Ain Shams University Faculty of Engineering

Computer and Systems Engineering (CSE)

Fall Semester – 2022

Software Project Management

CSE441

University Information System

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1. Introduction

1.1. Purpose

This project is a management system for faculty of engineering Ain Shams university. The University management system (UMS) is a web-based solution which covers all aspects of the university. It is developed for conducting, monitoring & analyzing complex activities of the University and its affiliated colleges like Centralized Admission, Centralized Examination, and much more.

1.2. List of Definitions

UMS: University management system

IT: Information Technology

WBS: Work Breakdown Structure

Gantt chart: a chart in which a series of horizontal lines shows the amount of work done or production completed in certain periods of time in relation to the amount planned for those periods

AON (**Activity-on-Node** diagram): A basic type of a logic diagram used in scheduling.

The PERT estimate (E): is based on a formula that includes your optimistic time estimate (O), your most likely time estimate (M) and your pessimistic time estimate (P). The basic equation is this: **E = (O + 4M +P) / 6**

ES: Early start time

EF: Early finish time

LS: Late finish time

LF: Late start time

Free float: an amount of time that a schedule activity can be delayed without delaying the early start of any immediately following schedule activities.

Total float: the amount of time that an activity can be delayed without delaying the project

Critical path (CPM): focuses on managing tasks

Critical chain: concentrates on managing the resources and buffer

Project buffer: the extra time you add to a task, so that even if it gets delayed, it won't affect the overall project schedule

Feeding Buffers: It is a buffer that is inserted before the first activity on the Critical Chain

1.3. Overview

The UMS is explained in this document is a very detailed way, in the beginning we have the Project charter that states a project exists and provides project managers with written authority to begin work, and then a feasibility study for the project in form of the

plans needed (Time plan, Cost plan and scope), then the project phases showing each phase needs and plan, then a WBS for all tasks in the project, and for sure a Gantt chart to visualize all the needed data and time plan for each task, then the AON diagram to know each task dependency in the project, the PERT estimate to know the average time of completion for the project, then the calculations to improve the critical paths to improve the estimated time for the project.

1.4. Assumptions

1.4.1. There is an available suitable server for the number of students.
1.4.2. The portal must be compatible with the various operating systems.
1.4.3. The portal must be compatible with the various web browsers.
1.4.4. The weekends are Saturday and Sunday.
1.4.5. We have 100 working days from the third of April till the eighteenth of August.

2. Project Charter

Project Title: University Information System

Project Description: The system consists of a set of sub-systems such as registration, grading, class schedule management, exam schedule management, classrooms allocation, library, and staff schedule management.

Date of Authorization: April 3

Project Start Date: April 3 **Project Finish Date:** August 16

Key Schedule Milestones:

- Collecting Main Features for the Project by April 25
- Implement User Interface + some features of Software System by June 19
- Complete the production version of Software by August 16

Budget Information:

The firm has allocated 80 thousand Egyptian pound for this project, and more funds are available if needed.

Most of the budget will be internal labor. All hardware will be outsourced.

Project Manager: Ahmed Adam, aadam@asu.eng.edu.eg

Project Objective:

The main objective of the project is to streamline the entire student information, make it accessible, so higher education campus leaders, faculty, academicians, and students have data right in their hands with no fuss. It eliminates manual workload and create intuitive, connected systems and innovative user experiences for all constituents.

Project Goals:

- Implement an integrated, flexible, reliable database system accessible through the internet.
- Provide a user-friendly, easy to use system with appropriate documentation.
- Provide clear, easy access to information in real time 24/7 for students, faculty, and staff.
- Provide student record maintenance reports, dashboards, and analytics.
- Provide a complete student portfolio with details about assessments, enrollments, course self-registration and outcomes tracking.

- Helps eliminate manual admission processes.
- Maintains detailed course history of the students.
- Provide the students with access to additional resources and advanced library management.
- Manage student fee payments.

Main Project Success Criteria:

- Executive and management support.
- Availability of resources when needed to complete the project.
- The software must meet all the written specifications.
- An understanding of the importance of the work.
- Project delivery on-time and on-budget.

Roles and responsibilities:

Name	Role	Position	Contact information
Omar Elhusseiny	Dean of the faculty	CEO	oelhusseiny@asu.eng.edu.eg
Keroles Karam	Sponsor	CEO	KKaram@asu.eng.edu.eg
Ahmed Adam	Project Manager	Manager	aadam@asu.eng.edu.eg
Eman Elshamy	Academic Affairs	Director	emanshamy@asu.eng.edu.e
Mohamed Gamal	Finance	Financial Director	mgamal@asu.eng.edu.eg
Nour Mohamed	Student services	Director	mnour@asu.eng.edu.eg
John Medhat	IT development team	CIO	johnmedhat@asu.eng.edu.eg
Mayar Ahmed	IT development team	Programmer	mahmed@asu.eng.edu.eg
Ali Mohamed	IT development team	Programmer	alimoh@asu.eng.edu.eg
Ali Ashraf	IT development team	Programmer	aliashraf@asu.eng.edu.eg

Salma Atef	IT development team	Programmer	salmatef@asu.eng.edu.eg
Joseph Karam	Testing team member	Tester	josephk@asu.eng.edu.eg
Khaled Ahmed	Testing team member	Tester	khahmed@asu.eng.edu.eg
Mariam Samir	Testing team member	Quality manager	mariams@asu.eng.edu.eg
Mina Ehab	IT development team	Database administrator	minaehab@asu.eng.edu.eg

Dependencies:

Project activity	Impacts on	Criticality
Maintain Student Records	Admissions Management	Critical
Admissions Management	Attendance Management	Critical
Transcript Management	Hostel Management	Medium
Attendance Management	Assessment Management	Critical
Assessment Management	Scheduling	Critical
Scheduling	Reports Management	Critical
Reports Management	Library Management	Critical
Library Management	Alerts and Notifications	Critical
Alerts and Notifications		Critical
Hostel Management	Sports Management	Medium
Sports Management		Medium

Approach:

- Within 6 days, we should identify the stakeholders and the project charter should be signed.
- Within 20 days, project management plan should be developed, the scope statement should be defined, requirements should be collected and studied well, a clear work breakdown structure should be finished and initial plans for time, scope and cost should be implemented.
- Hold weekly review meetings with the core project teams project manager and sponsor.
- Hold monthly meetings for change control board to provide guidelines for preparing change requests, evaluate change requests and manage the implementation of the approved changes.
- Purchase all required hardware upgrades within one month.
- Conduct through software testing per the approved test plans.

List of Prioritized Risks:

Ranking	Potential Risk
1	Physical damage such as any harm to organization hardware assets such as servers, laptops or network devices
2	Loss of data or data breaches
3	System disruption or malfunctioning of system in real time
4	Unreasonable project schedule and budget
5	Insufficient resources
6	Inability of the end-users to deal with the website

Sign-off: (signatures of all stakeholders)

Omar Elhusseiny | Eman Elshamy | Nour Mohamed | Mayar Ahmed

Ahmed Adam | Mohamed Gamel | John Medhat | Ali Mohamed

Ali Ashraf | Joseph Karam | Salma Atef | Mina Ehab

Khaled ahmed | Mariam Samir | Kerolos Karam

3. Project Time, Scope, and Cost Constraints

Project	Project Manager	Date
University information system	Ahmed Adam	10 April 2023

Justification
Needs: • Eliminating manual courses registration process that consumes a lot of work hours. • Decreasing overhead costs, optimizing the educational process, and ensuring that a university is as efficient as possible. Fulfilled by: Monitoring the progress of each student from the start of their academic journey to the degree, facilitating the educational process and supporting only the online registration.

