### **Practical No. 02**

#### **Aim of the Experiment**

**Estimation of Project Metrics** *To estimate cost, effort & duration for Expenses Tracker System*

#### **Problem Statement**

In this experiment, we will learn how to estimate cost, effort, and duration for a software project and then select one solution approach which will be found suitable to fulfill the organization’s goal.

#### **Theory**

##### **Objectives**

* Categorize projects using COCOMO & estimate effort and development time required for a project.
* Estimate the program complexity & effort required to execute it using Halstead's metrics.

#### **Project Estimation Techniques**

A software project is not just about writing source code, but also estimating:

* **Project size** – Measured in KLOC (thousands of lines of code).
* **Cost** – Overall development cost.
* **Duration** – Time taken to complete the project.
* **Effort** – Measured in Person-Months.

**COCOMO Model**

COCOMO (Constructive Cost Model) proposed by Barry Boehm is widely used for estimating cost.  
 **Types of Projects:**

* **Organic** – Small, simple apps with experienced teams.
* **Semi-detached** – Medium size and moderately complex.
* **Embedded** – Real-time or hardware-tied systems.

#### **Formulas**

1. **Effort (PM)** = a × (KDSI)^b
2. **Development Time (Tdev)** = 2.5 × (Effort)^c
3. **Persons Required** = Effort / Tdev

### **Simulation:**

1. **Project Name**: Expenses Tracker System
2. **Type**: Semi-detached (moderate size, some complexity)
3. **Estimated Size**: 4 KLOC
4. **Assume Constants** (for Semi-detached):  
   * a = 3.0, b = 1.12, c = 0.35

#### **Calculations**

1. **Effort (PM)** = 3.0 × (4)^1.12 = 3.0 × 5.27 ≈ **15.81 PM**
2. **Development Time** = 2.5 × (15.81)^0.35 ≈ 2.5 × 2.93 = **7.32 months**
3. **Persons Required** = 15.81 / 7.32 ≈ **2.16 ≈ 2 persons**

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### **Cost Estimation**

* **Cost per person/month** = ₹50,000
* **Total Estimated Cost** = 15.81 × 50,000 = ₹**7,90,500**

### **Halstead’s Metrics**

Used to estimate complexity using:

**Formulas:**

* n₁ = Number of distinct operators
* n₂ = Number of distinct operands
* N₁ = Total number of operators
* N₂ = Total number of operands
* **Program length (N)** = N₁ + N₂
* **Vocabulary (n)** = n₁ + n₂
* **Volume (V)** = N × log₂(n)
* **Difficulty (D)** = (n₁/2) × (N₂/n₂)
* **Effort (E)** = D × V
* **Time (T)** = E / 18
* **Estimated Bugs (B)** = V / 3000

### **Conclusion**

The COCOMO model helps in predicting the effort, development time, team size, and cost. For the Expenses Tracker system, such estimation helps the team plan resources efficiently and avoid over-utilization.