

# Software Engineering Task-11

Kavya Aggarwal

HU22CSEN0100288

## **COCOMO (Constructive Cost Model)**

COCOMO (Constructive Cost Model) is an algorithmic software cost estimation model developed by Barry W. Boehm in 1981. It helps estimate the effort, time, and cost required to develop a software project based on the size of the project in terms of lines of code (LOC). The model is widely used in software engineering to predict project costs effectively.

## **COCOMO Model Categories**

COCOMO is divided into three models based on the complexity and size of the project:

1. **Basic COCOMO**: Estimates effort and cost based on the size of the software.
2. **Intermediate COCOMO**: Considers additional cost drivers such as experience, tools, and hardware constraints.
3. **Detailed COCOMO**: Further refines the estimates by considering each component of the system separately.

## **COCOMO Equations**

The effort (E) and development time (T) are calculated using the following equations:

- **Effort (E) in Person-Months (PM):**

$$E = a * (KLOC)^b$$

- **Time (T) in Months:**

$$T = c * (E)^d$$

Where:

- KLOC = Thousands of Lines of Code
- a, b, c, d = Constants depending on project type

## COCOMO Project Types

1. **Organic Projects:** Simple, small teams, well-understood problems. (e.g., payroll system)
2. **Semi-Detached Projects:** Moderate complexity, mixed experience teams. (e.g., database systems)
3. **Embedded Projects:** Complex, hardware-software integration required. (e.g., real-time operating systems)

## Example 1: Basic COCOMO Calculation (Semi-Detached Model)

**Given:**

- Project Type: Semi-Detached
- Estimated Code Size: 20,000 LOC (20 KLOC)
- Constants for Semi-Detached Type: a = 3.0, b = 1.12, c = 2.5, d = 0.35

### Step 1: Compute Effort (E)

$$E = 3.0 * (20)^{1.12}$$

**E = 70.65 person-months**

## Example 2: Intermediate COCOMO Calculation (Organic Model with Cost Drivers)

### Given:

- Project Type: Organic
- Estimated Code Size: 50,000 LOC (50 KLOC)
- Constants for Organic Type:  $a = 2.4$ ,  $b = 1.05$ ,  $c = 2.5$ ,  $d = 0.38$
- Cost Drivers (Multipliers):
  - Analyst Capability: 1.1
  - Software Complexity: 1.15
  - Required Reliability: 1.2
  - Development Tools: 0.9
  - Overall Adjustment Factor (OAF) =  $1.1 * 1.15 * 1.2 * 0.9 = 1.37$

### Step 1: Compute Effort (E)

$$E = 2.4 * (50)^{1.05}$$

**E = 139.18 person-months**

Adjusting for cost drivers:  $E = 139.18 * 1.37$

**E = 190.68 person-months**

## Example 3: Detailed COCOMO Calculation (Organic Model with Component Breakdown)

### Given:

- Project Type: Organic
- Estimated Code Size: 80,000 LOC (80 KLOC)
- Constants for Organic Type:  $a = 2.4$ ,  $b = 1.05$ ,  $c = 2.5$ ,  $d = 0.38$
- Components:
  - User Interface (40 KLOC)
  - Backend (30 KLOC)
  - Database (10 KLOC)

- Cost Drivers (Multipliers for each component):
  - UI: 1.2
  - Backend: 1.1
  - Database: 1.3

### Step 1: Compute Effort for Each Component

#### User Interface:

$$EUI = 2.4 * (40)^{1.05}$$

**EUI = 111.79 person-months**

Adjusting for cost drivers: EUI = 111.79 \* 1.2

**EUI = 134.15 person-months**

#### Backend:

$$E_{Backend} = 2.4 * (30)^{1.05}$$

**EBackend = 83.98 person-months**

Adjusting for cost drivers: EBackend = 83.98 \* 1.1

**EBackend = 92.38 person-months**

#### Database:

$$EDB = 2.4 * (10)^{1.05}$$

**EDB = 24.58 person-months**

Adjusting for cost drivers: EDB = 24.58 \* 1.3

**EDB = 31.95 person-months**

## **Step 2: Compute Total Effort**

Total Effort( ETotal) = EUI + EBackend + EDB

$$ETotal = 134.15 + 92.38 + 31.95$$

$$ETotal = 258.48 \text{ person-months}$$

## **Conclusion**

COCOMO provides a structured approach to software cost estimation, helping project managers plan resources effectively. By considering project complexity and effort, it assists in better budgeting and scheduling for software development.