Scope Description	
In Scope	Out of Scope
• Each user should have an account with its email and password. • integrated, flexible, reliable database system accessible through the internet. • Support online admission processes. • Maintains detailed course history of the students. • Manage student fee payments. • Provide additional resources and advanced library management for students. • Provide a complete student portfolio with details about assessments, enrollments. • Support online courses registration • System should tolerate many users at the same time	• Does not keep track of the extra-curricular activities of students. • Student advising.

Project Deliverables
• Project charter • Requirements specification • Scope baseline • Gantt chart • Design of the portal • Software of the system

Project Exclusions
The system will not provide students' access to all the courses that the university offers instead, the student will only be given access to the program that s\he registered for.

Constraints
• Project must be delivered before the academic year starts (within 4-5 months) so the students can make their online registrations. • The budget should not exceed 80,000 LE. • All staff must be trained for the proper usage of online portal to facilitate students registered to the online education service of the university

Assumptions
1. There is an available suitable server for the number of students 2. The portal must be compatible with the various operating systems. 3. The portal must be compatible with the various web browsers.

Cost constraints details

A	B	C	D	E	F
	#Units/Hrs.	**Cost/Unit/Hr.**	**Subtotals**	**WBS Level 1 Totals**	**% of Total**
WBS Items					
1. Initiation				7,500 EGP	9. 5%
1.1 Project charter	30	250 EGP	7,500 EGP		
2. Planning				15,000 EGP	19%
2.1 Develop Team Contract			5000 EGP		
2.2 Project Scope statement			5000 EGP		
2.3 Requirement analysis			5000 EGP		
3. Execution				40,125 EGP	51%
3.1 Interface Design	250	60	15,000 EGP		
3.2 Feature Development	335	75	25,125 EGP		
4. Monitoring				16,050 EGP	20. 4%
4.1 Performance reports	140	50	7,000 EGP		
4.2 Manage change requests	40	70	2,800 EGP		
4.3 Perform Updates	125	50	6,250 EGP		
Total project cost estimate				78,675 EGP	

4. Project Phases

4.1. Concept & Initial Phase

First, we will do the project Charter

then identify the stakeholders through stakeholder register and stakeholder management strategy.

Possible Stakeholders:

Stakeholder management strategy:

Name	Level of interest	Level of influence	Potential management strategies
Omar Elhusseiny	High	High	Omar tends to set higher expectations for the work, so make sure to inform the development teams before the meetings and to raise the expectations to his level.
Keroles Karam	High	High	Keroles likes to make sure he is investing in the right company; he needs a lot of persuasion and focuses on achieving the maximum financial benefit from the project.
Ahmed Adam	High	High	Ahmed has great communication and leadership skills, but he didn't seem quite enthusiastic about this project, therefore we need to make sure that he's fully engaged in this project by showing him how much he can benefit from this project.
Eman Elshamy	Low	Low	Eman didn't seem interested about this project, don't spend too much time with her, but still monitor her behavior.
Mohamed Gamal	High	High	Mohamed has been a financial director for a long time, but this one will be his first project with our company, keep an eye on his progress and make sure his goals are aligned with the projects'.
Nour Mohamed	Low	High	Nour didn't seem interested about this project, don't spend too much time with her, but still monitor her behavior.
John Medhat	High	High	John tends to be high on the measure of openness since he has finished many projects successfully for our company.

4.2. Planning Phase

First, we will Start with the team contract

Project Name: University information system
Project Leader: Ahmed Adam

A. Commitments:

As a project team we will:

1. Only agree to do work that we are qualified and capable of doing.
2. Be honest and realistic in planning and reporting project scope, schedule, staffing and cost.
3. Operate in a proactive manner, anticipating potential problems and working to prevent them before they happen.
4. Promptly notify our customer(s) and sponsor of any change that could affect them.
5. Keep other team members informed.
6. Keep proprietary information about our customers in strict confidence.
7. Focus on what is best for the project as a whole.

B. Team Meeting Ground Rules: Participation

We will:

8. Keep issues that arise in meetings in confidence within the team unless otherwise indicated.
9. Be honest and open during meetings.
10. Encourage a diversity of opinions on all topics.
11. Give everyone the opportunity for equal participation.
12. Be open to new approaches and listen to new ideas.
13. Avoid placing blame when things go wrong. Instead, we will discuss the process and explore how it can be improved.

C. Team Meeting Ground Rules: Communication

We will:

14. Seek first to understand, and then to be understood.
15. Be clear and to the point.
16. Practice active, effective listening skills.
17. Use visual means such as drawings, charts, and tables to facilitate discussion.

D. Team Meeting Ground Rules: Decision Making

We will:

18. Make decisions based on data whenever feasible.
19. Seek to find the needed information or data.
20. Discuss criteria (cost, time, impact, etc.) for deciding before choosing an option.
21. Encourage and explore different interpretations of data.
22. Get input from the entire team before a decision is made.
23. Discuss concerns with other team members during the team meetings or privately rather than with non-team members in inappropriate ways.
24. Ask all team members if they can support a decision before the decision is made.

E. Team Meeting Ground Rules: Handling Conflict

We will:

25. Regard conflict as normal and as an opportunity for growth.
26. Seek to understand the interests and desires of each party involved before arriving at answers or solutions.
27. Choose an appropriate time and place to discuss and explore the conflict.
28. Listen openly to other points of view.
29. Repeat back to the other person what we understand and ask if it is correct.
30. Acknowledge valid points that the other person has made.
31. State our points of view and our interests in a non-judgmental and non-attacking manner.
32. Seek to find some common ground for agreement.

F. Meeting Procedures:

- Meetings will begin and end on time.
- Team members will come to the meetings prepared.
- Agenda items for the next meeting will be discussed at the end of each meeting.
- A Parking Lot will be used to capture 'off-the-subject' ideas and concerns.
- Unresolved issues will be added to the Issues list.
- If a team member cannot attend a meeting, he/she will send a representative with authority to make decisions.
- Meeting tasks will be rotated among members.

G. Meeting Guidelines:

- Meetings will be held every week.
- Meetings will be called by the project manager.
- Agendas will be issued every week.
- Evaluations of meetings will be conducted every 3 meetings.

Signatures: (Team members)

Mayar Ahmed Ali Mohamed Khaled ahmed Mariam Samir

Ali Ashraf Joseph Karam Salma Atef Mina Ehab

Next, we will define the project scope statement

- Implement an integrated, flexible, reliable database system accessible through the internet.
- Provide a user-friendly, easy to use system with appropriate documentation.
- Provide clear, easy access to information real time 24/7 for students, faculty and staff.
- Provide student record maintenance-reports, dashboards and analytics.
- Provide a complete student portfolio with details about assessments, enrollments, course self-registration and outcomes tracking.
- Helps eliminate manual admission processes.
- Maintains detailed course history of the students.
- Provide the students with access to additional resources and advanced library management.
- Manage student fee payments.

