Testing Concepts

Lab Book

Document Revision History

Date	Revision No.	Author	Summary of Changes
May 2022	1.0	Neelima Padmawar	Lab book creation

Table of Contents

Lab 1. White-box Testing – Code Coverage & Complexity

Goals	• Learn to find out the Code Coverage • Learn to determine Cyclomatic Complexity
Time	180 Minutes

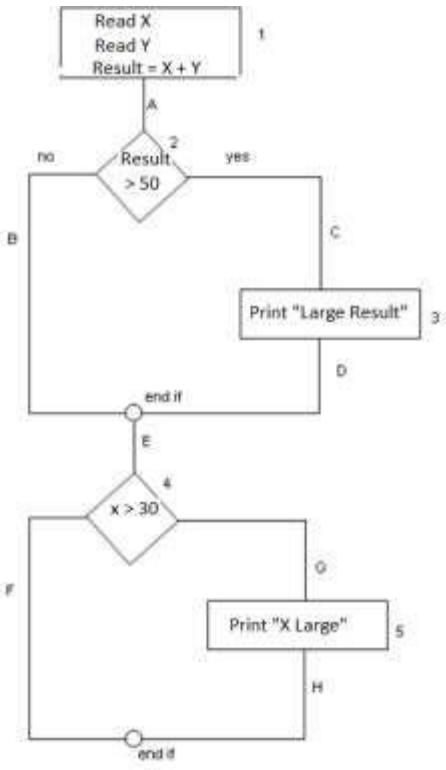
1.1 Read and understand the Code Coverage

1.1.1 To find no. of test cases required for 100% Code Coverage

Consider the below code snippet.

```
Read X
Read Y
Result = X + Y
IF Result > 50 THEN
Print “Large Result”
ENDIF
If X > 30 THEN
Print “X Large”
ENDIF
```

Method 1 : Draw Flow chart



Coverage Type	Route	No. of Test Cases Required
100% Statement Coverage	1A-2C-3D-E-4G-5H	1
100% Branch Coverage	1A-2C-3D-E-4G-5H , 1A-2B-E-4F	2
100% Path Coverage	1A-2B-E-4F, 1A-2B-E-4G-5H, 1A-2C-3D-E-4G-5H, 1A-2C-3D-E-4F	4

Method 2: Write Test Cases

Number the statements as below :

```
1. Read X
2. Read Y
3. Result = X + Y
4. IF Result > 50 THEN
5. Print "Large Result"
6. ENDIF
7. If X > 30 THEN
8. Print "X Large"
9. ENDIF
```

For 100% Statement Coverage : 1 test case required

Test Case Id	Test Condition	Input	Output
1	Result > 50 = TRUE X > 30 = TRUE	X=40, Y=20	All statements 1, 2, 3, 4, 5, 6, 7, 8, 9 execute.

For 100% Decision Coverage : 2 test cases required

Test Case Id	Test Condition	Input	Output
1	Result > 50 = TRUE X > 30 = TRUE	X=40, Y=20	All statements 1, 2, 3, 4, 5, 6, 7, 8, 9 execute. TRUE side of both decisions tested
2	Result > 50 = FALSE X > 30 = FALSE	X=20, Y=20	Only statements 1, 2, 3, 4, 6, 7, 9 execute. FALSE side of both decisions tested

Note: Path Coverage can be found by drawing flow chart.

1.1.2 What % of Coverage is achieved by given Test Case

Consider the same code snippet and flow chart discussed in sec 1.1.
What % of coverage is achieved with the test case : X=20, Y=20.

Coverage Type	Covered Status	% of Coverage
Statement Coverage	There are total 5 statements in the flowchart. But only 3 statements are covered i.e. 1, 2, 4 statements are tested and 3, 5 are not tested. So, (3/5)*100 = 60%	60%
Branch Coverage	There are total 4 branches/decisions in the flowchart. But only 2 branches/decisions are covered So, (2/4)*100 = 50%	50%
Path Coverage	There are total 4 paths in the flowchart. But only 1 path is covered. So, (1/4)*100 = 25%	25%

1.1.3 Complex Predicates

When a pseudocode with complex predicates is given, you can convert it into a pseudocode of simple predicates and then find the required code coverage.
Example :

complex predicate	Converted to Simple predicate

Read A
If A > 0 and A < 5 Then
  Print "A"
End If
	Read A
	If A > 0 Then
	  If A < 5 Then
	  Print "A"
	  End If
	End If

