

# **SOFTWARE PROJECT MANAGEMENT LAB - G2**

## **EXPERIMENT 4**

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**AIM:-** Write a program to implement intermediate COCOMO model to estimate effort, development time and average staff size.

### **THEORY:-**

The basic COCOMO model assumes that the effort is only a function of the number of lines of code and some constants evaluated according to the different software system. However, in reality, no system's effort and schedule can be solely calculated on the basis of Lines of Code. For that, various other factors such as reliability, experience, Capability. These factors are known as Cost Drivers and the **Intermediate Model** utilizes 15 such drivers for cost estimation.

Classification of Cost Drivers and their attributes:

(i) **Product attributes** –

- Required software reliability extent
- Size of the application database
- The complexity of the product

(ii) **Hardware attributes** –

- Run-time performance constraints
- Memory constraints
- The volatility of the virtual machine environment
- Required turnabout time

(iii) **Personnel attributes** –

- Analyst capability
- Software engineering capability
- Applications experience
- Virtual machine experience
- Programming language experience

(iv) **Project attributes** –

- Use of software tools
- Application of software engineering methods
- Required development schedule

The Intermediate COCOMO formula now takes the formula:

$$E = a_i (KLOC)^{b_i} * EAF$$

$$D = c_i (E)^{d_i}$$

| Software Projects | a   | b    | c   | d    |
|-------------------|-----|------|-----|------|
| Organic           | 3.2 | 1.05 | 2.5 | 0.38 |
| Semi Detached     | 3.0 | 1.12 | 2.5 | 0.35 |
| Embedded          | 2.8 | 1.20 | 2.5 | 0.32 |

**Table: Intermediate COCOMO coefficients**

### **CODE:-**

```
#include<bits/stdc++.h>
#include<iostream>
using namespace std;

int fround(float x){
int a; x=x+0.5;
a=x;
return(a);
}

int main (){
float table [3][4] = {3.2,1.05,2.5,0.38,3.0,1.12,2.5,0.35,2.8,1.20,2.5,0.32};
int i, j, size, model, rating;
char mode[][15]={"Organic", "Semi-Detached", "Embedded"}; char
driver[15][6]={"RELY","DATA","CPLX","TIME","STOR","VIRT","TURN","ACAP","
AEXP","PC AP","VEXP","LEXP","MODP","TOOL","SCED"};
float effort, EAF, a, time, staff, productivity;
float costdrivers [15][6]={
{0.75,0.88,1,1.15,1.40,-1},
{-1,0.94,1,1.08,1.16,-1},
{0.70,0.85,1,1.15,1.30,1.65},
{-1,-1,1,1.11,1.30,1.66},
{-1,-1,1,1.06,1.21,1.56},
{-1,0.87,1,1.15,1.30,-1},
{-1,0.87,1,1.07,1.15,-1},
{1.46,1.19,1,0.86,0.71,-1},
```

```

{1.29,1.13,1.00,0.91,0.82,-1},
{1.42,1.17,1,0.86,0.70,-1},
{1.21,1.10,1,0.90,-1,-1},
{1.14,1.07,1,0.95,-1,-1},
{1.24,1.10,1.00,0.91,0.82,-1},
{1.24,1.10,1,0.91,0.83,-1},
{1.23,1.08,1,1.04,1.10,-1}
};
cout<<"\nEnter the size of project(in KLOC) : ";
cin>>size;
if(size>=2 && size<=50)
    model=0;
else if(size>50 && size<=300)
    model=1;
else if(size>300)
    model=2;
cout<<"\nMode = "<<mode[model];
EAF=1;
cout<<"\n 0-Very Low\t 1-Low\t 2-Nominal\t 3-High\t 4-Very High\t 5-Extra High\n"<<endl;
for(i=0;i<15;i++){
do{
cout<<"\nRate cost driver "<< driver[i] << " on scale of 0-5 : "<<endl;
cin>>rating;
a=costdrivers [i][rating];
if(a== -1){
cout<<"\nNo value exist for this rating. Enter another rating..."<<endl;
}
}while(a== -1);
EAF=EAF*a;
}

effort=(table[model][0]* pow(size,table[model][1])) * EAF;
time=table[model][2]* pow(effort,table[model][3]);
staff=effort/time;
cout<<"\nEffort = "<<effort<< " Person-Month"<<endl;
cout<<"\nDevelopment Time = "<<time<< " Months"<<endl;
cout<<"\nAverage Staff Required = "<<fround(staff) <<" Persons"<<endl;

return 0;
}

```

## **OUTPUT:-**

```
C:\Users\Ashish\Downloads\SPM Lab Expt\SPM_LAB_04.exe
Enter the size of project(in KLOC) : 400

Mode = Embedded
0-Very Low    1-Low    2-Nominal    3-High    4-Very High    5-Extra High

Rate cost driver RELY on scale of 0-5 :
1

Rate cost driver DATA on scale of 0-5 :
2

Rate cost driver CPLX on scale of 0-5 :
3

Rate cost driver TIME on scale of 0-5 :
4

Rate cost driver STOR on scale of 0-5 :
5

Rate cost driver VIRT on scale of 0-5 :
4

Rate cost driver TURN on scale of 0-5 :
3

Rate cost driver ACAP on scale of 0-5 :
2

Rate cost driver AEXP on scale of 0-5 :
1

Rate cost driver PC AP on scale of 0-5 :
0

Rate cost driver VEXP on scale of 0-5 :
1

Rate cost driver LEXP on scale of 0-5 :
1

Rate cost driver MODP on scale of 0-5 :
2

Rate cost driver TOOL on scale of 0-5 :
4

Rate cost driver SCED on scale of 0-5 :
3

Effort = 225348 Person-Month

Development Time = 129.078 Months
```

**Finding & Learning:** - We have successfully implemented intermediate COCOMO model and calculated effort and development time for a given size of the project. COCOMO model is a very easy procedural cost estimation model for software projects.