



Polytechnic University of Durango

Software Quality Assurance

PDCA cycle and Software Testing

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1. Introduction

1.1 Purpose and Objectives of the Tests

This document defines the test plan for the distribution center's package management system, which is based on barcodes for package categorization and storage.

One of the main objectives is:

- Verify that the system meets all functional requirements.
- Validate compliance with non-functional requirements.
- Identify defects before deployment to production.
- Ensure the integrity of data and transactions.
- Validate system performance under normal load.

2. Testing Strategy

2.1 Types of Applicable Tests

Test Type	Description
Functional	Validate FR1-FR5.
Integration	Interaction between complete modules.
Regression	Re-run the tests to check if anything else has moved.
Performance	Verify if it meets the NFR-1 response times
Usability	Verify if it complies with the NFR-3 CLI interface.
Security	Verify if it complies with NFR-6
Reliability	Verify if it complies with the NFR-2 data integrity.

3. Testing Environment

3.1 Hardware

Test Computer:

- Intel Core i3 processor or higher
- 4GB RAM minimum
- 1GB free storage space

3.2 Software

- Operating System: Windows 10/11, macOS, or Linux.
- Python: Version 3.8 o superior.
- Database: SQLite 3.x
- Editor/IDE: VS Code
- Control de Versiones: File Explorer with Folders numbered.

4. Entry and exit criteria

Entry Criteria

- Source code available and compileable
- Test environment configured
- Database initialized successfully
- Documented and reviewed test cases
- Test data prepared
- Trained testing team

Exit Criteria

- 100% of high-priority test cases executed
- 90% of total test cases executed
- 95% of the cases executed were successful
- Zero open critical defects
- Major defects documented with workaround
- Test report completed
- Quality metrics within acceptable thresholds

5. Test Cases

5.1 Summary of Test Cases

Requirement ID	# Test Cases	Priority
FR1- Package Registration	15	High
FR2- Category Management	8	High
FR3- Location Assignment	10	High
FR4- Package Tracking	12	High
FR5- Reports	6	Media
NFR1- Performance	5	Media

NFR2- Reliability	6	High
NFR3- Usability	4	Media
NFR4- Security	5	Media
TOTAL	71	-

5.2 Detailed Test Cases for FR1

Use:

The 15 test cases for FR1 are already documented in the requirements specification document (TC-FR1-001 a TC-FR1-015).

5.3 New Test Cases to Develop

FR2: Category Management:

ID	Name	Description	Priority
TC-FR2-001	Express Categorization	Verify correct assignment to Express category	Alta ▾
TC-FR2-002	International Categorization	Validate detection of international packages	Alta ▾
TC-FR2-003	Heavy Categorization	Test weight threshold > 50kg	Alta ▾
TC-FR2-004	Fragile Categorization	Check weight < 5kg → Fragile	Alta ▾
TC-FR2-005	Standard Categorization	Default when no other rules apply	Media ▾
TC-FR2-006	Rule Priority	Validate rule application order	Alta ▾
TC-FR2-007	Search by Category	Retrieve all packages from a category	Media ▾

TC-FR2-008	Zones by Category	Verify correct assignment of zones A-E	Media ▾
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FR3: Location Assignment

ID	Name	Description	Priority
TC-FR3-001	Correct Assignment by Zone	Location matches category zone	Alta ▾
TC-FR3-002	Available Locations	Only available locations are assigned.	Alta ▾
TC-FR3-003	Mark Occupied Location	is_occupied = 1 after assignment	Alta ▾
TC-FR3-004	Free Location	is_occupied = 0 when package is delivered	Alta ▾
TC-FR3-005	No Locations Available	Error when zone is full	Alta ▾
TC-FR3-006	Location Code Format	ZONE##-## valid format	Media ▾
TC-FR3-007	100 Total Locations	5 zones × 20 locations	Media ▾
TC-FR3-008	Search by Zone	Filter locations by specific area	Baja ▾
TC-FR3-009	Occupation Inquiry	List only available/occupied	Baja ▾
TC-FR3-010	Prevention of Double Assignment	Same location_id not assigned twice	Alta ▾