1.2 TO DO

1.2.1 Code snippet 1:

```
1. int x,y,z;
2. printF("Enter three integers");
3. scanF("%d %d %d", &x, &y, &z);
4. if(x>y && x>z) {
5.     printF("%d is greater", x);
6. }
7. if(y>z) {
8.     printF("%d is greater", y);
9. }
10. else{
11.   printF("%d is greater", z)
12. }
```

1. How many test cases are required to achieve 100% Decision coverage?
2. How many test cases are required to achieve 100% Statement coverage?
3. How many test cases are required to achieve 100% Path coverage?

1.2.2 Code snippet 2 :

```
IF        (thundering AND storms) OR night
THEN      stay inside
ELSE      go outside
END IF
IF        bright sun
THEN      go to beach
END IF
```

1. How many test cases are required to achieve 100% Decision coverage?
2. How many test cases are required to achieve 100% Statement coverage?
3. How many test situations have "go to the beach" as the result?

1.2.3 Code snippet 3 :

```
1. int result = a+ b;
2. If (result> 0)
3.   Print ("Positive", result)
4. Else
5.   Print ("Negative", result)
```

Find the % of Statement & Branch Coverage for the following test cases :
1. a=3, b=9
2. a= -3, b= -9

1.2.4 Code snippet 4 :

```
1. Read A, B, C
2. If A>B Then
3.   Print (A/B)
4. End IF
5. If A>C Then
6.   Print (A/C)
7. End IF
```

Find the % of Statement Coverage & % of Path Coverage for the following test cases:
1. A = 5, B = 10 and C = 2
2. A = 10, B = 10 and C = 10
3. A = 10, B =5 and C = 2
4. A = 2, B= 5 and C = 10

1.3 Validate the coding standards using Review checklist

Note: You can make use of Code Review Check list explained in Lesson 02. You can also make use of sample template given below

Table: Template of Code Review Checklist

Sr. No.	Question	Remark (Yes / No)
Syntactical Errors		
1	Does every statement has a delimiter?	
2	Are the in-built functions spelled properly?	
Data Declaration Errors		
3	Have all variables been explicitly declared?	
4	Are variables properly initialized in declaration sections?	
Comparison Errors		
5	Are there any comparisons between variables having inconsistent data types?	
Control Flow Errors		
6	Does every cause has an effect?	
Input / Output Errors		
7	All Input statements handled correctly?	
8	All Output statements handled correctly?	

1.4 Draw Flow Graph & Determine CC

Draw corresponding flow graph and find the cyclomatic complexity (CC) for the following specifications:

Specification 1	Specification 2

IF A AND B
THEN C=50
ELSE
IF C AND D
THEN Error message
ENDIF
ENDIF
	IF customer no. > 200 AND article group = 330
	THEN discount = 5%
	ENDIF
	IF region code = 4 OR 8
	THEN invoice type = A
	ELSE invoice type = B
	ENDIF

Specification 3	**Specification 4**

Read A, B, C
IF A = 10 THEN
  IF B > C THEN
  A = B
  ELSE
  A = C
  ENDIF
ENDIF
Print A
Print B
Print C
	Wait for Card to be inserted
	IF card is valid THEN
	display “Enter PIN number”
	IF PIN is valid THEN
	select transaction
	ELSE
	display “PIN invalid”
	ELSE
	Reject card
	END

Lab 2. Black box Testing – BVA & ECP

Goals	• Learn to apply basic techniques for writing test cases. • Learn to prepare finite and best suitable test cases
Time	120 Minutes

2.1 Determine ECP & BVA

1. 'X' has given a data on a person age which should be between 18 and 99. Using BVA, find appropriate test cases.

2. In an Examination, a candidate has to score a minimum of 60 marks in order to clear the exam. The maximum that he can score is 100 marks. Identify the Valid Equivalence values if the student clears the exam.

3. Consider a scenario where a 'Driver on Hire' agency provides most reliable and affordable drivers on hire. The monthly salary structure configured for the drivers of this agency is : drivers up to 25 years old get a pay of Rs. 15000/- ; drivers of age 65 and older get a pay of 5% more and drivers of age 40 and older get a pay of 10% more than that of the drivers up to 25 years get. How many equivalence classes are distinguished in the above? Also, which values are chosen for making test cases when the normal variant of the boundary values analysis is used?

