Department of Computer Engineering

Academic Term: First Term 2023-24

Class: T.E /Computer Sem – V / Software Engineering

Practical No:	**5**
Title:	**Estimating project cost using COCOMO Model**
Date of Performance:	17/09/2023
Roll No:	9634
Team Members:	Aditya Mahanwar Alex Raj Rianna Rebello

Rubrics for Evaluation:

Sr. No	Performance Indicator	Excellent	Good	Below Average	Total Score
1	On time Completion & Submission (01)	01 (On Time)	NA	00 (Not on Time)	
2	Theory Understanding(02)	02(Correct)	NA	01 (Tried)	
3	Content Quality (03)	03(All used)	02 (Partial)	01 (rarely followed)	
4	Post Lab Questions (04)	04(done well)	3 (Partially Correct)	2(submitted)	

Signature of the Teacher:

EXPERIMENT NUMBER 5

Estimating the project cost for developing a "Smart Farming Assistant" mobile application. This app is designed to assist modern farmers in optimising their farming operations using advanced technology.

Project Scope : The "Farmer Helper" app aims to assist farmers in managing their agricultural activities. It will include features such as crop tracking, weather forecasts, pest and disease identification, market price information, and a community forum for farmers to exchange knowledge.

COCOMO Model: Given the project's scope, we'll use the Intermediate COCOMO mode to account for the complexity and project-specific factors.

Size of the Software: To estimate the size, we can use function points (FP). Let's assume that the "Farmer Helper" app has a size of 1,200 function points.

Step 4: Identify Project-Specific Factors For this estimate, we'll consider various project-specific factors:

- **Product Attributes**:
  - Required software reliability: Moderate (R_moderate) = 1.10
  - Complexity of the product: High (R_high) = 1.21

1. Product

	Description	*Very Low*	*Low*	*Nominal*	*High*	*Very High*	*Extra High*
RELY	Required software reliability	0.75	0.88	1.00	1.15	1.40	-
DATA	Database size	-	0.94	1.00	1.08	1.16	-
CPLX	Product complexity	0.70	0.85	1.00	1.15	1.30	1.65

- **Personal Attributes**:
  - Analyst capability: Good (R_analyst) = 0.85
  - Programmer capability: Very Good (R_programmer) = 0.88
  - Team cohesion: Moderate (R_team) = 1.05

3. Personnel

	Description	Very Low	Low	Nominal	High	Very High	Extra High
ACAP	Analyst capability	1.46	1.19	1.00	0.86	0.71	-
AEXP	Applications experience	1.29	1.13	1.00	0.91	0.82	-
PCAP	Programmer capability	1.42	1.17	1.00	0.86	0.70	-
VEXP	Virtual machine experience	1.21	1.10	1.00	0.90	-	-
LEXP	Language experience	1.14	1.07	1.00	0.95	-	-

- **Project Attributes**:
  - Development flexibility: High (R_flex) = 1.15
  - Risk management: Moderate (R_moderate) = 1.10
  - Process maturity: Moderate (R_moderate) = 1.10

4. Project

	Description	Very Low	Low	Nominal	High	Very High	Extra High
MODP	Modern programming practices	1.24	1.10	1.00	0.91	0.82	-
TOOL	Software Tools	1.24	1.10	1.00	0.91	0.83	-
SCED	Development Schedule	1.23	1.08	1.00	1.04	1.10	-

- **Platform Attributes**:
  - Database complexity: Moderate (R_moderate) = 1.10
  - Platform experience: Moderate (R_moderate) = 1.10

2. Platform

	Description	Very Low	Low	Nominal	High	Very High	Extra High
TIME	Execution time constraint	-	-	1.00	1.11	1.30	1.66
STOR	Main storage constraint	-	-	1.00	1.06	1.21	1.56
VIRT	Virtual machine volatility	-	0.87	1.00	1.15	1.30	-
TURN	Computer turnaround time	-	0.87	1.00	1.07	1.15	-