Goal

- Allows education institutions and students to digitally monitor and manage their academics.

Defining the Scope

Next, we will go to define the work breakdown structure and the Gantt chart, and the last thing is to list the prioritized risks which will be found in our project charter too.

Then, we will go to the quality plan:

Input

1) Enterprise environment factors as quality and government standards
2) Organizational process assets as WBS, risk template and standardized guidelines
3) Project scope statement
4) Project management plan

Tools & Techniques

1) Cost-benefit analysis
2) Cost of quality

Output

1) Quality management plan
2) Quality metrics as planned value, actual cost, earned value
3) Quality Checklist
4) Quality baseline
5) Update the project management plan

Quality

Quality is the degree to which the project fulfills requirements. Quality management planning determines quality policies and procedures relevant to the project for both project deliverables and project processes, defines who is responsible for what, and documents compliance.

The quality management plan identifies these key components:

Objects of quality review	Quality Measure	Quality Evaluation Methods
Project Deliverables as features development & UI design	Deliverable Quality Standards as Functionality, Reliability, Usability, Efficiency, Maintainability, Portability , Customer Satisfaction.	Quality Control Activities
Project Processes	Process Quality Standards as leadership, engagement of people Stakeholder Expectations	Quality Assurance Activities

The following is a brief explanation of each of the components of the quality management plan.

Project Deliverables and Project Processes	The key project deliverables and processes subject to quality review.
Deliverable Quality Standards and Customer Satisfaction	The quality standards that are the “measures” used to determine a successful outcome for a deliverable. These standards may vary dependent on the type of information technology project. The customer satisfaction criteria describe when each deliverable is complete and acceptable as defined by the customer. Deliverables are evaluated against these criteria.
Process Quality Standards and Stakeholder Expectations	The quality standards that are the “measures” used to determine if project work processes are being followed. The “Process Guidelines Checklist” on www.it.pm.vt.edu can be used as an aide. Stakeholder expectations describe when a project process is effective as defined by the project stakeholders. An example is the review and approval of all high impact changes to the project.
Quality Control Activities	The quality control activities that monitor and verify that the project deliverables meet defined quality standards.
Quality Assurance Activities	The quality assurance activities that monitor and verify that the processes used to manage and create the deliverables are followed and are effective.

Then, we will do procurement plan by deciding the contract type which is time and material contract and doing procurement statement:

Procurement Statement

Supplier/Company Relationships

Effective and efficient supplier relationships are vital to our success.
We always aim to:

• identify and work with best practice suppliers in the marketplace.
• ensure that our suppliers understand our business objectives and that we understand their objectives.
• ensure that we establish the structure of relationship best suited to the achievement of those objectives.
• encourage efficiency, continuous improvement, and innovation among our suppliers.
• give and receive open and honest feedback on performance to and from our suppliers, promote with our suppliers’ standards and policies that are compatible with our own.

The company approach to buying

The company buys a vast range of goods and/or services in different markets. We do not adopt the same procurement method in all cases, preferring instead to adopt the approach best suited to each need.

Depending on our requirements we will normally:
• seek proposals on a competitive basis from several suppliers; however, we may seek a proposal from a single supplier.
• ask for formal bids or tenders as part of the procurement and competitive benchmarking process.
• conduct negotiations with prospective suppliers, instead of or in conjunction with a formal bid or tender process
• vary the length and structure of contractual commitments we enter.
• In each case, our objective is to minimize cost and maximize value.
• In addition, we aim to ensure that the approach we adopt is fair and is clearly understood by our potential suppliers.

Statement of Business Ethics

The company expects all its employees involved in the procurement process to observe the highest standards of ethical conduct.
It is an expectation that our suppliers also reflect these behaviors as a condition of doing business with us.
These expectations are explained in the company Statement of Business Ethics.

Supplier Requirements and Purchase Order Terms and Conditions

The company has detailed requirements of all suppliers, these are contained in the 'Purchase Order Terms and Conditions' that are included as part of all Purchase Orders to suppliers.

Paying Suppliers

The company policy is to pay suppliers on time in accordance with our contractual commitments. The company's standard trading terms are 30 days from the end of the month of invoice with no discount except where a contractual obligation exists. Refer to Standard Purchase Order Terms and Conditions.

4.3. Executing Phase

Direct and Manage Project Execution

The direct and manage project execution process requires the project manager and the project team to perform multiple actions to execute the project management plan to accomplish the work defined in the project scope statement. Some of those actions are:

- Perform activities to accomplish project objectives.
- Expend effort and funds to accomplish the project objectives.
- Staff, train, and manage the project team members assigned to the project.
- Obtain quotations, bids, offers, or proposals as appropriate.
- Select sellers by choosing from among potential sellers.
- Obtain, manage, and use resources including materials, tools, equipment, and facilities.
- Implement the planned methods and standards.
- Create, control, verify, and validate project deliverables.
- Manage risks and implement risk response activities.
- Manage sellers.
- Adapt approved changes into the project's scope, plans, and environment.
- Establish and manage project communication channels, both external and internal to the project team
- Collect project data and report cost, schedule, technical and quality progress, and status information to facilitate forecasting
- Collect and document lessons learned and implement approved process improvement activities.

1. Interface Design

- Homepage Design
- Student details in a single view

2. Feature Development

- Maintaining Student Records
- Admissions Management
- Transcript Management
- Attendance Management
- Assessment Management
- Scheduling
- Reports Management
- Library Management
- Alerts and Notifications
- Hostel Management
- Sports Management

Perform Quality Assurance

The focus of quality assurance is on the processes used in the project. Quality assurance ensures that project processes are used effectively to produce quality project deliverables. It involves following and meeting standards, continuously improving project work, and correcting project defects.

The following table identifies:

- The project processes subject to quality assurance.
- The quality standards and stakeholder expectations for that process.
- The quality assurance activity
- How often or when the quality assurance activity will be performed.
- The name of the person responsible for carrying out and reporting on the quality assurance activity.

Project Process	Process Quality Standards/ Stakeholder Expectations	Quality Assurance Activity	Frequency/Interval	Who is Responsible
Review software development practices of the University Information System.	Software requirements specification. Developers have completely and accurately captured application requirements.	Quality audit and peer code review of software requirements specification.	At regular intervals (ex, biweekly) during the collection of requirements and a final review at the conclusion of requirements collection.	Quality manager “Mariam Samir” with other knowledgeable developers.

Acquire, Develop, and Manage Project Team

1. Acquire Project Team

It is the process of obtaining the human resources needed to complete the project. The project management team may or may not have control over team members selected for the project.