4. Consider a scenario where a 'Winter Sale' provides heavy discounts. A person he/she of age less than 8 years old (<8), or a person aged between 35 and 45 years (>35 and <45) or older than 60 years (>60) is eligible for the discounts in Winter Sale. How many equivalence classes can be distinguished in this example?

5. A wholesaler sells printer cartridges. The minimum order quantity is 5. There is a 20% discount for orders of 100 or more printer cartridges. Identify the test cases using various values for the number of printer cartridges ordered.

6. A company is going to provide their employees with a bonus which will be based on the employee's length of service in the company. The bonus calculation will be zero if they have been with the company for less than two years, 10% of their salary for more than two but less than five years, and 25% for five to ten years, 35% for ten years or more. The interface will not allow a negative value to be input, but it will allow a zero to be input. How many equivalence partitions are needed to test the calculation of the bonus?

2.2 Validate Command Line utility

Validate Command Line utility - 'MAX'. This utility displays the maximum of the two specified Integers. Please note down any assumptions that you make.
E.g. MAX 2 3

Steps to run Max command line utility

1. create a folder demo on E drive
2. Copy max.exe file in to demo folder
3. Click on start > run. Type **cmd**
4. Type "**E:**"
5. Type " **cd demo**"

Use following commands to run max utility

```
E:\demo> max 25 34
E:\demo> max 25 b
E:\demo> max a 34
E:\demo> max 25.45 34.67
```

Lab 3. Black box Testing – Decision Table Tests

Goals	• Learn to apply basic techniques for writing test cases. • Learn to prepare finite and best suitable test cases
Time	30 Minutes

3.1 Decision Table 1 :

Consider the following Decision table for hiring a Driver.

Conditions	Rule 1	Rule 2	Rule 3	Rule 4
Age above 25 and below 55	No	Yes	Yes	Yes
Clean Driving record	Smoking	Drinking	Yes	Yes
Outside the town ?	No	Yes	No	Yes
Actions				
Hire the Driver	No	No	Yes	Yes
Pay Rs. 10 per Km	No	No	Yes	Yes
Extra Allowances of Rs. 300	No	No	No	Yes

What is the expected result for the following test cases?

TC1: A 26-year-old driver for travelling to outside the town with Smoking or drinking habits in his driving record.
TC2: A 52-year-old driver with a clean driving record for travelling to outside the town
TC3: A 57-year-old driver with a clean driving record for travelling to outside the town

3.2 Decision Table 2 :

Consider the following Decision table for a Frequent Flyer.

Conditions	Rule 1	Rule 2	Rule 3	Rule 4
Frequent customer	Gold	gold	Silver	Silver
Room Type	Queen size	Twin size	Queen size	Twin size
Actions				
Free Upgrade	City Tour of 1 day	Queen size	No	Queen size
Discounted Upgrade	NA	5%	5%	None

What is the expected result for each of the following test cases?

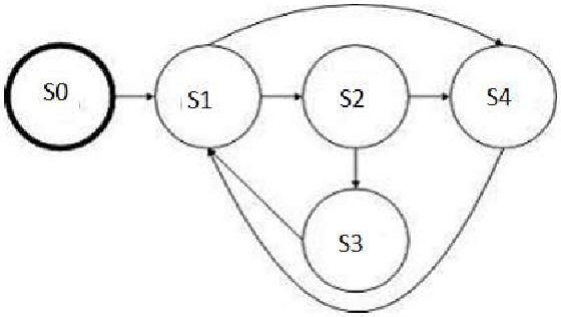
TC1: Gold frequent customer, staying in Twin size room.
TC2: Silver frequent customer, staying in Queen size room.

Lab 4. Black box Testing – State Transition Testing

Goals	• Read 'INSTRUCTIONS' before starting the assignment. • Understand the application and develop Test Scenarios
Time	30 minutes

4.1 Scenario 1 :

Consider the below state diagram.