Step 5: Calculate Effort and Schedule We'll use the Intermediate COCOMO formulas for estimating effort (E) and schedule (S):

scss

```
Effort (E) = a * (Size)^b * ∏(Ri)
Schedule (S) = c * (Effort)^d
```

For a "semi detached" project type, we'll use typical constants:

- `a` = 3.0
- `b` = 1.12
- `c` = 2.5
- `d` = 0.35

Calculate `∏(Ri)`:

Scss

```
∏(Ri) = R_moderate * R_high * R_analyst * R_programmer * R_team *
R_flex * R_moderate * R_moderate * R_moderate * R_moderate
∏(Ri) ≈ 1.10 * 1.21 * 0.85 * 0.88 * 1.05 * 1.15 * 1.10 * 1.10 * 1.10
* 1.10
∏(Ri) ≈ 1.92
```

Now, calculate Effort (E):

scss

```
Effort (E) = 3.0 * (1,200)^1.12 * 1.92
Effort (E) ≈ 5,149 Person-Months
```

Next, calculate Schedule (S):

scss

```
Schedule (S) = 2.5 * (5,149)^0.35
Schedule (S) ≈ 17.55 Months
```

Estimate Cost : Assuming your organisation's cost per person-month is $7,000:

bash

```
Cost = Effort * Cost per Person-Month
Cost = 5,149 * $7,000
Cost ≈ $36,043,000
```

So, the estimated cost of developing the "Farmer Helper" app is approximately $36,043,000. Remember that this is a high-level estimate, and actual costs may vary based on many factors, including feature changes and market dynamics.

Qno1: Analyse the COCOMO model and its different modes (Organic, Semi-detached,

Embedded) to determine the most suitable mode for a specific project type.

Ans: Let's analyze the COCOMO model and its different modes (Organic, Semi-detached, and Embedded) to determine the most suitable mode for the "Farmer Helper" app project. The choice of mode depends on project size, complexity, and other factors.

Organic Mode:

Characteristics: This mode is suitable for small to medium-sized projects with experienced developers and well-understood requirements. The team is cohesive and has a good track record.
Factors: Low risk, low complexity, minimal development flexibility.
Examples: Simple mobile apps, and small websites.
Semi-detached Mode:

Characteristics: This mode fits projects that fall between the organic and embedded extremes in terms of size and complexity. Requirements are somewhat understood, and the development team has moderate experience.
Factors: Moderate risk, moderate complexity, moderate development flexibility.
Examples: Medium-sized business applications, and e-commerce platforms.
Embedded Mode:

Characteristics: This mode is for large, complex projects with uncertain or evolving requirements. The team may be less experienced, and the project may involve new technologies or platforms.
Factors: High risk, high complexity, significant development flexibility.
Examples: Enterprise-level software, complex systems, and major infrastructure projects.
Now, let's assess which mode is most suitable for the "Farmer Helper" app project based on its characteristics:

Project Size: The size of the "Farmer Helper" app is not specified in terms of lines of code but is described as having multiple features, including crop tracking, weather forecasts, and more. This suggests a moderate to large size.

Complexity: The app's functionality includes complex elements like weather forecasting and pest/disease identification, indicating a moderate level of complexity.

Requirements: While some requirements are clear (e.g., crop tracking), others may evolve, especially if new features are added based on user feedback and changing agricultural needs. This points to some uncertainty.

Team Experience: The project's complexity suggests that it may require a skilled team. Still, without specific information on the team's experience, we can assume a moderate level of experience.

Based on these characteristics, the "Semi-detached" mode appears to be the most suitable for the "Farmer Helper" app project. This mode balances moderate risk, complexity, and development flexibility. It acknowledges the project's size and potential for evolving requirements while assuming a team with moderate experience.

However, it's crucial to note that the choice of mode can vary depending on more detailed project-specific factors, such as the team's expertise, the degree of requirement changes, and the technology stack. A project manager should conduct a thorough assessment and consider expert input to make the final determination.

Qno2: Apply the COCOMO model to estimate the project cost and effort required for a given software development project.

Ans: Let's apply the COCOMO II model to estimate the project cost and effort required for the "Farmer Helper" app project, considering the "Semi-detached" mode that we determined to be the most suitable. We'll use the previously provided project size (1,200 function points) and the project-specific factors for this estimation.

