28/10/24

4) a) Total number of attributes :-

Vehicle Class :

Attributes : make, model, year (3 attributes)

Car subclass :

Attributes : make, model, year, doors, trunk size (5)

Bike subclass :

Attributes : make, model, year, type of handlebar, frame material (5)

Truck sub class :

Attributes : make, model, year, cargo capacity, number of axles (5)

b) Verify if the design adheres to the independence axiom:-

Car subclass :

Unique attributes : number of doors, trunk size.

Bike subclass :

Unique attributes : type of handlebar, frame material

Truck subclass :

Unique attributes : cargo capacity, number of axles

c) Calculate total information content :

Vehicle class : 3 attributes

Car subclass : 5 attributes

Bike subclass : 5 attributes

Truck subclass : 5 attributes

Total information content : 3+5+5+5 = 18 attributes.

5. a) Calculate Z-scores.

$$Z = \frac{x - \mu}{\sigma}$$

x = observed value
μ = mean
σ = standard deviation

1. Task A (Low complexity):-

$$Z_A = \frac{6 - 5}{1} = 1$$

2. Task B (Medium complexity):

$$Z_B = \frac{12 - 10}{2} = 1$$

3. Task C (High complexity):-

$$Z_C = \frac{25 - 20}{3} = \frac{5}{3} \simeq 1.67$$

b) Analyze the Z-score:-

Task A: $Z_A = 1$

The completion time for task A is 1 standard deviation above the expected time. This indicates a slight deviation from expectations.

Task B: $Z_B = 1$

similar to task A, this indicates a moderate deviation from expectations

Task C: $Z_C \simeq 1.67$

Task C's completion time is significantly longer than expected, which may indicate usability issue or higher-than-expected complexity

c) Calculate probabilities:-

Task A: $Z = \frac{5.6}{1} = -1 = 0.1587$

Task B: $Z = \frac{10 - 12}{2} = -1 \approx 0.1587$

Task C: $Z = \frac{20 - 25}{3} \simeq -1.67 = 0.0475$

These probabilities indicate that there is relatively low chance for a randomly selected user to complete the tasks in less time than expected.

6. GIVEN:

No. of classes : 5

Average no. of methods per class : 4

Average cyclomatic complexity per method : 3

Average lines of code per method : 25

Quality assurance phase requires 20% of the development effort

Total no. of methods:

Total methods = no. of classes x methods per class = 5x4 = 20 methods

Total lines of code:

Total LOC = total methods x LOC per method = 20 x 25 = 500 LOC

Cyclomatic complexity:

Cyclomatic complexity is not directly used to calculate effort in this contentext, so we proceed

Development effort:

We will assume standard productivity rate.

Average productivity rate = 10 LOC per person-hour

$$\text{Development effort} = \frac{\text{Total LOC}}{\text{Productivity rate}} = \frac{500}{10} = 50 \text{ person-hours}$$

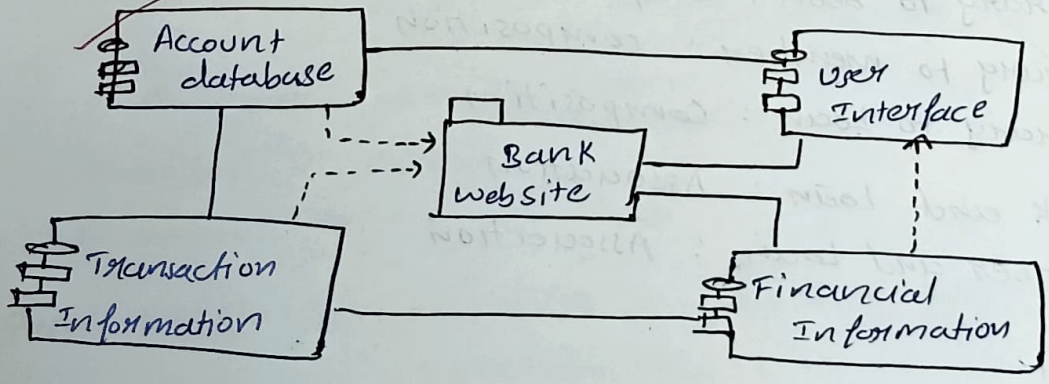
Quality Assurance effort:

QA effort = 20% of development effort = 0.20 x 50 = 10 person-hour

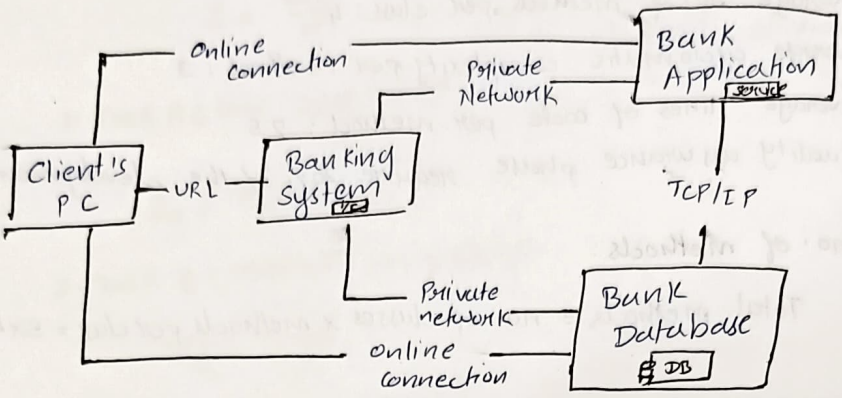
Total estimated effort:

Total effort = development effort + QA effort = 50 + 10 = 60 person-ho

7. Component diagram for banking system:-



Deployment diagram for banking system:-



8. a) Identify & Establish Relationship between classes

Book : bookID, title, author, ISBN, publish year, category

Member : memberID, name, membership Date, phone Number

Loan : LoanID, bookID, memberID, issue Date, due Date, return Date.

Library : LibraryID, address, books, members, loans

b) Define the multiplicity of each relationship:-

1. Library and Book : one to many [1 library to * Books]

2. Library - member: one to many [one library to * members]

3. Library - Loan : one to many [one library to * loans]

4. Book - Loan : 1 to many [1 Book to * Loans]

5. Member - Loan : one to many [1 member to * Loans]

c) Type of association between classes:

1. Library to book : Composition

2. Library to member : composition

3. Library to Loan : Composition

4. Book and Loan : Association

5. Member and Loan : Association.

9. a) Create a table-class mapping :-

1. Product :
   - Product ID (int, Primary Key)
   - Name (string)
   - Description (string)
   - Price (Float)
   - Quantity In Stock (int)

2. Customer :
   - customer ID (int, Primary Key)
   - First Name (string)
   - Last Name (string)
   - Email (string)
   - Phone Number (string)

3. Order :
   - OrderID (int, Primary Key)
   - Order Date (Date)
   - Customer ID (int, Foreign Key referencing customer)
   - Total Amount (Float)

4. Order Item :
   - Order Item ID (int, Primary Key)
   - OrderID (int, Foreign key referencing Order)
   - Product ID (int, Foreign Key referencing Product)
   - Quantity (int)
   - Item Price (float)

b) Calculate total number of attributes :-

1. Product : 5 attributes (Product ID, Name, description, Price, Quantity In stock)
2. Customer : 5 attributes
3. Order : 4 attributes
4. Order Item : 5 attributes

Total number of attributes in database table :

6 + 5 + 4 + 5 = 19

c) Estimate the total number of records in each table:-

Given:
200 products
150 customers
Each customer places an average of 10 orders
Each order contains an average of 5 order item

1. Product table = 200 records
2. Customer table = 150 records
3. Order table = 150 x 10 = 1500 records
4. Order Item table = 1500 x 5 = 7500 records

10. a) Total no. of methods in software system:

Total methods = no. of class x avg. method per class = 500 x 10 = 5000

b) Total number of test case:-

Total test case = Total methods x test cases per method = 5000 x 3 = 15000

c) Expected number of defects before testing:

Total defect before testing = Total methods x Defect Density = 5000 x 0.5 = 2500

d) Expected no. of defects detected & fixed:

Defects detected & fixed = Total defect before testing x DDE = 2500 x 0.70 = 1750

e) Expected no. of defects after testing:-

Defects remaining = Total defects before testing — Defects detected & fixed = 2500 - 1750 = 750