

(SPM)

MS. SHWETA TIWARI

Published: April 2, 2022

SPM: SOFTWARE PROJECT  
MANAGEMENT

SPM: UNIT-2 02/17

TOPIC On: COCOMO (Constructive Cost  
Estimation Model)

2 APRIL 2022 / IT-3rd year, VIth  
semester

FALL SEMESTER, YEAR (VIth, 3rd)  
FALL SESSION (2021-22)

**PREPARED FOR**

Engineering Students

All Engineering College

# COCOMO (Constructive Cost Estimation Model)

## Question Related to COCOMO model – 1

Suppose that a project was estimated to be **400 KLOC**. Calculate effort & time for each of **3** modes of development.

Software Product Type	a	b	c	d
<b>Organic</b>	2.4	1.05	2.5	0.38
<b>Semi-detached</b>	3.0	1.12	2.5	0.35
<b>Embedded</b>	3.6	1.20	2.5	0.32

Solution:

As we know that 3 modes of development are

1. **Organic**
2. **Semi-detached**
3. **Embedded**

Also we know that

$$\text{Effort} = a (\text{KLOC})^b \text{ person month}$$

$$\text{Time} = c (\text{Effort})^d \text{ Months}$$

Here, we are given  $\text{KLOC} = 400$

### 1. **Organic:**

$$\text{Effort} = a (\text{KLOC})^b \text{ person month}$$

$$= 2.4 (400)^{1.05} \text{ person month}$$

$$= 1295 \text{ person month}$$

$$\text{Time} = c (\text{Effort})^d \text{ Months}$$

$$= 2.5 (1295)^{0.38} \text{ Months}$$

$$= 38 \text{ Months}$$

### 2. **Semi-detached**

$$\text{Effort} = a (\text{KLOC})^b \text{ person month}$$

$$= 3 (400)^{1.12} \text{ person month}$$

$$= 2462 \text{ person month}$$

$$\text{Time} = c (\text{Effort})^d \text{ Months}$$

$$= 2.5 (2462)^{0.35} \text{ Months}$$

$$= 38.4 \text{ Months}$$

### 3. Embedded

$$\text{Effort} = a (\text{KLOC})^b \text{ person month}$$

$$= 3.6 (400)^{1.2} \text{ person month}$$

$$= 4772 \text{ person month}$$

$$\text{Time} = c (\text{Effort})^d \text{ Months}$$

$$= 2.5 (4772)^{0.32} \text{ Months}$$

$$= 38 \text{ Months}$$

## Question Related to COCOMO model – 2

Using the Basic COCOMO S1 model (see the tables and formulae below), calculate the effort required (in person-months), the overall development time, and the number of personnel required for each product described below.

---

### ***BASIC MODEL EQUATIONS***

1. Effort =  $a (\text{KLOC})^b$  person month
2. Development Time =  $c (\text{Effort})^d$  months
3. Number of People =  $\text{Effort} / \text{Development Time}$  persons

Software Product Type	<b>a</b>	<b>b</b>	<b>c</b>	<b>d</b>
<b>Organic</b>	2. 4	1.0 5	2. 5	0.3 8
<b>Semi-detached</b>	3. 0	1.1 2	2. 5	0.3 5
<b>Embedded</b>	3. 6	1.2 0	2. 5	0.3 2

**Product 1:** A semi-detached mode product delivering 75,000 lines of code.

**Product 2:** An embedded mode product delivering 75,000 lines of code.

**Product 3:** An organic mode product delivering 75,000 lines of code.

Briefly comment on your estimations for the above products.

### Solution:

We know that

Effort = **a (KLOC)**b. person month

Development Time = **c (Effort)**a months

Number of People = **Effort / Development Time** persons

Given that, estimated Lines of Code = 75,000 = 75 KLOC

### Product 1: Semi-detached Mode of Development

$$\text{Effort} = a (\text{KLOC})^b \text{ person month}$$

$$= 3 (75)^{1.12} \text{ person month}$$

$$= 377.73 \text{ person month}$$

$$= 378 \text{ person month}$$

$$\text{Development Time} = c (\text{Effort})^d \text{ Months}$$

$$= 2.5 (378)^{0.35} \text{ Months}$$

$$= 19.9 \text{ Months}$$

$$= 20 \text{ Months}$$

$$\text{Number of People} = \text{Effort} / \text{Development Time} \quad \text{persons}$$

$$= 378 / 20 \text{ persons}$$

$$= 18.9 \text{ persons}$$

$$= 19 \text{ persons}$$

### Product 2: Embedded Mode of Development

$$\text{Effort} = a (\text{KLOC})^b \text{ person month}$$

$$= 3.6 (75)^{1.2} \text{ person month}$$

$$= 640.288 \text{ person month}$$

$$= 640 \text{ person month}$$

$$\text{Development Time} = c (\text{Effort})^d \text{ Months}$$

$$= 2.5 (640)^{0.32} \text{ Months}$$

$$= 19.7 \text{ Months}$$

$$= 20 \text{ Months}$$

$$\text{Number of People} = \text{Effort} / \text{Development Time} \quad \text{persons}$$

$$= 640 / 20 \text{ persons}$$

$$= 32 \text{ persons}$$

### Product 3: Organic Mode of Development

$$\text{Effort} = a (\text{KLOC})^b \text{ person month}$$

$$= 2.5 (75)^{1.05} \text{ person month}$$

$$= 232.67 \text{ person month}$$

$$= 233 \text{ person month}$$

$$\text{Development Time} = c (\text{Effort})^d \text{ Months}$$

$$= 2.5 (233)^{0.38} \text{ Months}$$

$$= 19.8 \text{ Months}$$

$$= 20 \text{ Months}$$

$$\text{Number of People} = \text{Effort} / \text{Development Time} \quad \text{persons}$$

$$= 233 / 20 \text{ persons}$$

= **11.65** persons

= **12** persons

## Question Related To COCOMO Model-3

Company needs to develop a strategy for software product development for which it has a choice of two programming languages L1 and L2. The number of lines of code (LOC) developed using L2 is estimated to be twice the LOC developed with L1. the product will have to be maintained for five years. Various parameters for the company are given in the table below.

Parameter	Language L1	Language L2
Man years needed for development	LOC / 10000	LOC / 10000
Development Cost per year	Rs. 10,00,000	7,50,000
Maintenance Time	5 Years	5 Years
Cost of maintenance per year	Rs. 1,00,000	Rs. 50,000



**Total cost of the project includes cost of development and maintenance. What is the LOC for L1 for which the cost of the project using L1 is equal to the cost of the project using L2?**

Solution:

Lets Suppose LOC for the L1 = X

Given that: The number of lines of code (LOC) developed using L2 is estimated to be twice the LOC developed with L1.

Then LOC for the L2 = 2X

WE know that:

Total cost of the project includes cost of development and maintenance. And the LOC for L1 for which the cost of the project using L1 is equal to the cost of the project using L2.

Development cost of L1 + Maintenance cost of L1 = Development cost for L2 + Maintenance cost of L2

Development cost of L1 =  $(X / 10,000) * 1,00,0000$

Maintenance cost of L1 =  $5 * 1,00,000$

Development cost of L2 =  $(2X / 10,000) * 7,00,000$

Maintenance cost of L2 =  $5 * 50,000$

$\{(X / 10,000) * 10,00,000 + 5 * 1,00,000\} = \{(2X / 10,000) * 7,50,000 + 5 * 50,000\}$

$5X = 2,50,000$

$X = 5,000$

The LOC for L1 for which the cost of the project using L1 is equal to the cost of the project using  $L2 = 5,000$ .