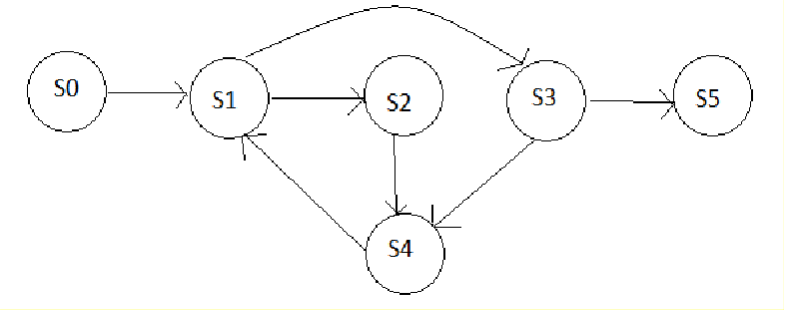


Check which of the following tests are valid and which of them are invalid.

A. S0-S1-S2-S3-S1-S4
B. S0-S1-S4-S1-S2-S3
C. S0-S1-S3-S1-S2-S1
D. S0-S1-S2-S3-S1-S2

4.2 Scenario 2 :

Given the Following state transition diagram, find the test case which covers minimum series of valid transitions to cover every state at least once.?



Lab 5. Creating Test Scenario – EXCHANGE on WEB

Goals	• Read 'INSTRUCTIONS' before starting the assignment. • Understand the application and develop Test Scenarios
Time	90 minutes

5.1 : Test Scenario Case Study. Posting an Ad on "EXCHANGE on WEB (EoW)"

www.eow.com **i**s the most preferred online web application in India for exchanging/selling of old products. In this case study, customer posts and advertisement of his product on the EoW portal.

Participants need to write Test Scenarios for testing Buttons, Hyper Links, and Form fields.

Note: Trainer will discuss the Test Scenario template and will share the same with participants

5.2 : Steps to post an Ad

1. The customer visit **https:\\www.eow.com** site. To login, click on **'Login with phone & OTP'**. Login using Friendsbook account is out of scope.
2. The customer enters 10 digit mobile no and clicks on **'Get OTP'**. The application sends an OTP (One Time Password) on his phone no.
3. The portal asks for the OTP confirmation code. User can enter the code and 'CONFIRM' to continue or CANCEL it. If the user has timed out (at max. 60 sec) in typing the OTP code, he can click **Resend code** for receiving another OTP code.
4. The portal displays the home page. Customer clicks on **'Submit a Free Ad'** to post a new add. Searching for products is out of scope.
5. Form of **'Submit a Free Classified Ad'** is displayed. Fill all the details in the form and click **'Submit'** button
6. The portal asks for the OTP sent on phone no. that is given while submitting the free classified Ad. User can enter the code and 'CONFIRM' to continue or CANCEL it. If the user has timed out (at max. 60 sec) in typing the OTP code, he can click **Resend code** for receiving another OTP code.
    - On entering correct OTP, it displays the message **'Ad is successfully posted'** else it displays the message **'Wrong Verification code! Ad is not posted'**

Note: Refer the figures corresponding to the steps.

