

Unit Testing Scenario and Sample Unit Test Plan

The following example follows one portion of an application from specification to turning the code over to Quality Assurance. In each phase there are examples of what is traditionally expected. If your organization adheres to methodology that is different from this one, then evaluate each step to determine that it is accomplished somewhere in your development cycle.

Phases:

- I. Specification
- II. Specification review
- III. Customer review
- IV. Writing the unit test plan
- V. Coding/Testing considerations
- VI. Unit test cases
- VII. Unit test plan review
- VIII. Move to Quality Assurance

PHASE I: Specification

Identification:

MOMS - Mail Order Management System
APE - Task #12, Address and Profile Entry Processing

Primary Functions:

This module will perform the following functions:

- A. Add a new customer
- B. Modify an existing customer
- C. Delete a customer
- D. Allow profile entry
- E. Prevent duplicate entries

References:

MOMS Data Dictionary, release #42
Button Definition Standards, release #6
Standard Field Tests, release #9

Functionality:

The address and profile processing routine is used by the Order Entry operators. The information on the screen must be completed before orders and payment information can be entered. The entry screen may be accessed from:

- A. Order Entry main menu selection 1: Enter a new customer
- B. Mail List Entry, Add option

All entries must contain sufficient information to create mailing labels for use in the United states and Canada. Profile information will be included only when it is available. The source code must be included for every entry.

No duplicate entries are permitted. The standard rules of capitalization will be employed.

Address Information Screen

The screenshot shows a software window titled "Address Information". The window contains several input fields and a vertical menu of action buttons. The fields are as follows:

Last Name:	Fratelli
First Name:	Martin
Address Line 1:	839 Front Street
Address Line 2:	Suite 192
City:	Cushing
State/Province:	NM
Zip/Postal Code:	15221-8224
Income Level:	0 Not Entered
No. in Household:	3
No. of Children:	1
Source Code:	IJM DataSources

On the right side of the window, there is a vertical stack of buttons: Add, Modify, Delete, Help, and Exit.

PHASE II: Specification Review

Quality Assurance jointly reviewed this specification with the programmer. The following **assumptions** must be confirmed:

1. The entry screen may be accessed from two sources, not just order entry. The list maintenance group will also have access.
2. The information on this screen must be present to add orders and payment information. The sequence of entry is not clear. We will permit orders to be entered before or after address information. Orders will not be fulfilled without all of the information and a message will be displayed to this effect if the situation arises. This is covered in more detail in the order processing module.
3. "Sufficient information to create a mailing label," will be treated to mean that the minimum amount of information will be:
 - A. Last Name
 - B. Address Line 1
 - C. City
 - D. State or Province

Zip or Postal Code, while desirable, is not a required entry.

4. If the source code is not known, it is acceptable to enter "Unknown."
5. Incomplete entries will be placing in a pending database to be completed when information is available. Entries in the pending file will be deleted automatically after 45 calendar days.
6. Testing for duplicate entries will be performed as follows. An entry is considered a duplicate if the First Name, Last Name, Address Line 1 and State/Province entry matches an existing database record. The State/Province entry must match exactly (it is always forced to uppercase). The Last Name entry will only examine the first five characters for duplication; the same is true for the Address Line 1 comparison.

Potential duplicates, based upon name and address, will be displayed and the operator will be allowed to make a determination concerning duplicates.

7. Since we do not have a document to identify the standard rules of capitalization, we will make all entries in upper and lowercase with the exception of State/Province which is always a two letter capitalized abbreviation.
8. Titles such as Mr., Ms., Mrs., etc., will be placed in the First Name field. The same is true of middle initials. Jr., III type entries will be acceptable in the Last Name field.
9. First initials may be used in lieu of full first names. They should be entered with a period, for example: use "S." not "S"
10. Income Level and Source Code will use drop down tables.
11. No special authorization is required to delete from the database. Names will not be deleted if there are any pending activities (payments, orders, etc.). All deleted names will be placed in a temporary file, from which they can be retrieved. They will remain in the temporary file for 18 months and then be deleted permanently.
12. Messages will be displayed when there is incomplete information on the screen giving the operator an opportunity to correct the entry.
13. Relational editing will take place after all entries are made, fields are individually validated whenever possible.

PHASE III: Customer Review

1. Zip/Postal Code is required. The US +4 may be omitted.
2. We will make multiple deliveries (more than one label) to the same Last Name and street address if there are more than two adults (number in household minus children greater than 2). Examine Address Line 2 to see if the address is a second apartment in the same building.
3. Please display a confirmation message on the screen after each entry. The message should be displayed for 1 second and go away without any operator action. If there is a problem with the entry, display a message that remains on the screen until the operator takes action.

