|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  | | | | |
|  | |  | | | |
| Project: | | {Personal Tutoring Service-PTS}  CSE 5325 – Fall 2023  Project Management | | | |
| Module: | | COCOMO | | | |
| Deliverable: | | COCOMO Estimate Report | | | |
| Version: | | | [1.0] | Date: | [11/09/2023] |

Prepared by: Keerthana Pyata 1002029148

TABLE OF CONTENTS

[1. Introduction 2](#_Toc23340379)

[2. Estimating Factors 3](#_Toc23340380)

[2.1 Source of Lines of Code 3](#_Toc23340381)

[2.2 Scale Drivers 3](#_Toc23340382)

[2.3 Cost Drivers 3](#_Toc23340383)

[3 Project Final Timeline and Cost Structure 4](#_Toc23340384)

[4. Conclusion and Recommendations 5](#_Toc23340385)

[Appendices 6](#_Toc23340386)

# 1. Introduction

The main aim for this documentation is to estimate Personal Tutoring Service-PTS cost, timeline and effort required to bring up this experience of learning to life. By gathering information on project needs, size, complexity, team and tools we can estimate cost, timeline and effort for Personal Tutoring Service system. To figure out those things we got a tool named COCOMO II. It’s like a guide which helps us to figure out how much time and money is needed for this project.

This cost estimation report helps to provide a detailed breakdown of financial aspects associated with developing PTS. It encompasses factors such as personnel cost, development tools, testing framework and other components which are related to it.

By the end of this analysis, stakeholders will gain insights into the financial implication of bringing PTS to life, aiding in informed decision making and strategic planning for successfully executing this educational initiative platform- Personal Tutoring Service.

**To get COCOMO findings, the following are three crucial factors were used:**

* Source line of code (SLOC)
* Scale driver
* Cost driver

**Estimates produced by COCOMO that are effective:**

The sum of following factors:

* Total size of SLOC
* Total duration
* Total effort
* Total productivity in developed SLOC per person-month
* Overall Cost

**Model and Methodology employed by COCOMO**

* In order to complete this project, we use waterfall methodology.
* For this project, we applied the SLOC methodology.
* In this project, there are 5 developers and 1 manager.

# 2. Estimating Factors

## 2.1 Source of Lines of Code

The following is the number of lines of code delivered as part of this project, A justification for the total amount of LOC is provided.

|  |  |
| --- | --- |
| **SLOC | Source Lines Of Code** | Value Chosen: 5000 |
| Justification: Source lines of code (SLOC) are a unit of measurement for the size of a software project. The number of lines of code, consisting of comments and blank lines, is used to calculate the program's overall size. The time and money required for the development, testing, and maintenance of a software system can be represented by the system's SLOC. Lines of code, or SLOC, are always a common metric in the software development industry despite these limitations. By giving project managers an approximate idea of the project's scope, it may help them with planning and resource allocation. It should be combined with other metrics and parameters to obtain a more accurate estimate of the time and cost required to develop and maintain a software system. | |

## 2.2 Scale Drivers

The following is the list of scale drivers, the values applicable to this project and a justification for each value chosen:

|  |  |
| --- | --- |
| **PREC | Precedentedness** | Value Chosen: Generally Familiar |
| Justification: Precedentedness is considered how much innovation is required. If the development team has prior experience with similar educational platforms or tutoring systems, it reduces the learning curve. This familiarity allows for more efficient decision-making, problem-solving, and a smoother development process. It influences project estimation by minimizing learning, enhancing productivity, reducing risks, improving communication and promoting consistency in development processes. These factors collectively contribute to more accurate and efficient estimation of effort and cost for project. | |

|  |  |
| --- | --- |
| **FLEX | Development Flexibility** | Value Chosen: Some Relaxation |
| Justification: Development flexibility show on the flexibility of requirements and how hardware and software interface specifications constrain the project. This project may require flexibility to adapt to changing educational methodologies, emerging technologies, and dynamic user needs. Choosing a balanced level of flexibility acknowledges the need to accommodate shifts in requirements and technological advancements without compromising the overall stability and predictability of the development process. | |

