

SECTION 1: SOFTWARE ENGINEERING LAB

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1.0 INTRODUCTION

Software Engineering relates to the process of development of quality software. Normally, Software is the single most expensive item in a computer system. During the life time of a system, about 95% of the cost is incurred on software and only 5% on hardware. Computer Aided Software Engineering (CASE) tools help in many software engineering tasks with the help of the information created using the computer. CASE tools support software engineering tasks for the different phases of Software Development Life Cycle (SDLC). MCS-0213 discusses various aspects of Software Engineering in detail. You must go through this course before taking the practical in this lab. The lab sessions in this unit revolve around various phases of software development.

This lab is an attempt to help you practice proper software development methodology. You must do these software development activities (lab sessions) with the help of suitable tools, preferably.

1.1 OBJECTIVES

After going through and working with the problems given in this section, you should be able to:

- Develop plan for a Software Project;
- Develop test cases;
- Reengineer the Software;
- Prepare and implement change requests and
- Develop Software with good quality.

1.2 SOFTWARE PROJECT MANAGEMENT

The software project management tools support project planning and scheduling. Some of the sample information that you can produce using these tools are:

A Sample Partial Project Plan

Overall Goal of the Project

The proposed software system should be able to:

- read the structured data available in the Excel files and store it in a Database system.
- validate data of the database on the basis of predefined business rules.
- prepare reports on data that is found to be in error during validation.
- prepare MIS reports from the validated data.

The Primary Data

The Primary data in the system is the employee data of the participant companies.

Delivery Deadlines

6 months from the date of Approval.

PROJECT PLAN

1 OBJECTIVES

The objective of the system can be defined here as:

- The proposed system should be able to read the data from Excel files and store validated data in the Database.
-

2 SPECIFIC PRODUCTS TO BE DELIVERED

The products that will be delivered (You need not include all):

- The tested system and Network
- Client Workstations
- A robust Database Management Server
- Any other third party software.

3 ACTIVITIES AND MILESTONES

The activities in the system, after including the provisions for security, are:

- Verification of the Users
- Migration of the Excel data
- Validation of the the migrated data
-

The milestones in the system are:

- Start of the Project : 1st June, 2006
- SRS Completion : 28th June, 2006
- Requiements finalization : 1st July, 2006
-

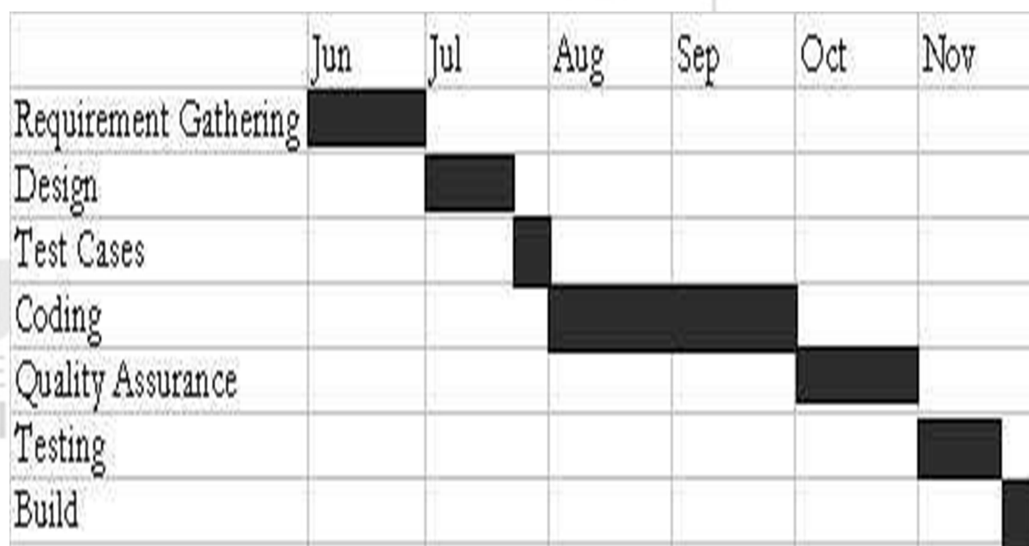
4 RESOURCE REQUIREMENT

The Hardware, Software, and Tools are required for the three different environments, viz., Development environment, Quality Control environment, and Deployment environment. These resources may be documented accordingly.

5 SCHEDULING

GANTT Chart

A very elementary Gantt or Timeline Chart for the development plan is given below..
The plan explains the tasks versus the time they will take to complete.



PERT Chart

A suitable PERT Chart for the development plan can be given here.