FR4: Package Tracking

ID	Name	Description	Priority
TC-FR4-001	Search by Barcode	Find existing package	Alta ▾
TC-FR4-002	Search Code Does Not Exist	Appropriate message if none exists	Alta ▾
TC-FR4-003	Status Update	Change status successfully	Alta ▾
TC-FR4-004	Valid States	Received, Stored, In Transit, Delivered	Alta ▾
TC-FR4-005	Audit Trail Creation	Automatic recording in AuditTrail	Alta ▾
TC-FR4-006	Audit Trail Completo	All fields populated correctly	Alta ▾
TC-FR4-007	Change History	Multiple changes recorded chronologically	Media ▾
TC-FR4-008	Liberation upon Surrender	Free location when status = Delivered	Alta ▾
TC-FR4-009	Search Time	< 1 second (NFR1.2)	Media ▾
TC-FR4-010	Search by Category	Filter packages by category_id	Baja ▾
TC-FR4-011	Search by Location	Packages in specific location	Baja ▾
TC-FR4-012	Search by State	Filter by current status	Media ▾

FR5: Reports

ID	Name	Description	Priority
TC-FR5-001	Full Report	All sections present	Alta ▾
TC-FR5-002	Count by Category	Correct numbers for each category	Alta ▾
TC-FR5-003	Count by State	Correct numbers by status	Alta ▾
TC-FR5-004	Occupancy by Zone	Correct % Calculation	Alta ▾
TC-FR5-005	Recent Activities	Last 10 actions shown	Media ▾
TC-FR5-006	Performance Report	< 2 seconds with 10,000 records	Media ▾

NFR1: Performance:

ID	Name	Description	Priority
TC-NFR1-001	Record < 2 sec	Registration time within the limit	Alta ▾
TC-NFR1-002	Search < 1 sec	Search time within the limit	Alta ▾
TC-NFR1-003	Report < 2 sec	Quick report generation	Media ▾
TC-NFR1-004	Allocation < 500ms	Quick location search	Media ▾
TC-NFR1-005	50 records/minute	Adequate throughput	Media ▾

NFR2: Reliability

ID	Name	Description	Priority
TC-NFR2-001	Rollback an Error	Transaction reversed if it fails	Alta ▾
TC-NFR2-002	Foreign Key Constraints	Referential integrity maintained	Alta ▾
TC-NFR2-003	Input Validation	Invalid data rejected	Alta ▾
TC-NFR2-004	DB Error Handling	Errors handled appropriately	Alta ▾
TC-NFR2-005	No Data Corruption	Consistent data after errors	Alta ▾
TC-NFR2-006	PRAGMA foreign_keys ON	Verify that it is enabled	Media ▾

NFR3 Usability

ID	Name	Description	Priority
TC-NFR3-001	Clear Menu	Numbered and descriptive options	Media ▾
TC-NFR3-002	Error Messages	Descriptive and actionable	Media ▾
TC-NFR3-003	Complete Confirmations	They include relevant details	Media ▾
TC-NFR3-004	Visual Indicators	Emojis/symbols improve readability	Baja ▾

NFR4: Security

ID	Name	Description	Priority
TC-NFR6-001	Parameterized Queries	There is no string concatenation	Alta ▾
TC-NFR6-002	SQL Injection Test	Malicious inputs handled correctly	Alta ▾
TC-NFR6-003	Input Validation	Sanitize before use	Alta ▾
TC-NFR6-004	Foreign Keys Enabled	PRAGMA executed	Media ▾
TC-NFR6-005	Handling Malicious Inputs	Strings like "1' OR '1'='1" are blocked.	Alta ▾

6. Testing Schedule

The following tables show the different iterations applied to the project using the PDCA methodology.

First iteration of PDCA.

Fase PDCA	Activities
Plan	<ul style="list-style-type: none">- Final review of the test plan.- Environment setup.
Do	<ul style="list-style-type: none">- Run the TC-FR1-5, along with the results log.
Check	<ul style="list-style-type: none">- Analysis of results.
Act	<ul style="list-style-type: none">- Correct the things that were found in the later stages.

Second iteration of PDCA:

Fase PDCA	Activities
Plan	<ul style="list-style-type: none">- Update test plan.- Add or edit the TC.
Do	<ul style="list-style-type: none">- Re-execute the TCs that failed from iteration 1.- Run the NFR-1-5.
Check	<ul style="list-style-type: none">- Analysis of results.
Act	<ul style="list-style-type: none">- Apply final corrections.- Update documentation and standardize what worked.

7. Defect Management

Severity of Defects

Level	Description	Example	Action
Critical	System not working, data loss	DB corrupted, crash	Resolve immediately
Major	Main functionality not working	Packages cannot be registered	Solve within 24 hours
Minor	Secondary functionality affected	Poorly done report	Resolve in 3 days or less
Trivial	Cosmetic problem	Typographical error	Resolve when possible

8. Quality Metrics

Metrics to track

- Test Pass Rate.
- Defect Density.
- Test Coverage.
- Defect Resolution Rate.
- Test Execution Progress.
- Average Time per Cost.