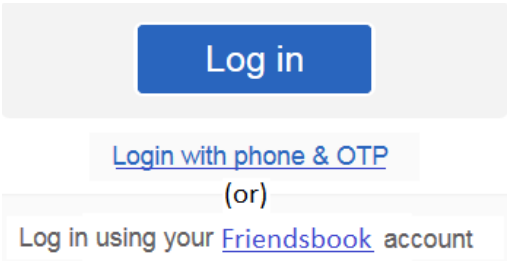


Figure 1

Figure 2

Figure 3

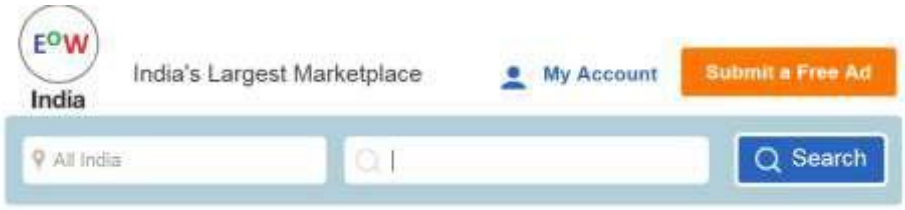


Figure 4

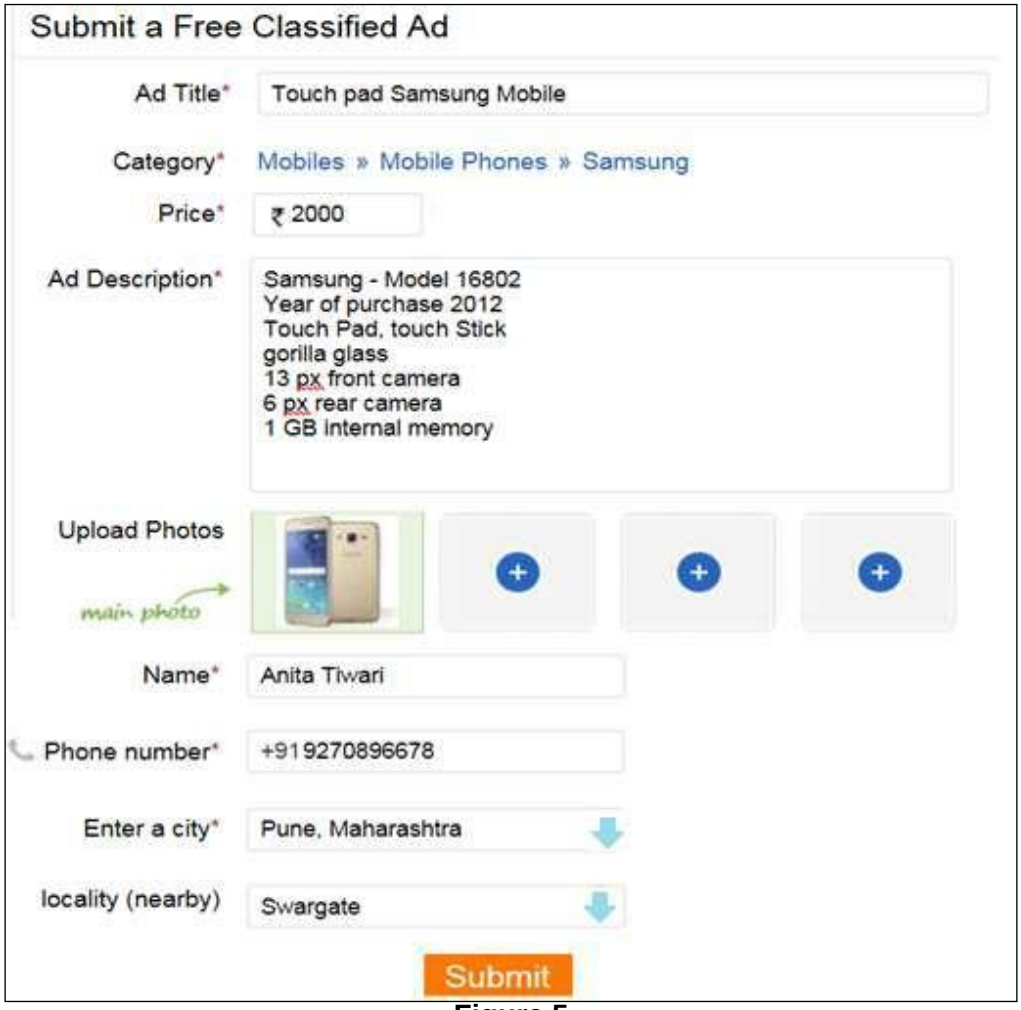


Figure 5

Figure 6

5.3 Rules:

1. The phone number should accept only 10-digit number
2. The OTP should accept only 4-digit number
3. The fields marked as * are mandatory fields on the form
4. Ad Title should accept maximum 70 characters and minimum 15 characters
5. The Category should accept only values given in following table

Category	Sub Category	Sub Category
Mobiles	Mobile phones	IPhone, Karbon, Lava, LG, Samsung, Micromax
	Tablets	Asus, Samsung, Appel I Pad
Cars	Cars	Toyota, Chevrolet, Zen, Swift
	Spare parts	Car glass, amplifier, Stereo system
	Beds	Single bed, double bed
	Wardrobes	Single door, two door, sliding door

6. Price accepts only digits in Rupees format
7. Ad Description should accept maximum 70 characters and minimum 15 characters
8. Upload Photos should allow browsing the pictures from your local machine. Minimum one photo should be uploaded.
9. Name should accept only characters
10. Select the City from the drop down box. This will automatically populate the Loacality based on the selected City. Refer the below given table for sample valid values of Cities and Localities combination.