6 BUDGETARY ESTIMATES

The whole budgetary estimates may be divided into resource procurement and software development costs. The software development efforts and cost may be estimated with the help of *COCOMO* or any other model used by the organization.

7 Summary

Please provide the summary here.

1.3 WORKING WITH REQUIREMENTS

Some of the activities that you can do with the help of tools are:

- Cost Estimation
- Creation of SRS
- Traceability of requirements
- Non-ambiguous requirements document
- Creation of Models

Some of the partial samples for some of the above are illustrated here:

1.3.1 Feasibility Report

You may include contents as per the following table. A sample is shown after the table.

Topic	Some of the contents of the topic
Introduction	Include the project background and report layout here.
Terms of Reference	Define the expectations of the project, the Time Frame and Available Resources
Existing System	Include the results of Fact Finding, working of the Current System and the problems in the Current System

System Requirements	Include the system requirements after discussion with the system user
Proposed System	Define the outline of the Proposed System, Input and Output
Development Plan, Economic Feasibility and other feasibilities	Include the Gantt Chart, Pert Chart, Cost estimation, etc.

INTRODUCTION

Background of the Project

The basic requirement of the user and working of the system are:

- The Client should be able to upload the available data in Excel files into the Database.
- This data is then validated by the software called VALIDITY CHECKER. This software contains the basic business rules and also produces error reports
-

Report Layout

Give the information about the layout of the report here.

TERMS OF REFERENCE

What is expected?

The expected system works by processing the employee data of an organization. The data is to be stored securely in the database. Statistical operations are done on the data to produce reports as desired by the client company.

Time Frame

The delivery deadline for the system is 6 months from the date of start of the project.

What resources are available?

The resources that are available are.

- Personnel (however, they need training)
- Linux Operating System
- Networked systems
- Servers and Database Management System

EXISTING SYSTEM

Working of the Current System

You can write this topic only after doing the requirement analysis. Information from the requirements gathering phase that includes outcomes of interviews of the users, questionnaires filled by them and workflows that are currently functioning. In the example, the current system

- reads the data from Excel files and stores them into the database.
- validates the data on the basis of business rules and generate reports to show the errors in data.
- enables for correction of data
- creates MIS reports

Problems in the Current System

The problems of the current system are:

- For every data collection cycle , new Excel-based system needs to be developed
- All the functions take a lot of time to complete.
-

SYSTEM REQUIREMENTS

The following types of requirements can be freezed:

- The system should be able to read the data from Excel files and store it in the Database.
-

PROPOSED SYSTEM

Project Outline

You may give the outline of the Proposed System here. Explain the terms and data references in the data dictionary.

DATA DICTIONARY

Some sample terms that are used in the documents :

Name	Expansion of Name	Where used	Additional Description
CLIENT		In Functional Diagrams and Class Diagrams	This is an Object
Excel Data Files		In Class Diagrams	This is an Object
Verify username & password		In Functional Diagrams	This is a Process
Data Validation		In Functional Diagrams	This is a Process
Generate Internal Reports		In Functional Diagrams	This is a Process
c_number	Client Number	In Class Diagrams	This is an attribute of Client. It is a Unique field
client_name	Client Name	In Class Diagrams	This is an attribute of Client
client_phnumber	Client Phone Number	In Class Diagrams	This is an attribute of Client
report number	Report Number	In Class Diagrams	This is an attribute of Report
.....

1.3.2 Software Requirement Specification (SRS)

Normally IEEE standard is followed. A typical format of SRS is as follows:

TABLE OF CONTENTS

Introduction

- Purpose
- Scope
- Definition

- Product and its function
- Benefits and Goals
- Overview

Overall Description

- Product Description
- Product Functioning
- Functions of Project
- Users of Project
- Assumptions made

Specific Requirements

- Interface Requirements
- User Requirements
- Hardware Requirements
- Software Requirements
- Logical Database Requirements

Basic Processing Actions of the System

Appendices

- Input/Output Formats
- Instruction for Security
- Results of Fact Finding
- Data Model
- Functional Model
- Process Specification.

A sample portion of SRS is given below:

INTRODUCTION

Purpose

SRS contains details of the proposed software system for the designers to design the system . Thus, SRS is a means of communicating the findings of the analysis stage to the design stage. The SRS includes .

- Interface
- Logical Database
- Hardware
- Performance and other constraints.

It also contains the assumptions made by the analyst and any systemic dependency.

Scope

The scope of SRS contains all the areas related to the project. The scope of SRS includes.

- Proposed software description
- Users of the proposed software
- Functional requirements of the software
- Assumptions and dependencies in the system
- Constraints

Definition

.....

Product and its functions

.....

