Software Analysis and Design – Assignments 1, 2 and 3

Our objective is to undertake a project assignment within our course that adopts a systematic approach to technical project management. This endeavour will integrate hands-on exercises, in-depth research, and collaborative teamwork to engineer an innovative library booking system.

At a high level, the project entails the design and development of a cutting-edge public library booking system aimed at improving the operational efficiency and overall user experience. Key functionalities will include inter-library book exchanges, sophisticated management of fines due to overdue returns or damage, streamlined processing of membership fees, and an all-encompassing user management system. The deployment of the system on a cloud infrastructure will ensure high availability and will be complemented by robust data migration strategies, transitioning from the current mode of operation (CMO) to a more advanced future mode of operation (FMO).

It is important to acknowledge the shortcomings of the existing library system, which is impacted by frequent crashes and the chronic issue of untracked books due to delayed returns. Our strategic roadmap is structured as follows:

- **Assignment 1:** Our initial task is to conduct comprehensive business requirement gathering and to clearly define all the necessary features for the envisioned FMO system.
- **Assignment 2:** Subsequently, we aim to outline the project budget and timelines, provide a potential high-level design, detail the projected activities, costs and timelines as well as conducting a thorough risk analysis for the FMO migration. With preliminary approvals in place, we will design a Request for Proposal (RFP).
- **Assignment 3:** With preliminary approvals in place, we will collect RFP responses to identify and select the most suitable design and delivery methodologies. This phase will culminate in the development of final System Design Specifications (SDS), inclusive of UML diagrams and Database Entity-Relationship Diagrams (ERD), as well as the formulation of test-Driven Development (TDD) and deployment strategies that address potential system failures, along with corresponding recovery and rollback plans.

Details of each assignment are articulated below.

Assignment 1: Business Requirement Gathering for FMO System

Objectives:

- To conduct an exhaustive business requirement analysis for a future mode of operation (FMO) system.
- To define a detailed feature set that meets the operational needs of a modern public library system.

Detailed Tasks:

- **Comprehensive Requirement Analysis**: Begin with a deep dive into the operational necessities of a contemporary library. Engage with a range of stakeholders to gather functional, non-functional, regulatory, and technical requirements.

- **Feature Set Definition**: Catalog the required features, including user account management, resource allocation algorithms, fine accrual and payment processing, and inter-library loan logistics.
- **Stakeholder Workshops**: Organize interactive sessions with library staff, patrons, IT personnel, and external partners to validate requirements and prioritize features based on impact and feasibility.
- **Requirement Documentation**: Produce a meticulous requirements document that outlines the user stories, use cases, and acceptance criteria for the FMO system. Ensure this document is clear enough to serve as a foundational reference for subsequent design and development phases.

Deliverables:

- A Requirement Specification Document that includes prioritized and validated user requirements, functional and non-functional needs, and regulatory compliance aspects.
- A Features Roadmap that sequences the implementation of features based on the project timelines and resource availability.
- A Stakeholder Approval Form signed by all key stakeholders, confirming agreement on the project requirements.

Evaluation Criteria:

- Thoroughness and clarity of the requirement analysis and articulation.
- Inclusion of diverse stakeholder perspectives and needs.
- Prioritization logic and justification for the feature set.
- Documentation standard, readability, and adherence to business analysis best practices.

Here is a link for a sample BRD. In general aim to cover topics such as:

1. **Executive Summary**
   - 1.1 Project Background
   - 1.2 Business Opportunity
   - 1.3 Project Objectives
   - 1.4 Summary of Stakeholder Needs
2. **Project Overview**
   - 2.1 Project Scope
   - 2.2 Project Goals and Objectives
   - 2.3 Project Assumptions
   - 2.4 Project Constraints
   - 2.5 Project Risks
3. **Stakeholder Analysis**
   - 3.1 Stakeholder List
   - 3.2 Stakeholder Roles and Responsibilities
   - 3.3 Stakeholder Needs and Requirements

4. **Business Requirements**
    - 4.1 Business Problem or Opportunity
    - 4.2 Business Objectives
    - 4.3 Success Criteria
    - 4.4 Business Process Overview
        - 4.4.1 Current Process Model
        - 4.4.2 Proposed Process Model
    - 4.5 Business Data Requirements
        - 4.5.1 Data Inputs
        - 4.5.2 Data Outputs
        - 4.5.3 Data Storage Requirements
    - 4.6 Regulatory, Compliance, and Quality Requirements

5. **Functional Requirements**
    - 5.1 User Requirements
    - 5.2 System Features and Functions
    - 5.3 User Interface Requirements
    - 5.4 Performance Requirements
    - 5.5 Security Requirements
    - 5.6 Integration Requirements
    - 5.7 Usability Requirements

