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 estimated KLOC in 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 total effort required to develop the software expressed in person months (pms).

Software project category	a_1	a_2	b_1	b_2
organic	2.6	1.08	2.6	0.35
semi-detached	3.9	1.17	2.6	0.35
embedded	3.4	1.24	2.6	0.34

The formulas to calculate the development effort based on the above table are.

organic : $\text{Effort} = 2.6 (\text{KLOC})^{1.08}$ PM

The six major components of library management system are

1. Login / Register — 0.10 KLOC
2) Search / Reserve a book - 0.18 KLOC
3) book transcation — 0.81 KLOC
4) maintain inventory - 0.21 KLOC
5) feedback - 0.6 KLOC
6) Account maintainance - 0.1 KLOC

∴ Total KLOC = 0.10 + 0.18 + 0.81 + 0.21 + 0.6 + 1.1 = 3.0 KLOC.

Organic:-

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

= $2.6 \times (3)^{1.08}$ pm

= 2.6×3.275

= 8.051 pm

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

= $2.6 \times (3)^{0.35}$

= 3.819 months

Semi detached :-

Development time (T) = $b_1 \times (KLOC)^{b_2}$ = $2.6 \times (3)^{0.35}$

= 3.819 months

Embedded :-

Development time (T) = $b_1 \times (KLOC)^{b_2}$ = $2.6 \times (3)^{0.34}$

= 3.77 months.

Semi detached : Effort = $3.9\ (KLOC)^{1.17}$ pm

Embedded : Effort = $3.4\ (KLOC)^{1.24}$ pm

Consider lines of code = 3000

i.e. value of KLOS = 3

Organic : effort = $2.5\ (KLOC)^{1.08}$ pm

$= 2.6\ (3)^{1.06}$

$= 2.6 \times 3.6809$

$= 9.370$ pm

Semi detached : effort = $3.9\ (KLOC)^{1.17}$ pm

$= 3.9\ (3)^{1.17}$

$= 3.9 \times 3.1364 = 31.732$ pm

Embedded : effort = $3.4\ (KLOC)^{1.24}$ pm

$= 3.4\ (3)^{1.24}$ pm

$= 3.4 \times 3.22$

$= 10.360$ pm

Intermediate cocomo model :-

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

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

$EAF = EAF_1 \times EAF_2 \times \cdots \cdot EAFn$

Total development effort $(CE) = Ei \times EAF$

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

KLOC = 3

Database size = 1.05

Application experience = 0.94

use of software tool = 0.89

main storage = 1.10

Virtual machine experience = 0.91

Virtual machine volatility = 1.19

$$E = 2.6 \times (3)^{1.08} \times (1.15 \times 0.94 \times 0.89 \times 1.10 \times 0.91 \times 1.19)$$

$$= 2.6 \times 3.687 \times 1.146$$

$$= 10.945 \text{ Pm}$$

Detailed cocomo model :-

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

effort = MpE Pm

Time = t_{PD} months.

The total KLOC is 3, let cost drivers are software reliability (high), language experience (high), product complexity (low), Analyst capability (high)

a) overall cost and schedule estimates

$$E = a_1 \times (KLOC)^{a_2} \times EAF;$$

$$= 2.6 \times (3)^{1.08} \times (1.15) \times (0.95) \times (0.85) \times (0.86)$$

$$= 10.617 \text{ pm}$$

$$D = b_1 \times (E)^{b_2} = 2.6 \times (10.617)^{0.35}$$

$$= 5.068 \text{ m}$$

b) Determine cost and scheduling estimates for different phases.

Planning and requirement

$\mu p = 7\%$ $Tp = 14\%$

$E = 16.617 \times 0.07 = 0.373$ Pm

$T = 5.368 \times 0.14 = 0.7315$ m

System Design

$\mu p = 17\%$, $Tp = 19\%$

$E = 16.617 \times 0.17 = 3.123$ Pm

$T = 5.368 \times 0.19 = 1.019$ m

Detailed Design

$\mu p = 25\%$, $Tp = 22\%$

$E = 16.617 \times 0.25 = 4.90$ Pm

$T = 5.368 \times 0.22 = 1.162$ m

Code and unit Test

$\mu p = 36\%$, $Tp = 32\%$

$E = 16.617 \times 0.36 = 7.36$ Pm

$T = 5.368 \times 0.32 = 2.35$ m 1.717 m

Integration and test:

$\mu p = 23\%$, $Tp = 27\%$.

$E = 16.617 \times 0.23 = 1.4150$ Pm

$T = 5.368 \times 0.27 = 1.48$ m

References:-

1. Software Engineering, by Roger S. Pressman's, A practional approach.
2. Software engineering, by Ugrasen Suman, Cengage Learning.

Questions (FAQ) :-

1) What is the use of COCOMO model?
2) Who proposed COCOMO model?
3) What are the benefits of COCOMO model?
4) How many modes are there in COCOMO model?
5) What is the full form of COCOMO model?
6) What is meant by development effort?
7) What is meant by development time?

4/12