Benefits and Goals

.....

Overview

.....

OVERALL DESCRIPTION**Product Description**

The Client should be able to upload the raw data in Excel files into the Database. The raw data is then validated using

Product Functioning

- The Raw data from the Clients is put into the database.

.....

Functions in the Project

There are five functions of the system.

- User Verification

The User is asked to enter the Username and Password. The system checks the validity of Username and Password, otherwise the User is asked to do so again. A maximum of three valid attempts are given to the user.

- Upload Raw Data

.....

- Validate Data

.....

- Put the Validated Data

.....

- Generating Reports

.....

Users of the Product

.....

Assumptions

.....

SPECIFIC REQUIREMENTS**Interface Requirements**

The Interface requirements include.

- Easy to follow Interface
- Very less graphics
- No hidden buttons
- Relevant error messages

.....

User Requirements

After a careful study of the requirements of the Client, analysts have come up with a set of requirements.

.....

Hardware and Software Requirements

There are three environments that have been created for the project, viz.,

- Development environment
- Quality Control environment
- Production environment

The hardware requirements for all the platforms may be indicated here.

Logical database Requirements

The following information is to be stored in the database:.

- The Clients Raw data
- The Clients Validated data
- Username and Password.

BASIC PROCESSING ACTIONS OF THE SYSTEM

The basic processing actions of the system are.

- Verification of the User
.....
- Upload Data

APPENDICES

APPENDIX A

INPUT / OUTPUT FORMATS

The input formats for the system contains the following screens. The convention used while making the input formats are.

Square box is used for user input

Rounded Square box is used for system display

Login screen

The following screen that inputs the Username and Password from the User for authentication of the User to the system is.

Login Id	<input type="text"/>
Password	<input type="text"/>
<div><input type="button" value="Close"/> <input type="button" value="Login"/></div>	

APPENDIX B

INSTRUCTIONS FOR SECURITY

Security is an integral part of any system. Clients send their confidential data with trust and it is our foremost duty to protect the security and privacy of the data of the Clients.

APPENDIX C

RESULTS OF FACT FINDING

Working of the Current System and its Problems

APPENDIX D

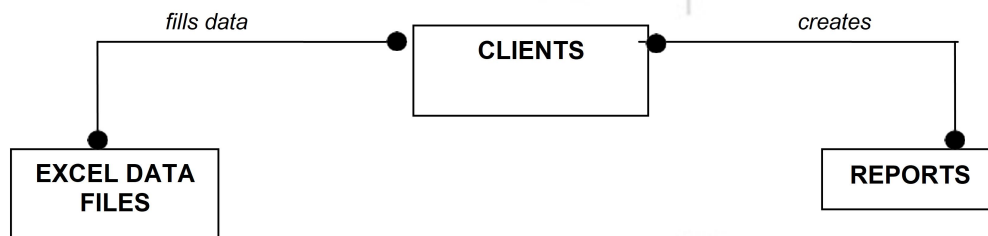
DATA MODEL

Classes involved in the Project

- Clients
- Excel Data Files
- Reports

Association between the classes

- Clients fill data in the Excel Data Files (M .. M)
- Clients generate Reports (M ... M)

E-R/Object Diagram for the system**Attributes of the Entities are**

Object Classes	Attribute
Clients	number name address phone number fax email
Excel data Files	excel file number client number
Reports	report number report name client number

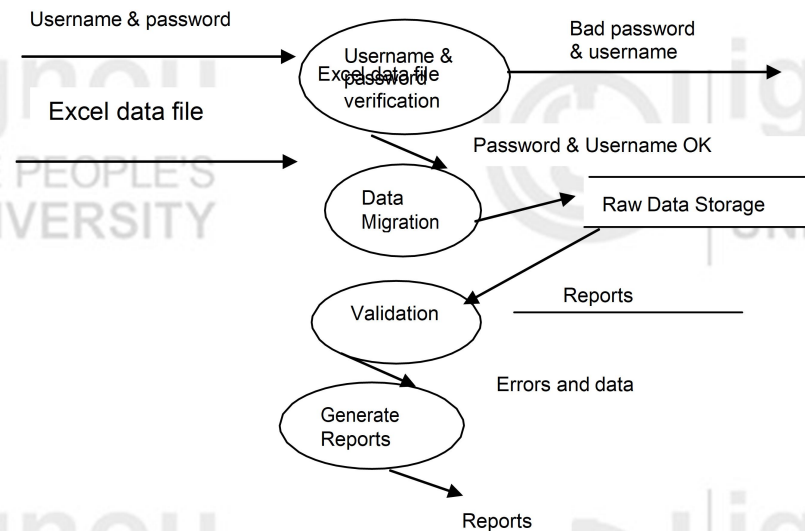
APPENDIX E

FUNCTIONAL MODEL

One sample DFD at level 1 is containing the processes:

- Username and Password verification
- Data Migration
- Validation of Migrated data
- Generate Reports

You can make various levels of DFDs



PROCESS SPECIFICATION

Let us give one sample process verification.