City	Locality
Pune, Maharashtra	Swargate
	Hinjewadi
	Shaniwarwada
Banglore, Karnataka	Whitefield
	Mathalli
	Bujgiri
Mumbai, Maharashtra	MG Road
	Dadar
	Nalasopara

Lab 7. Creating Test Cases – Cyber Shoppee

Goals	• Read the **"CyberShoppee**" System documentation before starting the assignment. • Develop creative test cases for the CyberShoppee Online Shopping website.
Time	180 minutes

7.1 Case Study: CYBERSHOPPEE

"CyberShopee" is a web based application and can be accessed over the internet. Using this application a user can shop online for different products.
This online shopping website facilitates user to shop various products such as TV, Camera etc. belonging to different categories.

Following is the complete list of functionalities of the system. You can make appropriate assumptions wherever necessary and proceed.

There are four categories of users who would access the system viz. **Admin**, **Customer**, **Dealer** and **Delivery user**. Each one of these users would have some exclusive privileges to be exercised on this website.

Note: Delivery user is out of scope.

Functionalities of **Admin** :

1. Register on the website
2. Login
3. Approve Dealer
4. Approve Agency
5. Add Category
6. Add Sub Category

Functionalities of **Customer** :

1. Register on the website
2. Login
3. View Product Details
4. Purchase Products
5. Place the Order
6. view Account
7. Change Password

Functionalities of **Dealer** :

1. Register on the website
2. Login
3. Add AgencyPerform Dealer Operations

Note: All operations are allowed only for the registered users.
Once the Order is confirmed, Cyber Shoppee will deliver the ordered products to the customer on his address specified during the registration. The Payment mode will be Cash on Delivery, Debit Card, Credit Card, Net Banking etc.

7.2 Work Flow:

7.2.1 Visit CyberShoppee Website

Visit https://cyberShopeesystem.com link through internet. This will take the user to the Home page of the website as given below. Refer to **Figure 1.1**.

Figure 1.1 CyberShopee Home Page

7.2.2 Register

Purpose	To register with CyberShopee website
Functionality	• User can register on the website.

As mentioned earlier, the user need to register on the website to avail different facilities provided. The user needs to fill in the registration form to do so. Refer to the **Figure 1.2**. Once the user has been successfully registered on the website, he can login to the website with the registered username & password and proceed.

Figure 1.2 Register

Requirements:

1. All fields are mandatory.
2. User Id should contain only 6 characters.
3. Full Name should contain upto 30 characters and begin with uppercase letter.
4. Address should contain 200 alphanumeric characters.
5. Email should accept only valid email address e.g. someone@gmail.com
6. Password should contain at least one uppercase character and one special character.
7. Contact Number should contain only 10 digits and begin with 7/ 8/ 9.
8. Role should be populated with these options (Admin, Customer, Dealer and Delivery).

7.2.3 Admin Module

Note: Dealer approval and Agency Approval not in scope.

