

Consider a application which , if required to be developed by DRDO, Contain 3 modules M1,M2,M3 having Following Size:

M1= 4600 LOC Optimistic developer

M2 = 6900 LOC Most Likely Developer

M3 = 8600 LOC Pessimistic developer.

What is the expected size of application In General, if the S/W development effort is 10 person-month, find the productivity?

**Solution:**

### **Step 1: Expected Size of the Application**

Given:

M1 (Optimistic LOC) = 4600

M2 (Most Likely LOC) = 6900

M3 (Pessimistic LOC) = 8600

We use the PERT (Program Evaluation and Review Technique) formula to estimate the expected size:

$$E(S) = (O + 4M + P) / 6$$

Substituting the given values:

$$\begin{aligned} E(S) &= \frac{4600 + 4(6900) + 8600}{6} \\ &= \frac{4600 + 27600 + 8600}{6} \\ &= \frac{40800}{6} = 6800 \text{ LOC} \end{aligned}$$

So, the expected size of the application is 6800 LOC.

### **Step 2: Calculate Productivity**

Productivity is given by:

$$\text{Productivity} = \frac{\text{Expected Size (LOC)}}{\text{Effort (Person-Month)}}$$

Given effort = 10 Person-Months,

$$\text{Productivity} = \frac{6800}{10} = 680 \text{ LOC/Person-Month}$$

A library management system is being developed to handle book records, user management, and borrowing/return transactions. The estimated Lines of Code (LOC) for different modules are:

Book Management: 10,000 LOC

User Management: 8,000 LOC

Borrow/Return System: 12,000 LOC

Given Data:

Average Productivity = 600 LOC per Person-Month

Effort Adjustment Factor (EAF) = 1.1

Cost Per Person-Month = ₹50,000

Find:

Total Estimated Effort (in Person-Months)

Estimated Project Duration (in Months)

Total Development Cost (in Rupees)

### Step 1: Calculate Total Estimated Effort

The estimated effort (in Person-Months) is given by:

$$\begin{aligned}\text{Effort} &= \frac{\text{Total LOC}}{\text{Productivity}} \times \text{EAF} \\ &= \frac{30,000}{600} \times 1.1 \\ &= 50 \times 1.1 = 55 \text{ Person-Months}\end{aligned}$$

### Step 2: Calculate Estimated Project Duration

Project duration depends on team size. Assuming an ideal team size of 5 developers, we can calculate the duration:

$$\begin{aligned}\text{Duration} &= \frac{\text{Effort}}{\text{Team Size}} \\ &= \frac{55}{5} = 11 \text{ Months}\end{aligned}$$

### Step 3: Calculate Total Development Cost

$$\begin{aligned}\text{Total Cost} &= \text{Effort} \times \text{Cost per Person-Month} \\ &= 55 \times 50,000 \\ &= ₹27,50,000\end{aligned}$$

### Final Answers:

1. Total Estimated Effort: 55 Person-Months
2. Estimated Project Duration: 11 Months (for a team of 5 developers)
3. Total Development Cost: ₹27,50,000

A software project requires 50,000 lines of code (KLOC = 50).

It follows the Organic mode of the COCOMO model. Calculate the Effort (in PM) and Development Time (in months) using the basic COCOMO equations. Also calculate cost required for the development of project. assume monthly salary of a person is 60k. For Organic Mode:  $a = 2.4$ ,  $b = 1.05$ ,  $c = 2.5$ ,  $d = 0.38$ .

