ensure each condition evaluates to true and false

Example: Simple Code Testing

```
if (age >= 18 AND income > 25000)
    approve_loan();
else
    reject_loan();
```

Test Cases:

- age=20, income=30000 (both true) → *approve*
- age=16, income=30000 (first false) → *reject*
- age=20, income=20000 (second false) → *reject*
- age=16, income=20000 (both false) → *reject*

Advantages:

- **Thorough testing**: Tests internal logic
- **Early defect detection**: Finds logic errors
- **Coverage measurement**: Quantifiable testing progress

Disadvantages:

- **Time consuming**: Requires code knowledge
- **Expensive**: Needs skilled testers
- **Maintenance**: Changes with code updates

Tools: JUnit (Java), NUnit (.NET), Coverage.py (Python)

Mnemonic

"Statement Branch Path Condition" for coverage types

Question 5(a) OR [3 marks]

Solution

Code Walk Through is informal code review technique where author presents code to team.

Table 31: Walk Through Process

Phase	Description	Duration
Preparation	Author prepares presentation	30 minutes
Presentation	Author explains code logic	1-2 hours
Discussion	Team asks questions, suggests improvements	30 minutes
Documentation	Record issues and action items	15 minutes

Key Characteristics:

- **Author-led**: Code author drives the session
- **Informal process**: Less structured than inspection
- **Educational**: Team learns about code functionality
- **Collaborative**: Open discussion encouraged

Participants:

- **Author**: Presents and explains code
- **Reviewers**: Ask questions and provide feedback
- **Moderator**: Keeps discussion focused (optional)

Benefits: Knowledge sharing, early problem detection, team collaboration, learning opportunity

Mnemonic

"Prepare Present Discuss Document"

Question 5(b) OR [4 marks]

Solution

Software Documentation provides information about software system for various stakeholders.

Table 32: Documentation Types

Type	Purpose	Audience
User Documentation	How to use software	End users
System Documentation	Technical details	Developers, maintainers
Process Documentation	Development process	Project team
Requirements Documentation	What system should do	All stakeholders

Internal Documentation:
- **Code comments**: Explain complex logic
- **Function headers**: Describe purpose and parameters

- **Variable names**: Self-documenting identifiers
- **README files**: Project overview and setup

External Documentation:
- **User manuals**: Step-by-step usage instructions
- **Installation guides**: Setup procedures
- **API documentation**: Interface specifications
- **Training materials**: Educational content

Benefits:
- **Maintainability**: Easier code updates
- **Knowledge transfer**: New team members learn faster
- **User support**: Reduces support requests
- **Quality assurance**: Documents requirements and design

Documentation Standards: Consistent format, regular updates, version control, accessibility

Mnemonic

"User System Process Requirements" for types

Question 5(c) OR [7 marks]

Solution

Black Box Testing examines software functionality without knowledge of internal code structure.

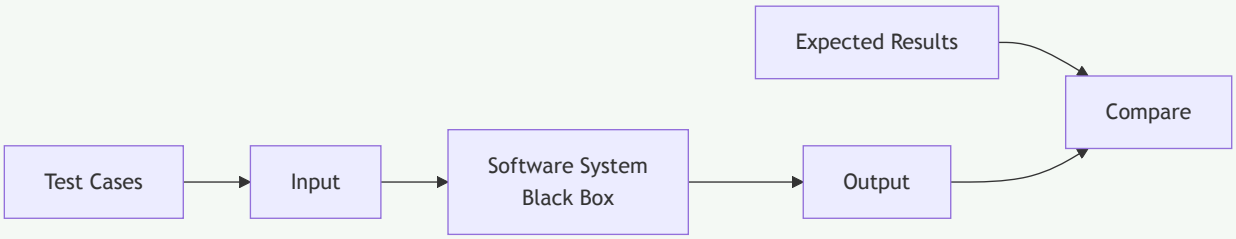


Table 33: Black Box Testing Characteristics

Aspect	Description
Focus	External behavior
Knowledge	Requirements and specifications
Approach	Input-output relationship
Coverage	Functional requirements
Perspective	User viewpoint

Black Box Testing Techniques:

Table 34: Testing Techniques

Technique	Description	Example
Equivalence Partitioning	Divide inputs into valid/invalid classes	Age: 0-17, 18-65, >65
Boundary Value Analysis	Test at boundaries	Test age: 17, 18, 65, 66
Decision Table	Complex business rules	Insurance premium calculation
State Transition	System state changes	ATM states: idle, processing, error

1. **Equivalence Partitioning**:
   - **Valid partitions**: Accepted inputs
   - **Invalid partitions**: Rejected inputs
   - **Test one value** from each partition

Example: Password length (6-12 characters)
   - Valid: 6-12 characters
   - Invalid: <6 characters, >12 characters

2. **Boundary Value Analysis**:
   - Test **minimum, maximum, just below minimum, just above maximum**
   - Most errors occur at boundaries

Example: For range 1-100
   - Test: 0, 1, 2, 99, 100, 101

3. **Decision Table Testing**:
   - **Conditions**: Input conditions
   - **Actions**: Expected outputs
   - **Rules**: Condition-action combinations

Advantages:
   - **User perspective**: Tests from user viewpoint
   - **No code knowledge needed**: Testers don't need programming skills
   - **Unbiased**: Not influenced by code implementation
   - **Early testing**: Can start with requirements

Disadvantages:
   - **Limited coverage**: May miss some code paths
   - **Redundant testing**: Might test same logic multiple times
   - **Difficult test case design**: Hard without internal knowledge

Types of Black Box Testing:
   - **Functional Testing**: Core functionality
   - **Non-functional Testing**: Performance, usability
   - **Regression Testing**: After changes
   - **User Acceptance Testing**: Final validation

Tools: Selenium (web), Appium (mobile), TestComplete, QTP

When to Use:
   - System testing phase
   - User acceptance testing
   - Integration testing
   - Regression testing

Mnemonic

"Equivalence Boundary Decision State" for techniques