Project Scope: The "Farmer Helper" app aims to assist farmers in managing their agricultural activities. It will include features such as crop tracking, weather forecasts, pest and disease identification, market price information, and a community forum for farmers to exchange knowledge.

COCOMO Model: Given the project's scope, we'll use the Intermediate COCOMO mode to account for the complexity and project-specific factors.

Size of the Software: To estimate the size, we can use function points (FP). Let's assume that the "Farmer Helper" app has a size of 1,200 function points.

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Calculate ∏(Ri):

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R_flex * R_moderate * R_moderate * R_moderate * R_moderate
∏(Ri) ≈ 1.10 * 1.21 * 0.85 * 0.88 * 1.05 * 1.15 * 1.10 * 1.10 * 1.10
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∏(Ri) ≈ 1.92
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Now, calculate Effort (E):

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Estimate Cost: Assuming your organization's cost per person-month is $7,000:

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Cost = 5,149 * $7,000
Cost ≈ $36,043,000
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So, the estimated cost of developing the "Farmer Helper" app is approximately $36,043,000. Remember that this is a high-level estimate, and actual costs may vary based on many factors, including feature changes and market dynamics.

Qno3: Evaluate the factors influencing COCOMO estimates, such as project size, personnel capabilities, and development tools, and their implications on project planning and scheduling.

Ans: Let's evaluate the factors influencing COCOMO estimates, such as project size, personnel capabilities, and development tools, and discuss their implications on project planning and scheduling for the "Farmer Helper" app:

Project Size:

Influence on COCOMO Estimates: Project size, often measured in function points or lines of code, directly impacts COCOMO estimates. Larger projects typically require more effort and time to complete.

Implications on Planning and Scheduling: For the "Farmer Helper" app, which is estimated to be of moderate to large size (1,200 function points), a longer development timeline and more resources may be needed. Project managers should plan for a substantial development period and allocate sufficient personnel and resources.
Personnel Capabilities:

Influence on COCOMO Estimates: Personnel capabilities, including the skills and experience of the development team, can affect productivity and the quality of work. COCOMO considers factors like analyst capability, programmer capability, and team cohesion.
Implications on Planning and Scheduling: Having a skilled and experienced team can positively influence project efficiency. It may lead to faster development and better problem-solving capabilities. However, if the team lacks expertise in certain areas required by the app, additional training or external expertise may be needed, which can affect the project timeline.
Development Tools:

Influence on COCOMO Estimates: The choice of development tools, languages, and frameworks can impact productivity and development speed. Modern tools and efficient development environments may result in faster progress.
Implications on Planning and Scheduling: Selecting appropriate development tools for the "Farmer Helper" app can expedite development. However, it's essential to account for any learning curves associated with new tools. The compatibility of tools with the project's requirements and the team's familiarity with them should be considered during project planning.
Risk Factors:

Influence on COCOMO Estimates: COCOMO accounts for risk factors like development flexibility, risk management, and process maturity. High levels of risk can lead to longer development times and increased resource allocation.
Implications on Planning and Scheduling: The "Farmer Helper" app project includes features like pest and disease identification, which may involve complex algorithms and potential uncertainty. Adequate risk management strategies and contingency plans should be in place to address unforeseen challenges and mitigate their impact on the schedule.
Platform and Technology Factors:

Influence on COCOMO Estimates: The complexity of the technology stack and platform attributes can affect development efforts. Complex platforms or unfamiliar technologies may require more effort.
Implications on Planning and Scheduling: The choice of platforms and technologies for the app should align with project requirements. Extensive integration work or adapting to new platforms may extend the development schedule. Careful planning and resource allocation are necessary to account for these factors.
In summary, project size, personnel capabilities, development tools, risk factors, and technology choices are crucial considerations when applying COCOMO estimates to project planning and scheduling for the "Farmer Helper" app. Project managers should carefully assess these factors, allocate resources accordingly, and develop a realistic schedule that accounts for potential challenges and uncertainties. Additionally, effective risk management and continuous monitoring of progress are essential to keep the project on track.