

Experiment No-2

Date: 23/11/2021

Aim: To calculate effort Estimation using Cocomo for library management system

BASIC COCOMO MODEL:-

The basic COCOMO model estimates effort in a function of the estimated KLOC in the proposed project. The basic COCOMO model is very simple, quick and applicable to small to medium organic-type projects. It is given as follows:

$$\text{Effort} = a_1 \times (\text{KLOC})^{a_2} \text{ PM}$$

$$\text{Time} = b_1 \times (\text{Effort})^{b_2} \text{ months}$$

$$P = \text{Effort} / \text{Time}$$

where KLOC is estimated size of the software Product expressed in kilo lines of code and P is the number of persons required to complete the work.

a_1, a_2, b_1, b_2 are constants for each category of software products.

Time is the estimated time to develop the software, expressed in months.

Effort is the total effort required to develop the software, expressed in ^{Person} months. (PMS)

Software project category	a ₁	a ₂	b ₁	b ₂
Organic	2.5	1.06	2.5	0.36
Semi-detached	3.0	1.13	2.5	0.34
Embedded	3.4	1.20	2.5	0.33

The formula to calculate the development effort based on the above table are

Organic : Effort = $2.5 (KLOC)^{1.06} \text{ pm}$

Semi detached : Effort = $3.0 (KLOC)^{1.13} \text{ pm}$

Embedded : Effort = $3.4 (KLOC)^{1.20} \text{ pm}$

The six major components of Library management system are

Login/Register - 85 LOC

Search/Reserve a book - 120 LOC

Book transaction - 160 LOC

Maintain Inventory - 250 LOC

Feedback - 100 LOC

Account maintenance - 200 LOC

Total LOC = $85 + 120 + 160 + 250 + 100 + 200$

= 830 LOC

= 0.83 KLOC

∴ Value of KLOC = 0.83

To calculate development effort,

organic: $\text{Effort} = 2.5 (\text{KLOC})^{1.06} \text{ pm}$

$$= 2.5 (0.83)^{1.06} \text{ pm}$$

$$= 2.5 \times 0.82077$$

$$= 2.05193 \text{ pm}$$

Semi detached: $\text{Effort} = 3.0 (\text{KLOC})^{1.13} \text{ pm}$

$$= 3.0 (0.83)^{1.13}$$

$$= 3.0 \times 0.81013$$

$$= 2.430409 \text{ pm}$$

Embedded: $\text{Effort} = 3.4 (\text{KLOC})^{1.20} \text{ pm}$

$$= 3.4 (0.83)^{1.20} \text{ pm}$$

$$= 3.4 \times 0.79963$$

$$= 2.71877 \text{ pm}$$

To calculate development time,

$$\text{Time} = b_1 \times (\text{KLOC})^{b_2} \text{ m}$$

organic: $\text{Time} = 2.5 \times (0.83)^{0.36} \text{ m}$

$$= 2.5 \times 0.93517$$

$$= 2.33780 \text{ m}$$

Semi detached: $\text{Time} = 2.5 \times (0.83)^{0.34} \text{ m}$

$$= 2.34653 \text{ m}$$

Embedded: $\text{Time} = 2.5 \times (0.83)^{0.33} \text{ m}$

$$= 2.3509 \text{ m}$$

Intermediate cocomo model:-

The effort and time are calculated using cost drivers considering the various aspects of Product development environment. These cost drivers are used to adjust the project complexity for estimation of effort and these are termed as effort adjustment factors (EAF)

$$\text{Initial effort (E)} = a_1 \times (\text{KLOC})^{a_2}$$

$$\text{EAF} = \text{EAF}_1 \times \text{EAF}_2 \times \dots \times \text{EAF}_n$$

$$\text{Total development effort (E)} = E \times \text{EAF}$$

$$\text{Development time (T)} = b_1 \times (E)^{b_2}$$

$$\text{KLOC} = 0.83$$

The parameters considered are

Data base size	- nominal	- 1.00
Application Experience	- nominal	- 1.00
Use of software tool	- high	- 0.91
Main storage	- high	- 1.06
Virtual machine Experience	- low	- 1.10
Virtual machine volatility	- low	- 0.87

$$E = 2.5 \times (0.83)^{1.06} \times (1.00 \times 1.00 \times 0.91 \times 1.06 \times 1.10 \times 0.87)$$

$$= 2.5 \times 0.8207 \times 0.9231$$

$$= 1.89397 \text{ PM}$$

$$T = 2.5 \times (E)^{0.36} = 2.5 \times (1.89397)^{0.36} = 3.14625 \text{ M}$$

Detailed cocomo model:

The detailed cocomo model inherits all the features of the intermediate cocomo model for the overall estimation of the project cost. The detailed cocomo model uses different effort multipliers (cost drivers) for each phase of the project.

$$\text{Effort} = \text{MPE PM}$$

$$\text{Time} = \text{TPD months.}$$

The total KLOC is 0.83.

Percentage distribution of the development effort

Project type	Plan and requirement	System design	Detailed design	Code & unit test	Integration & test
organic	6	16	26	42	16
organic	6	16	24	38	22

Percentage distribution of the development time

Project type	Plan and requirement	System design	detailed design	Code & unit test	Integration & test
organic	10	19	24	39	18
organic	12	19	21	34	26

Table 2

$$\text{Effort (E)} = 1.89397 \text{ PM}$$

$$\text{KLOC} = 0.83$$

Plan and requirement:-

$$\text{Plan and requirement (\%)} = 6 + (6-6)/(32-2) \times 0.83 = 6\%$$

$$\text{Effort} = 0.06 \times 1.89397 \text{ PM}$$

$$= 0.1136382 \text{ PM}$$

System Design:-

$$\text{System Design} = 16 + (16-16)/(32-2) \times 0.83 = 16\%$$

$$\text{Effort} = 0.16 \times 1.89397 \text{ PM}$$

$$= 0.3030352 \text{ PM}$$

Detailed design:-

$$\text{Detailed design} = 24 + (26-24)/(32-2) \times 0.83 = 25\%$$

$$\text{Effort} = 0.25 \times 1.89397 \text{ PM}$$

$$= 0.4734925 \text{ PM}$$

Code and unit test:-

$$\text{Detailed design} = 38 + (42-38)/(32-2) \times 0.83 = 39\%$$

$$\text{Effort} = 0.39 \times 1.89397 = 0.7386483 \text{ PM}$$

Integration and Test:-

$$\text{Detailed design} = 22 + (16-22)/(32-2) \times 0.83 = 24\%$$

$$\text{Effort} = 0.24 \times 1.89397 = 0.4545528 \text{ PM}$$