Interface Design:

Mayar Ahmed	IT development team	Programmer
Ali Mohamed	IT development team	Programmer
Joseph Karam	Testing team member	Tester

Feature Development:

Ali Ashraf	IT development team	Programmer
Salma Atef	IT development team	Programmer
Khaled Ahmed	Testing team member	Tester

2. Develop Project Team

This improves the competencies and interaction of team members to enhance project performance. Objectives include:

- Improve skills of team members to increase their ability to complete project activities.
- Improve feelings of trust and cohesiveness among team members to raise productivity through greater teamwork.

Effective teamwork includes assisting one another when workloads are unbalanced, communicating in ways that fit individual preferences, and sharing information and resources.

We should provide the programmers and testers with the required courses in the fields of software development, database management and software testing that helps them improve their skills in order to complete the UI design and feature development.

We should also give them sessions about communication skills and teamwork standards if needed.

3. Manage Project Team

This involves tracking team member performance, providing feedback, resolving issues, and coordinating changes to enhance project performance. The project management team observes team behavior, manages conflict, resolves issues, and appraises team member performance. As a result of managing the project team, the staffing management plan is updated, change requests are submitted, issues are resolved, input is given to organizational performance appraisals, and lessons learned are added to the organization's database.

We should organize a weekly or a biweekly meeting involving the team members with the project manager to perform the project team management.

Distribute Information and Manage Stakeholders' Expectations

1. Distribute Information

We should make information available to project stakeholders in a timely manner. Information distribution includes implementing the communications management plan, as well as responding to unexpected requests for information.

2. Manage Stakeholders' Expectations

We should communicate with stakeholders and manage their expectations and concerns for the purpose of meeting the stakeholder needs, addressing issues, resolving conflict situations, and achieving the project goals. The process is based on holding communications and taking change requests to gather feedback and make updates to project documentation.

The project manager "Ahmed Adam" takes responsibility for managing stakeholder expectations, resolving conflicts, and detecting and settling any issues arising during the project course.

Conduct Procurements

In this procedure we should acquire seller responses, analyze their bids, choose a seller, and award a contract to the best seller. The process involves choosing experts with specialized knowledge in proposal evaluation, industry regulatory environment, government laws and regulations, technical matters, and negotiations.

The finance department under the supervision of the financial director "Mohamed Gamal" takes responsibility for this process, with the assistance of the project sponsor "Keroles Karam".

The conferences make sure that every prospective bidder comes with clear information and understanding of the procurement and the procedure includes proposal evaluation which uses the source selection criteria on which the bidder proposals are analysed to make sure they are complete so there is no delay in the bidder conferences

4.4. Monitoring and Controlling phase

We will get a **performance report** after every 3 meetings or a milestone and the main points which will be included in the report are:

1) The project is under or above the budget using cost variance and performance cost index.
2) Review the tangible measurements
3) Review the quantitative measurements
4) The project is ahead or behind schedule using schedule variance and performance schedule index.
5) The result of monitoring risks
6) The result of monitoring quality
7) Ensure that the completed actions fit the project scope.
8) Ensure that CEO provides what is needed for the project in an appropriate time

The Quantitative Measurements:

It can be measured by:

1) The attitude of the workers
2) Their morale to work
3) The development in the attitudes regarding the physical environment
4) Their communication with the superiors.

Monitor Risks:

1) Monitor the risk response plan by implementing the response plan for each incident and report it in the performance report
2) Identify trigger conditions
3) Continually analyze for new risks
4) Evaluate the effectiveness of your risk management plan using risk management protocols and response scenarios to determine where we can make improvements.

Monitor & Control Quality:

Input:

1) Quality Management Plan
2) Quality metrics as planned value, actual cost, earned value
3) Quality Checklists
4) Organizational process assets
5) Work Performance Information
6) Approved Change Request
7) Deliverables

Tool & Techniques

1) Control chart
2) Histogram
3) Run chart
4) Scatter diagram
5) Statistical sampling
6) Inspection
7) Defect repair review

Output

1) Quality control measurements
2) Validated defect repair
3) Update quality baseline
4) Recommend corrective actions
5) Recommend preventive actions
6) Request changes
7) Defect repair
8) Update organizational process assets
9) Validate deliverables
10) Update project management plan

Controlling the Schedule:

After determining the status of the schedule, in case the project is behind the schedule:

1) Study the factors that cause schedule changes
2) Determine that the schedule has changed
3) Write that in the progress report
4) Update the Gantt chart
5) Do the variance analysis such as analyzing float or slack
6) Update the project management plan

Controlling the Cost:

After reviewing the budget plan, in case the project is above the budget:

1) Update the cost baseline
2) Informing project stakeholders of authorized changes to the project that will affect costs
3) Update the project management plan

Control the Scope:

The following are included as the inputs in the control scope process:

1. Project Management Plan
2. Project Documents
3. Work Performance Data
4. Organizational Process Assets

The following tools and techniques are used in the control scope process:

1. Variance Analysis
2. Trend Analysis

The following are included as the outputs in the Control Scope process:

1. Work Performance Information
2. Change Requests
3. Project Management Plan Updates
4. Project Document Updates
5. Minimized scope

At the final stage of monitoring:

Let the staff try using the system and review it then make change requests, project management plan updates if needed.

Administer Procurements:

Inputs

The key inputs to this process are a contract, other procurement documents, project management plan and work performance information. Work performance Information basically has the information about the progress of the work, i.e., how much work is completed and what's the cost incurred to complete that work. In this case, it has information like how much work is completed as per the contract and money spent to get that work completed as per the contract.

Techniques

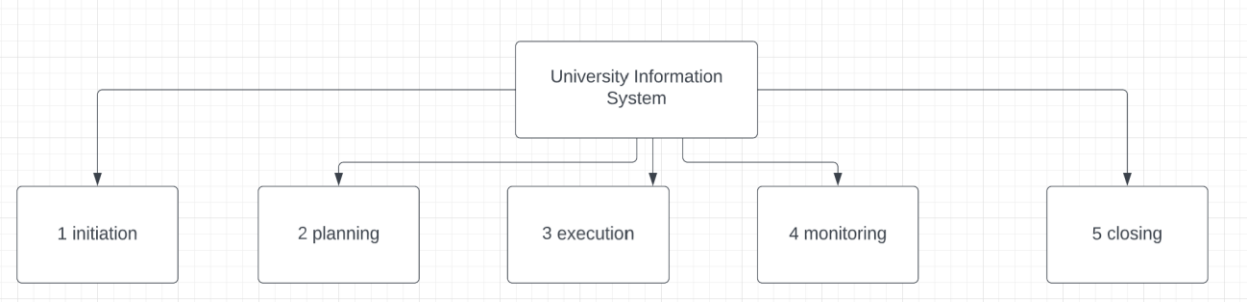
First look at, Contract Change Control System. This is similar to a normal change control system but used specifically for managing changes to the contract. Usually, the process of making changes to the contract, i.e. Contract Change Control System is listed in the contract document itself.

The next technique is Procurement Performance reviews this is the process of formally reviewing the seller deliverables. Usually, this is also documented in the contract document. The procurement performance reviews are done once a month. Unscheduled inspection and audits can also be performed to ensure that seller is following the processes that they claim they do.