|  |  |
| --- | --- |
| **RESL | Architecture/Risk Resolution** | Value Chosen: Often (60 %) |
| Justification: More time and money may be needed to manage project risks and address architectural problems in projects with a high Architecture/Risk Resolution. The development of a Personal Tutoring Service system involves inherent risks, such as the integration of various educational components, user data security, and real-time interaction functionalities. A high level of Risk Resolution is justified to ensure that the team is well-prepared to identify, assess, and mitigate risks effectively, minimizing potential disruptions to the project. | |

|  |  |
| --- | --- |
| **TEAM | Team Cohesion** | Value Chosen: Basically cooperative |
| Justification: The COCOMO (Constructive COost Model) is a tool for estimating the time and money needed to create software by factoring in the level of team cohesion present during development. It's a measurement of how well everyone in the development team can talk to one another and work together. Building a Personal Tutoring Service system requires seamless collaboration among developers, instructional designers, and educational experts. High Team Cohesion is essential to ensure effective communication, shared understanding of project goals, and collaborative problem-solving. This is particularly crucial for a system that involves multiple aspects of education and technology. | |

|  |  |
| --- | --- |
| **PMAT | Process Maturity** | Value Chosen: SEI CMM Level 2 |
| Justification:  Estimating the time and money needed for a project with low Process Maturity might be difficult since it may take more time and money to set up a development process and guarantee adherence to standards and procedures. Developing a robust and reliable Personal Tutoring Service system necessitates a mature development process. A higher level of Process Maturity ensures that the organization has well-established and optimized processes for requirements gathering, design, implementation, testing, and maintenance. This contributes to a more predictable and efficient development lifecycle. | |

Based on the particular requirements of creating a Personal Tutoring Service system, each of these scale drivers was chosen. The aim is to guarantee that the development team possesses the necessary tools to manage the complexity of educational technology, adapt to evolving demands, efficiently manage risks, create robust collaboration, and uphold an established and dependable development methodology. These Scale Drivers work together to provide a more precise and customized estimate of effort and cost for the PTS system project.

## 2.3 Cost Drivers

The following is the list of cost drivers, the values applicable to this project and a justification for each value chosen:

|  |  |
| --- | --- |
| **ACAP | Analyst Capability** | Value Chosen: Very High |
| Justification: The development of a Personal Tutoring Service system requires a high level of analytical capability, particularly in understanding educational requirements and translating them into effective system features. A “Very High” ACAP value is justified to underscore the importance of having skilled analysts who can navigate the complexities of educational technology. | |

|  |  |
| --- | --- |
| **APEX | Applications Experience Cost Driver** | Value Chosen: Very High |
| Justification: A “Very High” APEX value is justified to emphasize the importance of prior experience in developing educational platforms or similar systems. This experience contributes to a more efficient development process, better decision-making, and a higher likelihood of success in achieving the objectives of the Personal Tutoring Service system. | |

|  |  |
| --- | --- |
| **PCAP | COCOMO Programmer Capability Cost Driver** | Value Chosen: Very High |
| Justification: A “Very High” PCAP value is justified for a Personal Tutoring Service system, as it emphasizes the need for highly skilled programmers. The complexity of educational systems requires expertise in software development, algorithm design, and interactive user interface creation which helps to ensure the successful implementation of the desired platform. | |

|  |  |
| --- | --- |
| **PLEX | Platform Experience Cost Driver** | Value Chosen: Very High |
| Justification: Considering the possible range of platforms on which a Personal Tutoring Service system may be deployed, a “Very High” PLEX value is justified. This accounts for the need to have experienced developers who can navigate the details of various platforms, ensuring a consistent and optimized user experience across different devices and operating systems. | |