Figure 1.3 Admin Home Page

a. Add Category

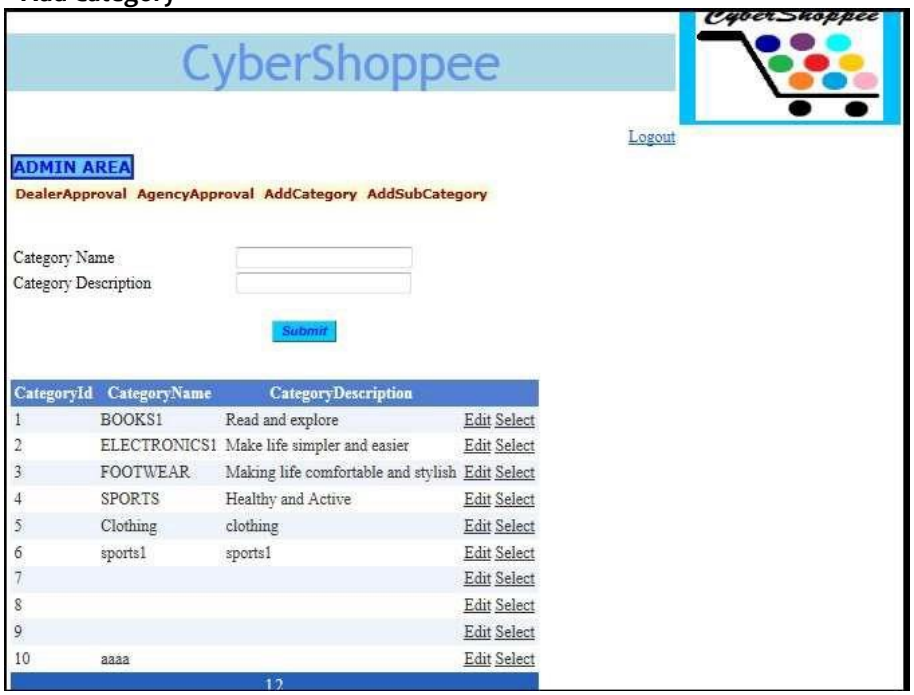


Figure 1.4 Add Category Page

Purpose	To add product categories
Functionality	• Admin can add product category • Admin can edit product category • Admin can update product category

Requirements:

1. Category Name and Category Description cannot be blank.
2. Admin can edit any information of existing category & it should be successfully updated.

b. Add Sub Category

Figure 1.5 Add Sub Category Page

Purpose	To add product sub category
Functionality	• Admin can add product sub category • Admin can update product sub category

Requirements:

1. The select category dropdown box is auto populated with the existing category ids.
2. User needs to select category id
3. User needs to fill in the subcategory name and subcategory description & both fields cannot be left blank.
4. Admin can edit any information of a product subcategory using same page.
5. User need to click on the "Edit" link to update the details of existing subcategory.
6. Once user has edited the details, he can confirm the same by clicking on Update link.

7.2.4 Customer Module

a. Search Products

Figure 1.6 Search Product Page

Figure 1.7 Add To Cart Page

Purpose	To search product
Functionality	• Customer can search for a product • Customer can then add the searched product in the shopping cart

Requirements:

1. Customer need to select the category.
2. Based on category selected the subcategory will be populated.
3. Customer need to click on the Search button to initiate the search of the product.
4. If the matching product exists, the details will be displayed in the table below.
5. Customer can click on View Product link to view the selected product and at the same time he can also add this product to the cart by clicking on the Add to Cart button.
6. When user clicks on "Add to Cart" button, product gets added in to the cart.
7. Select Quantity field cannot be null.
8. When user clicks on "Cancel" button user should navigate to Search Product page.

b. My Orders

Figure 1.8 My Orders Page

Purpose	To view orders
Functionality	• Customers can view orders placed by him

Requirements:

1. Customer can click on My Orders tab to view his orders.
2. If the cart is null, and user clicks on "Place Order" Button, the order should not get added into My Orders.

c. My Cart

Figure 1.9 My Cart Page

Purpose	To view products in cart and place order
Functionality	• Customer can add products in cart • Customer can place order

Requirements:

1. Customer can place order for selected items form the cart.
2. Customer can remove selected items form the cart.

d. Change Password

Figure 1.10 Change Password Page

Purpose	To change password
Functionality	Customer can change password

Requirements:

1. Customer can click on "Change" button and change the password.
2. Customer can click on "Exit" button to come out from current page and navigate to customer's home page.
3. New password and Confirm password should match with each other.
4. If Old password is incorrect, system should alert customer with proper error message.

e. My Account

Figure 1.11 My Account Page

Purpose	To Edit account Details
Functionality	Customer can edit his account details.

Requirements:

1. Customers are restricted to edit "Customer Id".
2. Customer Name should contain only characters and begin with uppercase letter.
3. Email should be in someone@gmail.com format.
4. Contact Number should contain only 10 digits and begin with 7or 8 or 9.
5. Customer can click on "Edit profile" to edit the profile.
6. Customer can click on "Save Changes" button to save edited profile.
7. Customer can click on "Cancel" button to cancel the changes and should navigate to Customer Home page.

7.2.5 Dealer Module

a. Dealer Operations

Figure 1.12 Add Product Details

Purpose	To add product details
Functionality	• Dealer can add product details. • Dealer can update product details.

Requirements:

1. All fields are mandatory.
2. Sub category dropdown box should auto populate.
3. Product Name can be alphanumeric.
4. Model Number can be alphanumeric.
5. Unit cost should contain only digits.
6. Description should contain 100 characters.
7. Dealer can click on browse button and able to upload the image.
8. Dealer can click on "Add" button to add the products.
9. Dealer can click on "Update" button to update the products.
10. Dealer can click on "Add Size Quantity" button to add the product quantity.