4.5. Closing Phase

- Gaining stakeholder and customer acceptance of the final system
- If projects are not completed, sum up the learned lessons in a report
- A final report and presentation to the sponsor/senior management

5. Work breakdown structure



Level 1

1. Initiation
2. Planning
3. Execution
4. Monitoring
5. Closing

1. Initiation:

1. Project charter

2. Identify stakeholders

2. Planning:

- 2.1 Develop Team Contract

- 2.2 Project Scope statement

- 2.3 Requirement analysis

3. Execution:

-3.1 Interface Design

- 3.1.1 Homepage Design
- 3.1.2 Student Dashboard
    - 3.1.2.1 Registered course's view
    - 3.1.2.2 Profile view
    - 3.1.2.3 Grades view
    - 3.1.2.4 Transcript view
- 3.1.3 Hostel Management view
- 3.1.4 Sports Management view
- 3.1.5 Staff information view

-3.2 Feature Development

- 3.2.1 Maintaining Student Records
    - 3.2.1.1 student reports
    - 3.2.1.2 dashboard

        - 3.2.1.2 analytics
- 3.2.2 Admissions Management
    - 3.2.2.1 define criteria for admission/enrollment
    - 3.2.2.2 Application Management
    - 3.2.2.3 Inquiry Management
- 3.2.3 Transcript Management
    - 3.2.3.1 Define Transcript contents
    - 3.2.3.2 Manage Transcript requests
- 3.2.4 Attendance Management
    - 3.2.4.1 Develop method for tracking attendance
    - 3.2.4.2 define attendance restrictions
- 3.2.5 Assessment Management
    - 3.2.5.1 Find third party assessment platforms
    - 3.2.5.2 Maintain assessment history
- 3.2.6 Scheduling
    - 3.2.6.1 track number of courses and enrollments
    - 3.2.6.2 register number of campus halls
    - 3.2.6.3 develop schedule creator that avoids conflicts
- 3.2.7 Reports Management
    - 3.2.7.1 graphical representation of data
    - 3.2.7.2 performance reports
- 3.2.8 Library Management
    - 3.2.8.1 Book tracking
    - 3.2.8.2 Membership management
    - 3.2.8.3 Book reservation
- 3.2.9 Alerts and Notifications
    - 3.2.9.1 Automate general email announcements
    - 3.2.9.2 Individual alert management
- 3.2.10 Hostel Management
    - 3.2.10.1 Room Tracking
    - 3.2.10.2 Student request processing
    - 3.2.10.3 Room fee management
- 3.2.11 Sports Management
    - 3.2.11.1 Register available sports
    - 3.2.11.2 Sports Announcements
    - 3.2.11.3 Court reservation

4-Monitoring and controlling

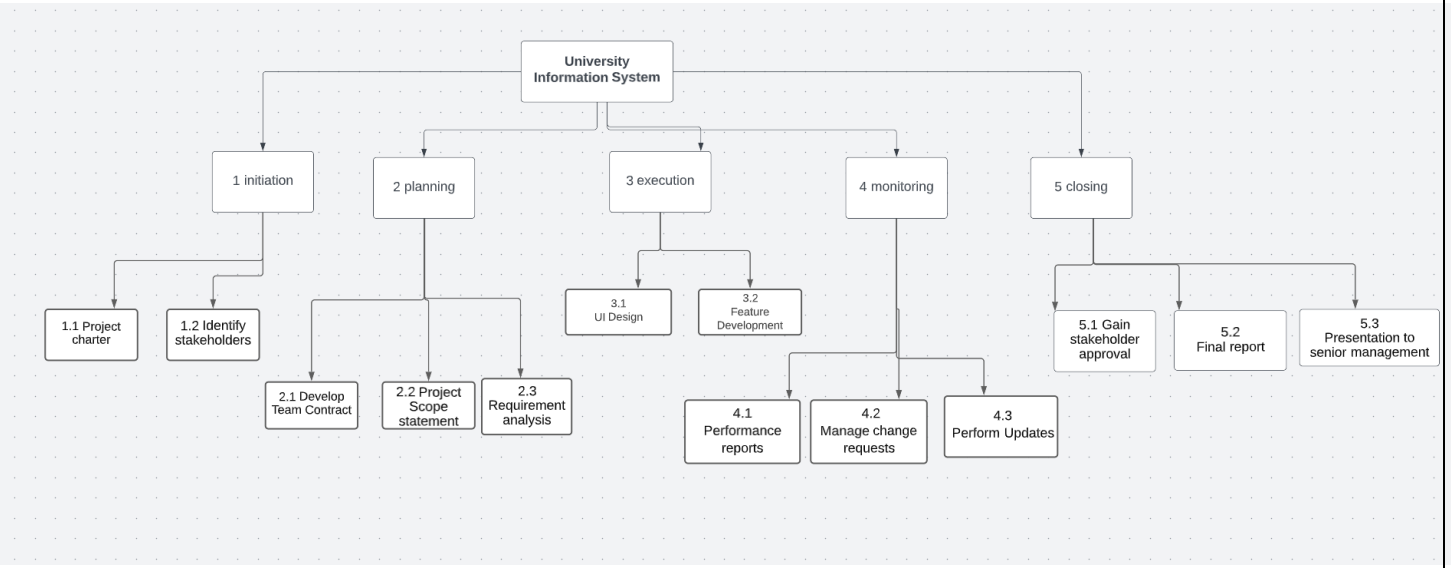
- 4.1 Performance reports
- 4.2 Manage change requests
- 4.3 Perform Updates

5- Closing

- 5.1 Gain stakeholder approval
- 5.2 Final report
- 5.3 Presentation to senior management