|  |  |
| --- | --- |
| **LTEX | Language and Tool Experience Cost Driver** | Value Chosen: Very High |
| Justification: For a Personal Tutoring Service system, a “Very High” LTEX value is selected because it indicates how crucial proficiency with particular programming languages and development tools is. This expertise is critical for efficient coding, effective debugging, and leveraging the full capabilities of chosen technologies. | |

|  |  |
| --- | --- |
| **PCON | Personnel Continuity Cost Driver** | Value Chosen: Very High |
| Justification: The continuity of personnel is crucial for maintaining consistency in development approaches, especially in a project with specific educational goals. A “Very High” PCON value is used to prioritize team stability, reduce knowledge transfer overhead, and ensure that the team remains cohesive throughout the project's lifecycle. | |

**Platform:**

|  |  |
| --- | --- |
| **TIME | Execution Time Constraint Cost Driver** | Value Chosen: High |
| Justification: Real-time interactions and responsiveness are critical for a PTS system. A “High” TIME value is justified to emphasize the need for efficient algorithms, optimized code, and a responsive system. This ensures that educational interactions occur seamlessly in real-time, providing a positive user experience. By this it helps to create software programs that utilize as little available execution time as possible. | |

|  |  |
| --- | --- |
| **STOR | Main Storage Constraint Cost Driver** | Value Chosen: High |
| Justification: The storage requirements for educational content, user data, and system-related information in a PTS system can be significant. A “High” STOR value is justified to address the need for a well-optimized storage strategy, efficient data retrieval, and sufficient storage capacity to accommodate the growing volume of educational materials. | |

|  |  |
| --- | --- |
| **PVOL | Platform Volatility Cost Driver** | Value Chosen: Low |
| Justification: We have chosen the Platform volatility cost driver(PVOL) to be “Low” because there is not going to be any major change for a year after the project is deployed. This implies a reduced emphasis on continuous adaptation to evolving platforms, and the system may be designed with a stable and less volatile technology stack. | |

**Product:**

|  |  |
| --- | --- |
| **RELY | Required Software Reliability Driver** | Value Chosen: Nominal |
| Justification: A “Nominal” RELY value suggests that the PTS system acknowledges the importance of reliability without overemphasizing it. This implies a balanced approach, where the system aims for a standard level of reliability that meets user expectations without investing excessively in error prevention and recovery mechanisms. | |

|  |  |
| --- | --- |
| **DATA | Database Size Cost Driver** | Value Chosen: Very High |
| Justification: A Personal Tutoring Service system likely involves the storage and management of a substantial amount of user and educational data. The chosen “Very High” DATA value accounts for the need for a scalable and efficient database structure. This ensures that the system can handle a large volume of user data, educational content, and transactional information without compromising in the performance. | |

|  |  |
| --- | --- |
| **CPLX | Product Complexity Cost Driver** | Value Chosen: Very low |
| Justification: In project planning, the Product Complexity Cost Driver quantifies the impact of a software product's complexity on its development and maintenance costs. The COCOMO (Constructive Cost Model) estimation methodology uses it as one of the cost determinants. A “Very Low” CPLX giving indicates that a simple and uncomplicated PTS system is the goal. This suggests a user interface, feature set, and educational module set that is minimalistic. It is expected that the development work will be minimal, producing a straightforward system. | |

|  |  |
| --- | --- |
| **RUSE | Required Reusability Cost Driver** | Value Chosen: Very High |
| Justification: Building a Personal Tutoring Service system may involve the reuse of components, modules, or educational content. A “Very High” RUSE value is justified to emphasize the importance of designing components with high reusability. This approach enhances development efficiency, reduces redundancy, and promotes a consistent user experience across the platform. | |

|  |  |
| --- | --- |
| **DOCU | COCOMO Documentation Match to Life-Cycle Needs Cost Driver** | Value Chosen: Very Low |
| Justification: A “Very Low” DOCU value implies minimal documentation requirements for the PTS system. This suggests a project where documentation is kept to a minimum, potentially focusing only on essential aspects. This approach can put a higher value on quick development than in-depth documentation for different user groups. | |

