

Basis Path Testing

This version will involve:

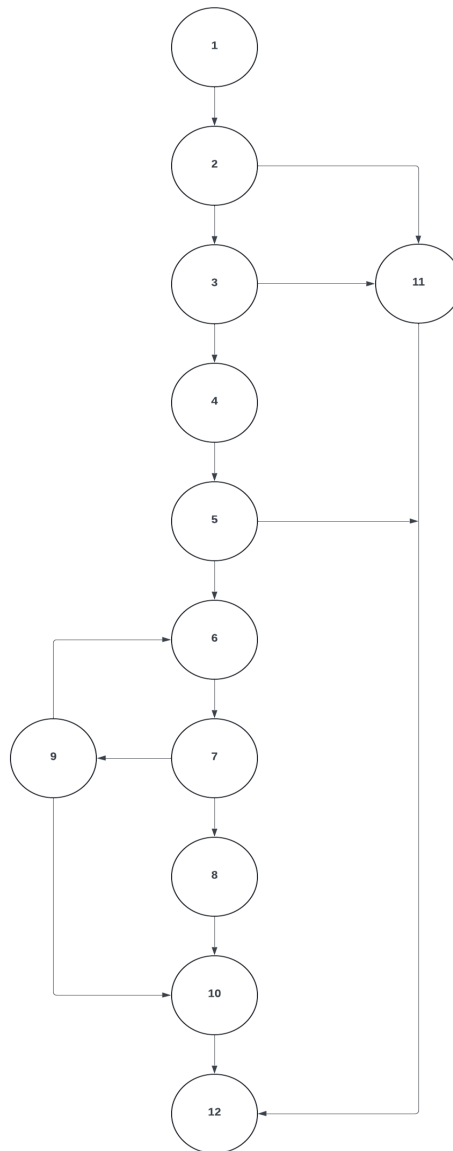
Input Validation: Checks if the username and password fields are not empty.

Authentication Check: Verifies if the username exists and if the password matches the stored hash for that username.

Session Handling: Establishes a session if the login is successful; otherwise, it might log the attempt or provide feedback about the failure.

Error Handling: Provides feedback to the user about the status of the login attempt.

Step 4: Create Flow Graph for the Loyalty System



ID	Nodes	Edges
1	Start	1 to 2
2	Check if inputs are empty	2 to 3(inputs not empty) 2 to 11(inputs empty)
3	Validate username and password	3 to 4(inputs valid) 3 to 11(inputs invalid)
4	Authenticate user	4 to 5(credentials correct) 4 to 11(credentials wrong)
5	Retrieve shopping cart	5 to 6
6	Determine loyalty level	6 to 7 (loyalty level), 6 to 9 (no loyalty level)
7	Calculate discount based on loyalty	7 to 8(applicable discount) 7 to 9(no discount)
8	Apply discount	8 to 9
9	Update shopping cart with new prices	9 to 10
10	Proceed to checkout	10 to 12
11	Provide feedback on error	11 to 12
12	End	

Step 2: Compute Cyclomatic Complexity

Using the formula :

$$CC = E - N + 2P:$$

$$E \text{ (Edges)} = 15$$

$$N \text{ (Nodes)} = 12$$

$$P \text{ (Connected Components)} = 1$$

$$CC = 15 - 12 + 2 \times 1 = 5$$

Step 3: Compute Independent Basis Paths

Four independent paths through the code can adequately test all logic:

1. **Start, Inputs Empty, Provide Feedback, End** (failure due to empty fields)
2. **Start, Inputs Not Empty, Invalid Format, Provide Feedback, End** (failure due to invalid format)
3. **Start, Inputs Valid, Credentials Incorrect, Provide Feedback, End** (failure due to incorrect credentials)
4. **Start, Inputs Valid, Credentials Correct, No Loyalty Level, Apply No Discount, Update Prices, Checkout, End** (no loyalty benefits)
5. **Start, Inputs Valid, Credentials Correct, Loyalty Level Determined, Discount Applicable, Apply Discount, Update Prices, Checkout, End** (discount applied)

Step 4: Derive Test Cases

For each path identified, craft specific inputs to verify proper handling of different scenarios:

Path 1: Inputs are empty.

- Test: Provide no username or password.
- Expected Outcome: Error message about required fields.

Path 2: Inputs are present but invalid.

- Test: Provide an improperly formatted email and a short password.
- Expected Outcome: Error message about invalid input formats.

Path 3: Inputs are valid, but credentials do not match.

- Test: Correct format, but incorrect username or password.
- Expected Outcome: Error message about incorrect credentials.

Path 4: All checks pass, no loyalty level.

- Test: Correct credentials, no loyalty level in user profile.
- Expected Outcome: Checkout with full price, no discounts applied.

Path 5: All checks pass, loyalty level determines discounts.

- Test: Correct credentials, applicable loyalty level.
- Expected Outcome: Successful checkout with discounts applied based on loyalty level.