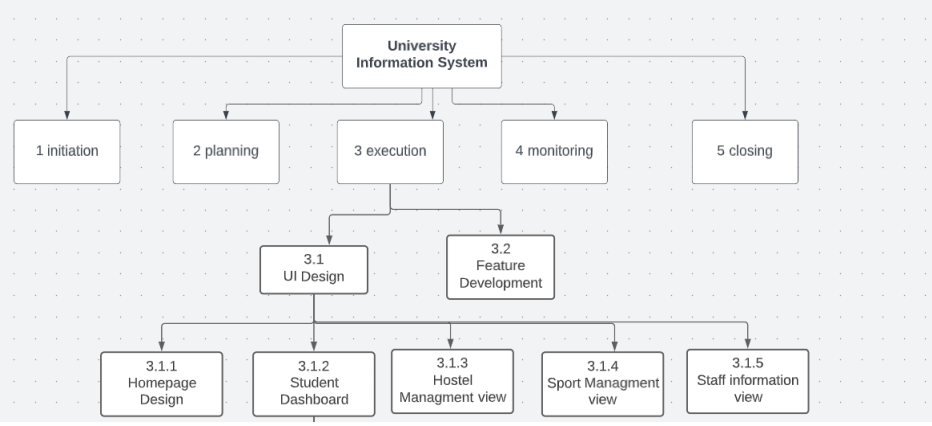
WBS Diagrams

LEVEL 1, 2

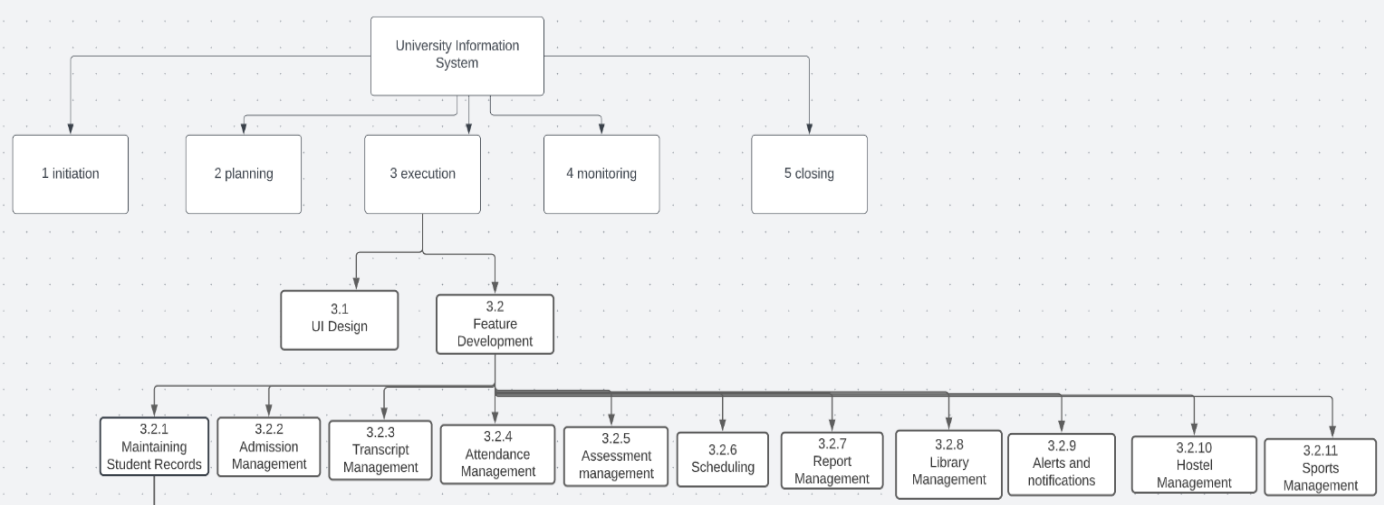


LEVEL 3:

- 3.1 UI Design

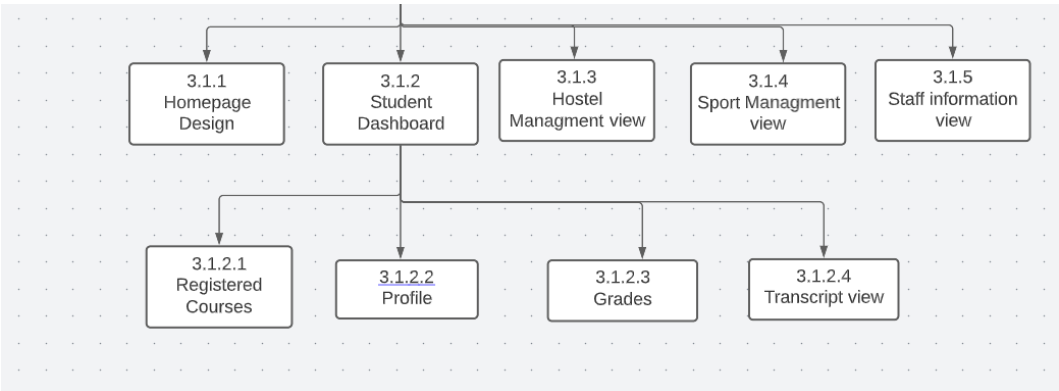


- 3.2 Feature Development

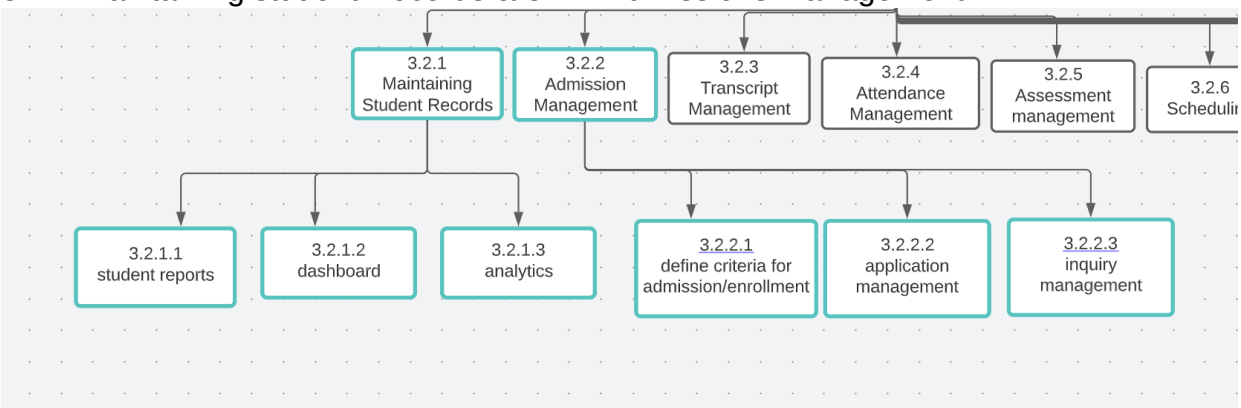


LEVEL 4:

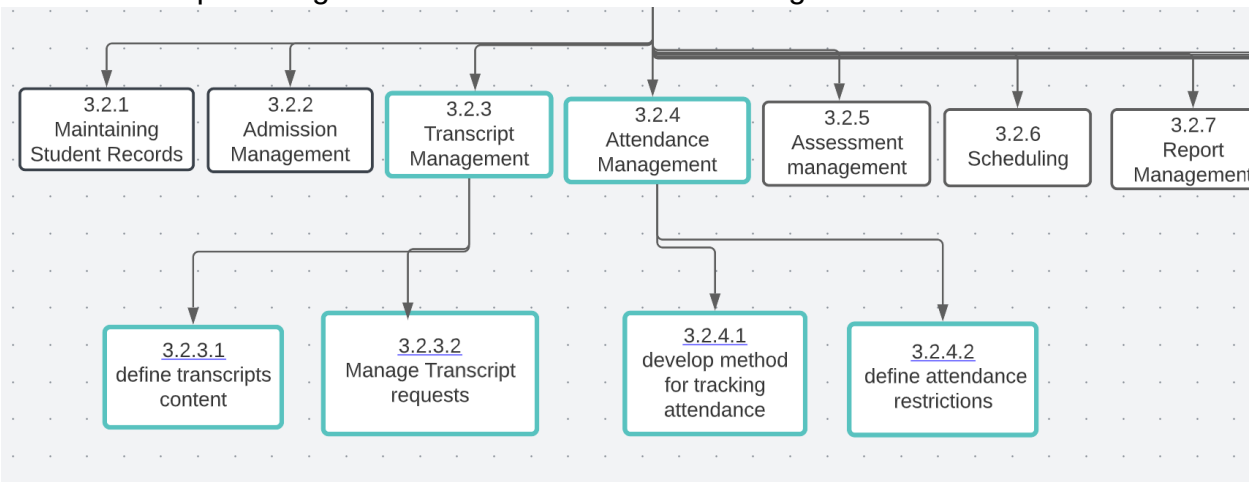
- 3.1.2 Student Dashboard



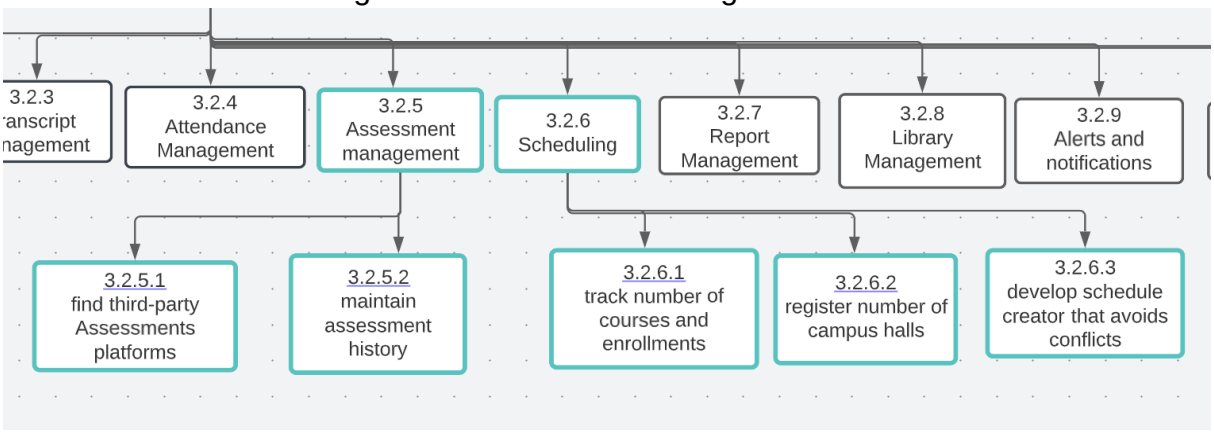
- 3.2.1 Maintaining student Records & 3.2.2 Admissions Management



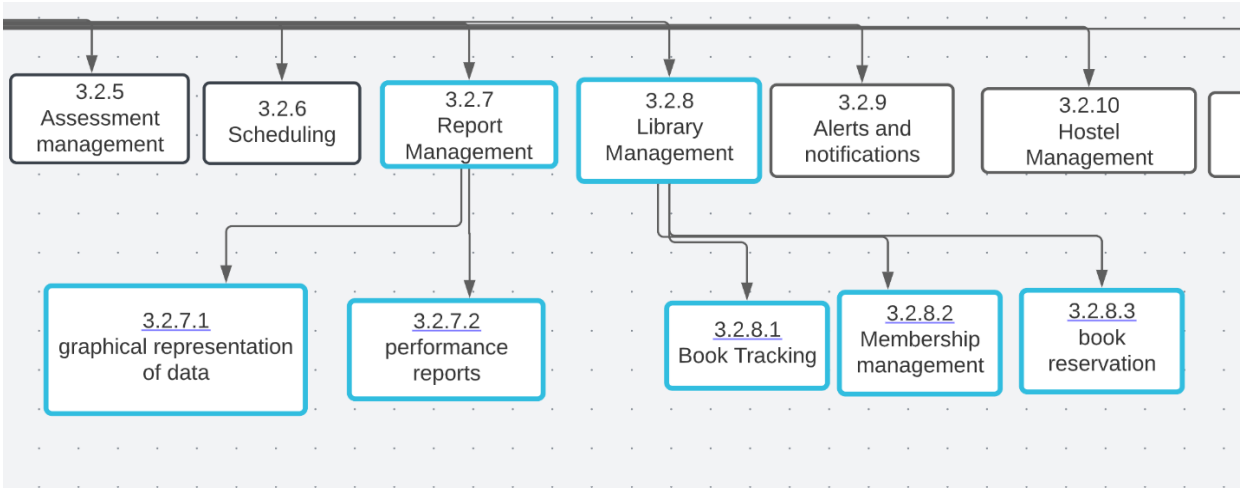
- 3.2.3 Transcript Management & 3.2.4 Attendance Management



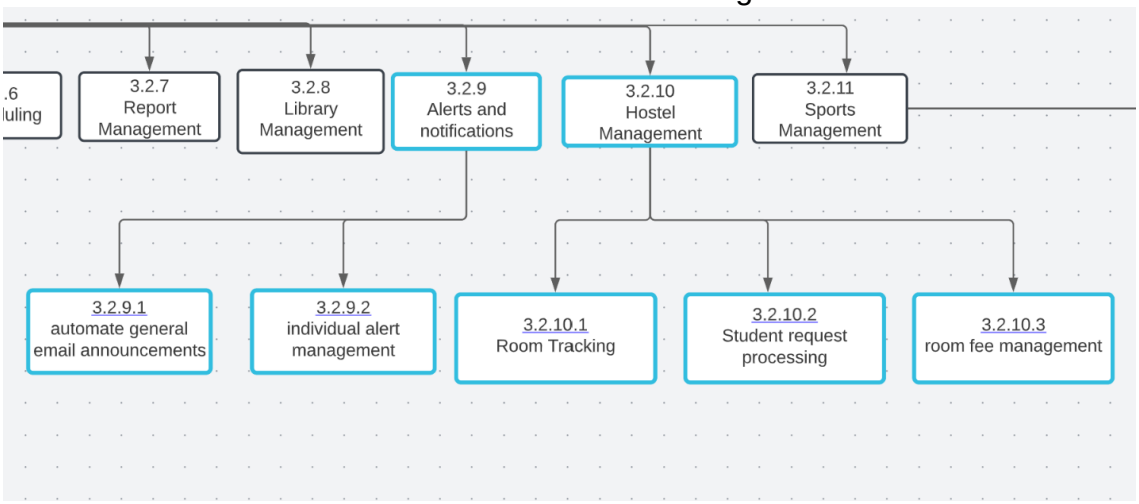
- 3.2.5 Assessment Management & 3.2.6 Scheduling



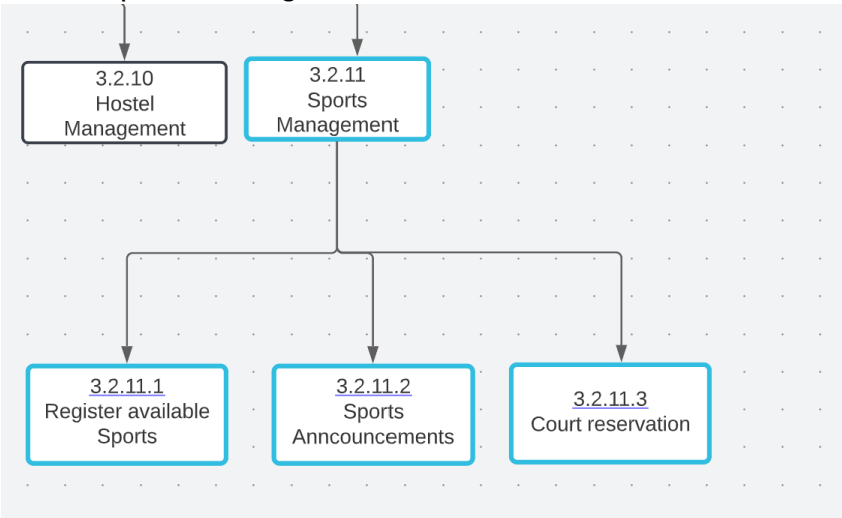
- 3.2.7 Report Management & 3.2.8 Library Management