Process: Username and Password Verification

Input: Username & Password

Output: Access grant or denied message

Processing

The Client enters the Username and Password and clicks the Login button.

The system connects with the DBMS and verifies them in the related database. If both are valid: allow user to enter the system with the allowed access rights for that user. Otherwise prompt wrong Username-Password message and take the user to the screen where s/he can re-enter the Username-Password.

Interface Description

The interface contains the text boxes where the user can enter Username and Password. It also contains a Login button for login and a Close button on closing the application.

Internal Data Structure

The process uses the encrypted username and password table that also contains information about the access permissions.

1.4 DESIGN DOCUMENT

SCOPE

Define the System Objectives here
.....

Architecture Design

Give the architecture of the system based on the analysis and flow models.

DATA DESIGN

Refine the E-R diagram if needed and make one table for each entry and datastore and table for all M.M relationships.

For example, the Client table may be:

COLUMN HEADING

client_no
client_number
client_addr
.....

CONSTRAINTS

Primary Key
Not Null
Not Null

INTERFACE DESIGN

Human-Machine Interface Design Rules

Follow the basis rules for the interface design. These can be classified into three main types:

- External Interface design
- Interface to the External Data
- Interface to the external system or devices

External Interface Design

- Easy to follow Interface
- Zero or very less graphics as not being used commercially

- No hidden buttons
- Proper error messages

Interface to the External Data

The system has to use proper external data. The system makes a connection with the DBMS to do so. The rules that have to be followed while interfacing with the external data are:

- You must do the type checking.
- Field overrun that is maximum size should be enough to accommodate the largest data of that type
- It is always better to encrypt the data and then store it in the database.

Interface to the External System or Device

PROCEDURAL DESIGN

Verification of the User

Algorithm

Input:

Output:

STEPS

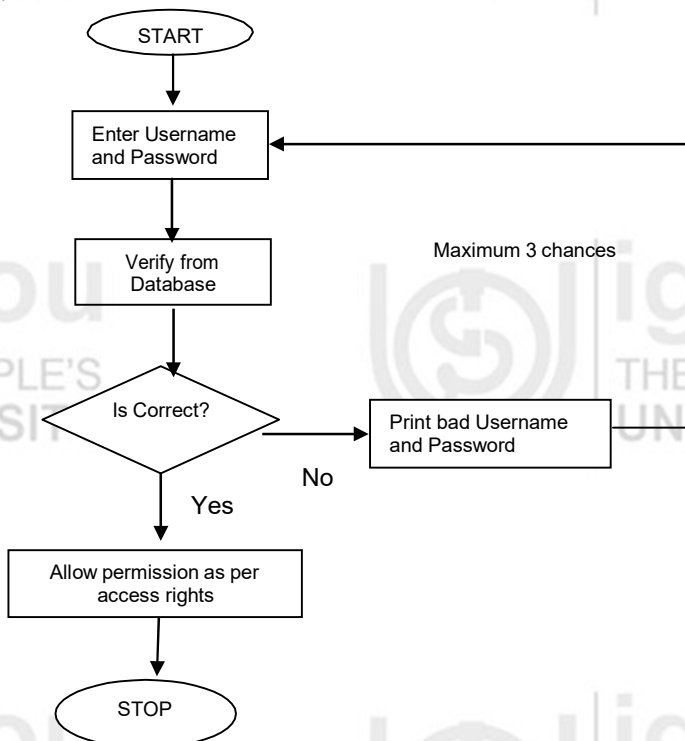
Ask the Client to enter Username-Password.

Check Username and Password combination in the encrypted database.

If the Username and Password is correct then give permission with allowed access rights.

Else, access is denied and the enter Username and Password screen is shown again. This cycle will be done a maximum of three times

Flow Chart



INTERFACE DESIGN

Login Screen

OUTPUT / REPORTS DESIGN

Design your output reports

DATA SECURITY AND RIGHTS

Security is the integral part of any system. You can use encryption and authentication or any other security mechanism as the need may be.

1.5 TESTING

A sample test case may be:

Login Screen

S.No.	Test Case ID	Do	Expected Result
1.	QT1-001	<p>Enter user id in the text box specified.</p> <p>User id must not be more than 510 characters and it should not contain any special char and no spaces including in the start.</p> <p>Enter password in the text box specified. Password must not be more than 10 characters</p> <p>Click on the Login button.</p>	<p>Successful login in to the system if the values are found in the database</p>
.....			