All of the assumptions in PHASE II, are acceptable with the above exceptions and additions.

PHASE IV: Writing the Unit Test Plan

I. Introduction

Description: APE, Address and Profile Entry processing is an integral part of list management and will be responsible for all names added to the catalogue database.

Risks and contingencies: This module is required to implement the system and must be completed before other down line features can be tested. If this module is delayed in development or testing, the entire project will be delayed. Note that this task is on the critical path.

Test strategy and approach: Field testing will be performed manually and functional tests will be written in detail to be turned over to the automation test team. Test data will be taken from the MOMS Test Partition located on the Test Server.

Coverage requirements: 100% statement coverage. Standard (Release #9) tests will be performed on all character, date, and numeric entries.

Assumptions: All assumptions are identified and confirmed in PHASE II and PHASE III. These sections are included in this document.

Test objectives: All field entry must work properly, the module must be activated from the identified menu or button. This module is used extensively and the entry screen, messages, and responses must not be delayed.

Features to be tested: Verify that the Add, Modify, Delete, and Exit buttons work. No duplicate entries. Demonstrate that the correct context sensitive Help screens (by screen number) are displayed.

Features that will not be tested (and why): The content of the Help screens will be tested by the Training Department.

II. Unit Walkthrough

A structured walkthrough is presently scheduled. The complexity of the module does not warrant a review by itself, but the risk associated with it not working suggests that the review must take place. Participants in this review should include: testers, programmers, and support analysts. The order entry group should send at least one observer.

III. Tests, Scripts and Cases

Unit Tests

U1: Verify last name entry.

U1-S1: Last name is a required field. Attempt to enter a record with all entries except last name.

U1-S2: Last name may not exceed 35 characters. Submit a record with all fields completed and a last name of 36 characters.

U1-S3: Hyphens and apostrophes are permitted, but may not be the first character or the last character, and they must not appear in pairs. Attempt to enter a last name with a leading apostrophe; a trailing hyphen; a pair of hyphens in the middle of the name.

U1-S4: Enter a last name with a hyphen in the middle.

U1-S5: Enter a last name with a space-hyphen-space sequence in the middle and verify that the spaces are removed when exiting the field.

U2: Verify first name entry.

U2-S1: First names without last names are not permitted.

U2-S2: Insert a title such as Ms. or Mr. with the first name.

U2-S3: First name may not exceed 20 characters. Submit a record with all fields completed and use a first name of 21 characters.

U3: Verify address entry.

U3-S1: Verify that if address line 2 is used when address line 1 is not, line 2 automatically moves to line 1, when the Add button is clicked.

U3-S2: Verify that address is treated as a required entry.

U4: Verify City, State/Province, Zip/Postal code entry.

U4-S1: Verify that when a Zip/Postal code is entered that is not found in the Master Code database, an error message is displayed.

U4-S2: Verify that these fields are treated as required entries.

U5: Verify income level entry.

U5-S1: Enter a value from 0 to 5 and demonstrate that the corresponding dollar amounts are displayed.

U5-S1: Make an entry using the drop down table. A sample screen follows:

Last Name:	Fratelli
First Name:	Martin
Address Line 1:	839 Front Street
Address Line 2:	Suite 192
City:	Cushing
State/Province:	NM
Zip/Postal Code:	15221-8224
Income Level:	0 Not Entered
No. in Household:	1 - Less than \$25,000
No. of Children:	2 - \$25,000 - \$59,999
Source Code:	3 - \$60,000 - \$79,999
	4 - \$80,000 - \$99,999
	5 - Greater than \$99,999

U6: Verify household member entry.

U6-S1: Verify that this field may be left blank when no information is available.

U6-S2: Verify that when this number exceeds 10 a warning message appears.

U6-S3: Verify that this field contains a numeric entry or spaces.

U6-S4: Verify that the number of children is always less than the total number in the household.

U7: Verify source code entry.

U7-S1: Verify that only entries from the drop down table are permissible.

U7-S2: Verify that the point-and-shoot table works.

U8: Verify that duplicate entries cannot be made.

String Tests (Low level Integration)

S1: Verify that the module can be accessed from the Order Entry main menu.

S2: Verify that the module can be accessed from the Mail List entry Add button.

1. Single click
2. Ctrl-A
3. <Enter>
4. <Space bar>

S3: Verify that name and address entries are found in the Catalogue database.

S4: Use the filtering features of the List Selection Program.

IV. Test Execution and Support

Platform and environment

Platforms will include microcomputers with a minimum of 32 megabytes of memory and using either Windows 95 or NT (all versions.)

The application will run on the corporate network.

Progress measures and reporting

Status reports will be delivered at the weekly Friday meetings. The report will include: defect counts and identify the number of completed tests and the count of severe, moderate, and minor defects.

