

Date: 15-10-2021

Experiment No-2

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

Project Category	a_1	a_2	b_1	b_2
organic	2.6	1.01	2.5	0.35
Semi-detached	2.9	1.10	2.5	0.33
embedded	2.6	1.18	2.5	0.31

The six major components of library management system are:

- 1) Login/Register - 0.09 KLOC
- 2) Search/Reserve a book - 0.15 KLOC
- 3) Book Transaction - 0.2 KLOC
- 4) maintain Inventory - 0.23 KLOC
- 5) feedback - 0.12 KLOC
- 6) Account maintenance - 0.18 KLOC

$$\therefore \text{Total KLOC} = 0.09 + 0.15 + 0.2 + 0.23 + 0.12 + 0.18$$

$$\text{KLOC} = 0.97 \text{ KLOC}$$

organic: Development effort (E) = $a_1 \times (\text{KLOC})^{a_2} \text{ pm}$

$$= 2.6 \times (0.97)^{1.01}$$

$$= 2.52123 \text{ pm}$$

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

$$= 2.5 \times (0.97)^{0.35}$$

$$= 2.4734 \text{ months}$$

Semidetached :

$$\text{Development Effort (E)} = a_1 \times (\text{KLOC})^{a_2} = 2.9 \times (2.97)^{1.10} \text{ pm} \\ = 2.8044 \text{ pm}$$

$$\text{Development time (T)} = b_1 \times (\text{KLOC})^{b_2} = 2.5 \times (2.97)^{0.33} \text{ months} \\ = 2.47499 \text{ months}$$

Embedded:-

$$\text{Development Effort (E)} = a_1 \times (\text{KLOC})^{a_2} = 2.6 \times (2.97)^{1.18} \text{ pm} \\ = 2.5082 \text{ pm}$$

$$\text{Development time (T)} = b_1 \times (\text{KLOC})^{b_2} = 2.5 \times (2.97)^{0.31} \text{ months} \\ = 2.4765 \text{ months}$$

Intermediate cocono model

The effort and time are calculated using cost drivers. Let us consider the following cost drivers.

Database size = nominal - 1

Application Experience - nominal -

use of software tool - high -

virtual machine Experience - (high) low -

virtual machine volatility - low

main storage - high

- 1

- 1

- 0.91

- 1.10

- 0.87

- 1.06

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

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

$$\text{Total development effort (E)} = E_1 \times \text{EAF}$$

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

$$\text{Total development effort (E)} = a_1 \times (\text{KLOC})^{a_2} \times \text{EAF}$$

$$E = 2.6 \times (2.97)^{1.01} \times 0.91 \times 1.10 \times 0.87 \times 1.06$$

$$E = 2.3274 \text{ PM}$$

$$\text{Development time (T)} = 2.5 \times (E)^{0.35}$$

$$= 2.5 \times (2.3274)^{0.35}$$

$$T = 3.36004 \text{ months}$$

Detailed COCOMO model:-

Detailed COCOMO model defines 5 life cycle phases for effort distribution.

Table 1: Phase-wise distribution of the development effort

Project type	Plan and requirement	System design	Detailed design	Code and unit test
organic (2 KLOC)	6	16	26	42
organic (32 KLOC)	6	16	24	38

Development time for phase-wise distribution

Project type	plan and requirement	System design	Detailed design	Code and unit test	Integration test
organic (2 KLOC)	10	19	24	39	18
organic (32 KLOC)	12	19	21	34	26

The effort estimation $E = 2.3274 \text{ PM}$

$$\text{KLOC} = 2.97 \text{ KLOC}$$

Plan and Requirement

$$\text{plan and requirement (\%)} = 6 + (6-6)/(32-2) \times 2.97 = 6\%$$

$$\begin{aligned} \text{Effort} &= 0.06 \times 2.3274 \text{ PM} \\ &= 0.139644 \text{ PM} \end{aligned}$$

System Design

$$\text{System design} = 16 + (16-16)/(32-2) \times 2.97 = 16\%$$

$$\text{Effort} = 0.16 \times 2.3274 \text{ PM} = 0.372384 \text{ PM}$$

Detailed design

$$\text{detailed design} = 24 + (26-24)/(32-2) \times 2.97 = 25\%$$

$$\text{Effort} = 0.25 \times 2.3274 \text{ PM} = 0.5818 \text{ PM}$$

Code and unit test:

$$\begin{aligned}\text{code and unit test} &= 38 + (42-38)/(32-2) \times 2.97 \\ &= 38.39 \\ &= 39 \%\end{aligned}$$

$$\text{effort} = 0.39 \times 2.97 \text{ PM} = 1.1583 \text{ PM}$$

Integration and test:

$$\begin{aligned}\text{Integration and test} &= 22 + (16-22)/(32-2) \times 2.97 \\ &= 24 \%\end{aligned}$$

$$\text{Effort} = 0.24 \times 2.97 \text{ PM} = 0.7128 \text{ PM}$$

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