TEST LOG

Function	Purpose of Set of Test Cases per Area	Test Case ID(s)	No of Test Cases run	Number of Test Cases Successful
Login	The verification of username and password	QT1-001	8	100%
.....				

1.6 IMPLEMENTATION

It must contain the proper comments. The coding should be structured as per software architecture.

VALIDATION CHECKS**Verification of the User**

- Both User Id and Password are mandatory
- The size of User Id must be 10 characters long

ERROR AND EXCEPTION HANDLING

A proper mechanism of Error Handling is necessary in any system.

COMMENTS

Comments are an integral part of any system. Like any properly developed and maintained system with high quality, this system too has sufficient comments and description of the processes, functions, classes, and data structures.

CODING STANDARDS

The defined coding standards of the software developers may be followed. A sample clause in coding standard may be: "A consistent naming pattern is one of the most important elements of predictability and discoverability in a managed code. For each type, you must follow the defined capitalization styles, case sensitivity and word choice.

1.7 LIST OF PROBLEMS

The following is the list of problems that are to be attempted during the prescribed lab sessions.

Project Planning

Session 1: Suppose that you need to build software for a Railway Reservation System. Write a statement of scope that describes the software.

Session 2: Estimate the effort and cost required to build the above software. Use any estimation technique.

Requirements Analysis

Session 3: Develop SRS (Software Requirements Specification) for the Railway Reservation System (RRS)..

Session 4: (a) Draw DFDs up to appropriate levels for the RRS.

(b) Draw ERDs for the RRS. Describe the relationships between different entities.

(c) Design Data Dictionary for RRS.

Design

Session 5: Develop a modular design for RRS.

Session 6: Develop user interface design for RRS.

Testing

Session 7: Write a program in 'C' language for the multiplication of two matrices . using pointers.

Session 8: Develop a set of test cases that will completely test the program in session 7. The test case should be separately developed for Unit testing, Module testing and Integration testing.

Web Software Engineering

Session 9: Design a web page that accepts a matrix as input and computes its transpose. The web page should have two text boxes and a submit button labelled as **Input Elements** . After entering the number of rows of the input matrix in the first text box and number of columns of the input matrix in the second text box of the web page, SUBMIT button should be clicked. Once clicked, a number of text boxes which are equivalent to the number of elements in the matrix will appear along with a submit button at the bottom labelled as **Compute Transpose**. When the **Compute Transpose** button is clicked, the transpose of the input matrix has to be displayed.

Session 10: Develop test cases for the web pages of 9(a). Then, develop test report after testing using the test cases developed.

Software Quality

Session 11: Write a Program that is correct but of not good quality. Justify your answer.

Make necessary assumptions.

Session 12: Write a Program that is correct but still not reliable. Justify your answer. Make necessary assumptions.

Software Change Management

Session 13: Develop "Railway Reservation System" as per specifications given in Sessions 1, 3, 4,5 and 6.

Session 14 : Demonstrate the Software developed in Session 13 to any other person and make a list of Changes suggested by him/her. Implement changes in Software following the Change Control process and demonstrate the updated Software to the same person.

Advanced Software Engineering

Session 15 : Select a software that you use regularly such as MS-office, Gmail, MS-Excel etc.

Create a set of usage scenarios for the software.

Session 16 : Select a small portion of any program written by you. Check if the portion of code selected by you is having constructs that violate the structured programming paradigm. If yes, then rewrite the code to conform to structured programming paradigm. If no, check another portion of code.

Sessions 17 and 18 : Have a look at the output of any program that was not written by you. Preferably, look at an application that is not developed by you and write the program for the development of that application or a portion of that application.

Sessions 19 and 20 : Assume that you interested in developing a "Library Information System (LIS)". Visit any Library.

As a visitor of Library, make a list of requirements that need to be fulfilled by LIS. Now, develop Software for LIS. Ensure yourself that LIS developed by you is fulfilling the requirements. Preferably, try to obtain requirements for LIS from any person who visits a library, develop LIS and then get it

validated by him/her.

1.8 SUMMARY

This section provides an introduction to software engineering lab in action. In this lab section, we provide some basic information on how one can prepare the project plan, Data dictionary, software requirement specification, Data model, functional model, different kinds of design tools, data analysis, testing. You can find more details on these topics in the MCS-213 : Software Engineering course. A learner should solve the problems given in this section with the help of CASE/software tools to get the best benefits from this section.