**Project:**

|  |  |
| --- | --- |
| **TOOL | COCOMO Use of Software Tools Cost Driver** | Value Chosen: Very High |
| Justification: The development of a sophisticated educational platform necessitates the use of various software tools for design, testing, and project management. A “Very High” TOOL value is used to ensure that the team has access to and proficiency in a comprehensive set of tools which helps in enhancing the development process and overall project efficiency. | |

|  |  |
| --- | --- |
| **SITE | COCOMO Multisite Development Cost Driver** | Value Chosen: Very High |
| Justification: The COCOMO Multisite Development Cost Driver is a crucial factor in project planning, as it can have a substantial effect on the total project cost and schedule. A “Very High” SITE value is selected for a Personal Tutoring Service system, especially if the development team is distributed across multiple locations. This emphasizes the need for effective communication, collaboration tools, and coordination strategies to ensure seamless integration of efforts across different sites. | |

|  |  |
| --- | --- |
| **SCED | Required Development Schedule Cost Driver** | Value Chosen: Low |
| Justification: A “Low” SCED value indicates that the development schedule for the PTS system may have a more flexible timeline. This suggests a willingness to extend the development timeline if needed, with less emphasis on strict deadlines and a reduced pressure to meet aggressive schedules. | |

# 3. Project Final Timeline and Cost Structure

* **Previous Cost, Work and Duration (from assignment #2);**

|  |  |
| --- | --- |
| Duration | 3 Months |
| Human Resource Cost | 239,000$ |
| Non-Human Resource Cost | 61,350$ |
| Profit [0.5\*(Human cost + Non-Human Cost)] | [0.5\*(239,000+61,350)] = 150,175$ |
| Total Cost | 300,350+150,175 = 450,525$ |

* **New Timeline and Cost Structure Using COCOMO II**

|  |  |
| --- | --- |
| New Schedule (Duration) | 4.9 months |
| COCOMO estimated costs (Human Resources)  (Requirement + Product Design +Detailed Design + Code/Unit Test + Integration Testing) | 270,000$ |
| Non-Human Resources | 61,350$ |
| Maintenance Cost | 12,000$ |
| Profit [0.5\*(human+non-human+maintenance cost)] | [0.5\*(270,000+61,350+12,000) = 171,675$ |
| Total Cost | 343,350+171,675 = 515,025$ |

# 4. Conclusion and Recommendations

**Conclusion**

In Project Scope and Feasibility Analysis, a budget of 300,350$ was estimated. But when we did the calculation using COCOMO II we have exceeded our budget when estimated manually. This happened because we initially did not estimate project cost and timeline based on these factors:

* Personnel Capability
* Project Size
* Development Environment
* Risk and Uncertainty
* Software tools and Methodologies
* Project Management and Communication

Initially, the project contains Human resources allocated for only 3 months without using any formulas. But when calculated using formulas for completion of this project it requires more months than initial calculation.

The following are the results of COCOMO II for Personal Tutoring Service:

* Total SLOC size: 5000
* Duration: 4.9 months
* Total Cost: 270.2K$

**Recommendations:**

Well, there are few reasons why we need to employ COCOMO model when developing the project. The following are those:

* Accurate forecast on project total cost
* Gives an appropriate deadline for the project.
* It’s easy to use as steps and specifics are simple.
* Reports and graphs showing the details of cost, timeline etc., are easily and automatically generated.
* It even calculates considering with individual team member, hardware and software.

Despite having benefits of COCOMO, the project will be SPLIT between original estimate and COCOMO estimate.

In COCOMO calculation it doesn’t include software licenses, facility rent and other expenses. However, we must consider those services as they are quite expensive.

# Appendices

Additional documents, Screen Shots of COCOMO reports, references.