### Given Data:

- Project Size: 50,000 LOC (KLOC = 50)
- COCOMO Organic Mode Constants:
  - $a = 2.4$ ,  $b = 1.05$ ,  $c = 2.5$ ,  $d = 0.38$
- Monthly Salary per Person: ₹60,000

### Step 1: Calculate Effort (in Person-Months)

The effort estimation in COCOMO is given by:

$$\text{Effort (PM)} = a \times (\text{KLOC})^b$$

Substituting the given values:

$$\text{Effort} = 2.4 \times (50)^{1.05}$$

Using exponent calculation:

$$(50)^{1.05} \approx 57.27$$

$$\text{Effort} = 2.4 \times 57.27 = 137.45 \text{ PM}$$

### Step 2: Calculate Development Time (in Months)

The development time is given by:

$$\begin{aligned}\text{Time (T)} &= c \times (\text{Effort})^d \\ &= 2.5 \times (137.45)^{0.38}\end{aligned}$$

Using exponent calculation:

$$(137.45)^{0.38} \approx 9.02$$

$$\text{Time} = 2.5 \times 9.02 = 22.55 \text{ Months}$$

### Step 3: Calculate Total Development Cost

$$\begin{aligned}\text{Total Cost} &= \text{Effort} \times \text{Salary per Month} \\ &= 137.45 \times 60,000 \\ &= ₹82,47,000\end{aligned}$$

### Final Answers:

1. Effort Required: 137.45 Person-Months
2. Development Time: 22.55 Months
3. Total Development Cost: ₹82,47,000

A banking application consists of the following components:

External Inputs (EI):10, Average Complexity, weighting factor 4.

External Outputs (EO):5, High Complexity, weighting factor 7.

External Inquiries (EQ):8, Low Complexity, weighting factor 3.

Internal Logical Files (ILF):4, Average Complexity, weighting factor 10.

External Interface Files (EIF):6, High Complexity, weighting factor 7.

Given: Sum of 14 adjustment factors of FPA = 35, Effort rate 1.5 Persons-Month Per FP, Cost Per Person Month is Rupees 50000/-

Calculate estimate of Effort, Time & Cost using FP based estimation technique.

### Step 1: Calculate Unadjusted Function Points (UFP)

The formula to calculate Unadjusted Function Points (UFP) is:

$$UFP = \sum (Count \times WeightingFactor)$$

Component	Count	Complexity	Weighting Factor	Contribution
External Inputs (EI)	10	Average	4	$10 \times 4 = 40$
External Outputs (EO)	5	High	7	$5 \times 7 = 35$
External Inquiries (EQ)	8	Low	3	$8 \times 3 = 24$
Internal Logical Files (ILF)	4	Average	10	$4 \times 10 = 40$
External Interface Files (EIF)	6	High	7	$6 \times 7 = 42$

$$UFP = 40 + 35 + 24 + 40 + 42 = 181$$

## Step 2: Calculate Adjusted Function Points (AFP)

The formula to calculate AFP is:

$$AFP = UFP \times (0.65 + 0.01 \times \text{Sum of Adjustment Factors})$$

Given Sum of Adjustment Factors = 35,

$$AFP = 181 \times (0.65 + 0.01 \times 35)$$

$$AFP = 181 \times (0.65 + 0.35) = 181 \times 1.0 = 181$$

## Step 3: Calculate Effort (in Person-Months)

Effort estimation formula:

$$\text{Effort} = AFP \times \text{Effort Rate}$$

$$= 181 \times 1.5$$

$$= 271.5 \text{ Person-Months}$$

## Step 4: Calculate Development Time (in Months)

A standard approximation for time estimation:

$$\text{Time} = 2.5 \times (\text{Effort})^{0.38}$$

$$= 2.5 \times (271.5)^{0.38}$$

Approximating the exponentiation:

$$(271.5)^{0.38} \approx 12.57$$

$$\text{Time} = 2.5 \times 12.57 = 31.43 \text{ Months}$$

## Step 5: Calculate Total Development Cost

$$\text{Cost} = \text{Effort} \times \text{Cost per Person-Month}$$

$$= 271.5 \times 50,000$$

$$= ₹1,35,75,000$$

## Final Answers:

1. Effort Required: 271.5 Person-Months
2. Development Time: 31.43 Months
3. Total Development Cost: ₹1,35,75,000