PHASE V: Coding/Testing Considerations

APE, task #12, will be treated as a single unit. Our definition of a unit of code is: an amount of code that is independently testable.

Additional tasks

- Test coverage: At least one positive and one negative test on all screen entry fields.
- 100% statement coverage for functional areas; 35% coverage for error handling routines.
- Library routines will be minimally tested with library scripts.
- String testing will include all modules.
- Automation: Our capture playback tool will be used to record all tests for documentation.
- All test setups will be automated.
- Static analysis (path, dead code, redundant code) will be reviewed daily.
- Code Management: Source control will be utilized.
Version control will be utilized.
- Integration: Will submit code for Tuesday and Friday builds.

PHASE VI: Unit Test Cases

Last Name Tests

Test No.	Test ID	Initial State	Test	Expected Result
1	U1-S1-C1	Valid entry in all fields.	Erase the last name and click Add.	Error 101: Last name is a required field.
2	U1-S2-C1	Valid entry in all fields.	Enter a last name with 35 characters and no spaces. Click Add.	Name is accepted, record is added and a clear input screen is displayed.
3	U1-S2-C2	Valid entry in all fields.	Enter a last name of 36 characters and no spaces.	Error 103: Last name may not exceed 35 characters.
4	U1-S3-C1	Valid entry in all fields.	Enter a last name in the form: 'Xxxxx	Name is accepted, record is added and a clear input screen is displayed.
5	U1-S3-C2	Valid entry in all fields.	Enter a last name in the form: 'Xxxxx	Error 107: First character must be a letter.
6	U1-S3-C3	Valid entry in all fields.	Enter a last name in the form XxxX-Xxxxx.	Name is accepted, record is added and a clear input screen is displayed.
7	U1-S3-C4	Valid entry in all fields.	Enter a last name in the form -Xxxxxxx	Error 107: First character must be a letter.
8	U1-S3-C5	Valid entry in all fields.	Enter a last name in the form Xxxxxx-	Error 111: Last character must be a letter.
9	U1-S3-C6	Valid entry in all fields.	Enter a last name in the form XxxX-XxxX-XxxX	Name is accepted, record is added and a clear input screen is displayed.
10	U1-S3-C7	Valid entry in all fields.	Enter a last name in the form XxxX--Xxxxx	Automatically correct and redisplay entry with single hyphen; Name is accepted, record is added and a clear input screen is displayed.

Similar state-transition matrices are created for each of the test scripts.

PHASE VII: Unit Test Plan Review

The walkthrough participants included Quality Assurance, Programming, and Support. The test plan appears to be thorough and we believe it provides adequate coverage. Coding can now begin.

PHASE VIII: Move to Quality Assurance

A unit test package is completed for the application and System Testing is notified that the application is ready to be released to their group.

Unit Test Package

- Compiles with production compiler options (no warning messages).
- Version control applied.
- All tests in the unit test plan have passed.
- Code walkthrough completed.
- Acceptable complexity levels.
- Follows department coding standards.
- Documentation complete.
- Source code uses comments.
- Diagrams have been added to the specification.
- 100% statement coverage in testing.
- Changes to JCL required.
- Test databases or other data structures modified.
- No undocumented features in program.
- Source control entered.
- All sign-offs complete.
- All scheduled reviews performed.
- Y2K compliant.

Additional notes and comments:

- ☞ The contents of the unit test package are negotiated between the testing organization and the development team.
- ☞ When reviewing specifications, it is more productive to return them with a list of assumptions as opposed to a series of questions. It may not be clear to the author why you have a question and precisely what you do not understand.
- ☞ It may be useful to add additional columns to the state -transition matrices used to identify the unit test cases. For example you may want to include columns to record testing platforms or suitability to be included in the regression test.

Test Id	Initial State	Test	Expected Result	Win 3.1	WFWG 3.11	Win 95	Win 98	Win NT 4
1: U1-S1-C1	Valid entry in all fields.	Erase the last name and click add	Error 101: Last name is a required field	NA		✓		✓

- ☞ Test automation may require more detail than the example above. For example, a procedure may be required.

U1-S1-C1 Procedure:

1. Start Mail Order Management System, MOMS100, from test partition SysTestOne.
2. Press Alt-O, for Order Entry menu.
3. Press Alt-A, for Add New Customer.
4. Enter all fields using the "Fratelli" customer template.
5. Press Tab after entering Source Code to position the cursor back to the Last name field.
6. Press the Delete key 8 times to delete the last name.
7. Single click the Add button.
8. Verify that error dialogue box is displayed in the center of the entry window with Error 101: Last name is a required field.
9. Click OK in the error dialogue box and verify that it is removed and the cursor returns to the Last name field.