6. **Non-Functional Requirements**
    - 6.1 Scalability Requirements
    - 6.2 Reliability Requirements
    - 6.3 Availability Requirements
    - 6.4 Maintainability Requirements
    - 6.5 Disaster Recovery and Business Continuity

7. **Technical Requirements**
    - 7.1 Technology Stack
    - 7.2 Development Environment
    - 7.3 Deployment Environment
    - 7.4 Third-Party Integrations
    - 7.5 Data Migration Plan

8. **Transition Requirements**
    - 8.1 Training Needs
    - 8.2 Data Conversion
    - 8.3 System Cutover

- 8.4 Support and Maintenance Plans

9. **Appendices**
    - 9.1 Glossary of Terms
    - 9.2 Acronyms and Abbreviations
    - 9.3 Reference Documents
    - 9.4 Version History
10. **Approval**
    - 10.1 Stakeholder Approval
    - 10.2 Change Management Process

Assignment 2: Budgeting, Design, and Risk Analysis for FMO Migration

Objectives:

- To establish a comprehensive budget and timeline for the library system's transition to the FMO.
- To produce a high-level system design that addresses the core functionalities and requirements gathered in Assignment 1.
- To conduct a detailed risk analysis that considers both the technical and operational aspects of the FMO migration.
- To draft a Request for Proposal (RFP) that will attract competent vendors for the final system design and implementation.

Detailed Tasks:

- **Budgeting**: Construct a detailed budget plan accounting for all the resources needed for the system's development, including personnel, hardware, software, and contingency allowances.
- **Timeline Development**: Develop a project timeline with clear milestones, phase gates, and deliverable dates, ensuring that each critical path item is identified and accounted for.
- **High-Level System Design**: Sketch the initial system design, focusing on the architecture, database schema, and integration points. This should also cover preliminary interface design sketches and workflow diagrams.
- **Risk Analysis**: Execute a risk analysis exercise to identify potential issues that could impede the project's success. This should include mitigation strategies and contingency plans. Special attention should be paid to risks associated with data migration and system integration.
- **RFP Design**: Prepare a detailed RFP document that outlines the project scope, requirements, expected deliverables, and selection criteria. This document should be robust enough to guide potential vendors in proposing viable solutions.

Deliverables:

- A Project Budget Document that offers a detailed breakdown of costs.
- A Gantt Chart or similar timeline visualization detailing the project's key phases and milestones.
- High-Level Design Overviews, including architectural blueprints and preliminary database and interface designs.
- A Risk Analysis Report with a comprehensive list of identified risks, their potential impact, and planned mitigation strategies.
- An RFP Document ready for distribution to potential vendors.
- A Vendor Selection Matrix that assists in evaluating and choosing the best proposals.

Evaluation Criteria:

- Accuracy and realism of the budget and timeline.
- The practicality and foresight evident in the high-level design.
- The comprehensiveness of the risk analysis and the robustness of the mitigation strategies.
- Alignment of the budget, timeline, and high-level design with the project's goals and stakeholder expectations.
- The clarity, completeness, and professionalism of the RFP document.

Assignment 3: Final System Design and Implementation Planning

Objectives:

- To finalize the System Design Specifications (SDS) with detailed UML and Database Entity-Relationship Diagrams (ERD).
- To establish a comprehensive Test-Driven Development (TDD) strategy, along with deployment plans that encompass system failure responses, recovery, and rollback protocols.

Detailed Tasks:

- **Selection of Design and Delivery Methodologies**: Evaluate the received proposals and select the most suitable design and implementation methodologies based on innovation, cost-effectiveness, and alignment with the project's goals.
- **Final SDS Creation**: Elaborate on the SDS, detailing all system components using UML diagrams for software architecture and ERD for database design. These should reflect a thorough understanding of the requirements and provide clear guidance for developers.
- **TDD and Deployment Strategy**: Formulate a TDD strategy that ensures code quality from the outset. Develop a deployment plan that includes detailed steps for rolling out the system, handling potential failures, and ensuring minimum downtime during migration.
- **Recovery and Rollback Plans**: Design robust recovery and rollback plans that can be swiftly executed in case of system failures to minimize impact on library services.

Deliverables:

- An in-depth SDS that includes comprehensive UML and ERD documents.
- A TDD Plan that outlines the testing protocols and quality assurance measures.
- A Deployment Plan with detailed steps for system implementation, including checkpoints for system health and functionality.
- Recovery and Rollback Documentation that provides clear instructions for restoring system stability in the event of a malfunction.

Evaluation Criteria:

- The thoroughness of the vendor selection process and the rationale behind the chosen methodologies.
- The detail and accuracy of the final SDS, particularly the UML and ERD.
- The robustness of the TDD and deployment strategies, particularly their ability to minimize risk and ensure system quality.
- The practicality and responsiveness of the recovery and rollback plans.