- 3.2.9 Alerts and Notifications & 3.2.10 Hostel Management



- 3.2.11 Sports Management



6. Gantt Chart

Schedule (high level):

GANTT CHART

	Task Mode	Task Name	Duration	Start	Finish	Predecessors
1		**1. Initiation**	**6 days**	**Mon 03-04-23**	**Mon 10-04-23**	
2		1.1. Identify stakeholders	3 days	Mon 03-04-23	Wed 05-04-23	
3		1.2. Project charter	3 days	Thu 06-04-23	Mon 10-04-23	2
4		**2. Planning**	**20 days**	**Tue 11-04-23**	**Mon 08-05-23**	1
5		2.1. Develop Team Contract	3 days	Tue 11-04-23	Thu 13-04-23	2
6		2.2. Project Scope statement	7 days	Fri 14-04-23	Mon 24-04-23	5
7		2.3. Requirement analysis	10 days	Tue 25-04-23	Mon 08-05-23	6
8		**3. Execution:**	**67 days**	**Tue 09-05-23**	**Wed 09-08-23**	4
9		**3.1. Interface Design**	**30 days**	**Tue 09-05-23**	**Mon 19-06-23**	**7**
19		<First Milestone>	0 days	Mon 19-06-23	Mon 19-06-23	9,35
20		**3.2. Feature Development**	**67 days**	**Tue 09-05-23**	**Wed 09-08-23**	
21		**3.2.1. Maintaining Student Records**	**7 days**	Tue 09-05-23	Wed 17-05-23	**7**
25		**3.2.2. Admissions Management**	**7 days**	Thu 18-05-23	Fri 26-05-23	**21**
29		**3.2.3. Transcript Management**	**7 days**	**Tue 09-05-23**	**Wed 17-05-23**	**7**
32		**3.2.4. Attendance Management**	**5 days**	**Mon 29-05-23**	**Fri 02-06-23**	**25**
35		**3.2.5. Assessment Management**	**8 days**	**Mon 05-06-23**	**Wed 14-06-23**	**32**
38		**3.2.6. Scheduling**	**10 days**	**Thu 15-06-23**	**Wed 28-06-23**	**35**
42		**3.2.7. Reports Management**	**12 days**	**Thu 29-06-23**	**Fri 14-07-23**	**38**
45		**3.2.8. Library Management**	**6 days**	**Mon 17-07-23**	**Mon 24-07-23**	**42**
49		**3.2.9. Alerts and Notifications**	**12 days**	**Tue 25-07-23**	**Wed 09-08-23**	**45**
52		**3.2.10. Hostel Management**	**10 days**	**Thu 18-05-23**	**Wed 31-05-23**	**29**
56		**3.2.11. Sports Management**	**5 days**	**Thu 01-06-23**	**Wed 07-06-23**	**52**
60		**4. Monitoring and controlling**	**93 days**	**Mon 03-04-23**	**Wed 09-08-23**	
64		**5. Closing**	**5 days**	Thu 10-08-23	Wed 16-08-23	

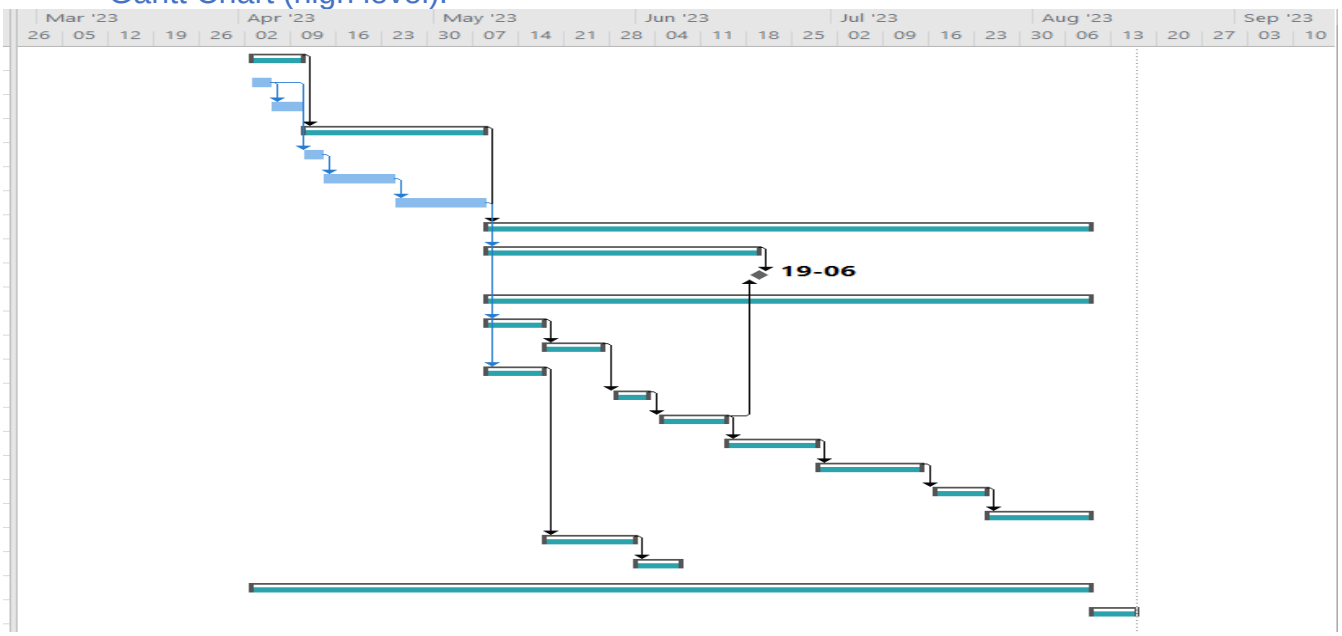
Schedule (more detailed part 1):

8			**3. Execution:**	**67 days**	**Tue 09-05-23**	**Wed 09-08-23**	4
9			**3.1. Interface Design**	**30 days**	**Tue 09-05-23**	**Mon 19-06-23**	**7**
10			3.1.1. Homepage Design	6 days	Tue 09-05-23	Tue 16-05-23	
11			**3.1.2. Student Dashboard**	**6 days**	**Wed 17-05-23**	**Wed 24-05-23**	
16			3.1.3. Hostel Management view	6 days	Thu 25-05-23	Thu 01-06-23	
17			3.1.4. Sports Management view	6 days	Fri 02-06-23	Fri 09-06-23	
18			3.1.5. Staff information view	6 days	Mon 12-06-23	Mon 19-06-23	
19			<First Milestone>	0 days	Mon 19-06-23	Mon 19-06-23	9,35
20			**3.2. Feature Development**	**67 days**	**Tue 09-05-23**	**Wed 09-08-23**	

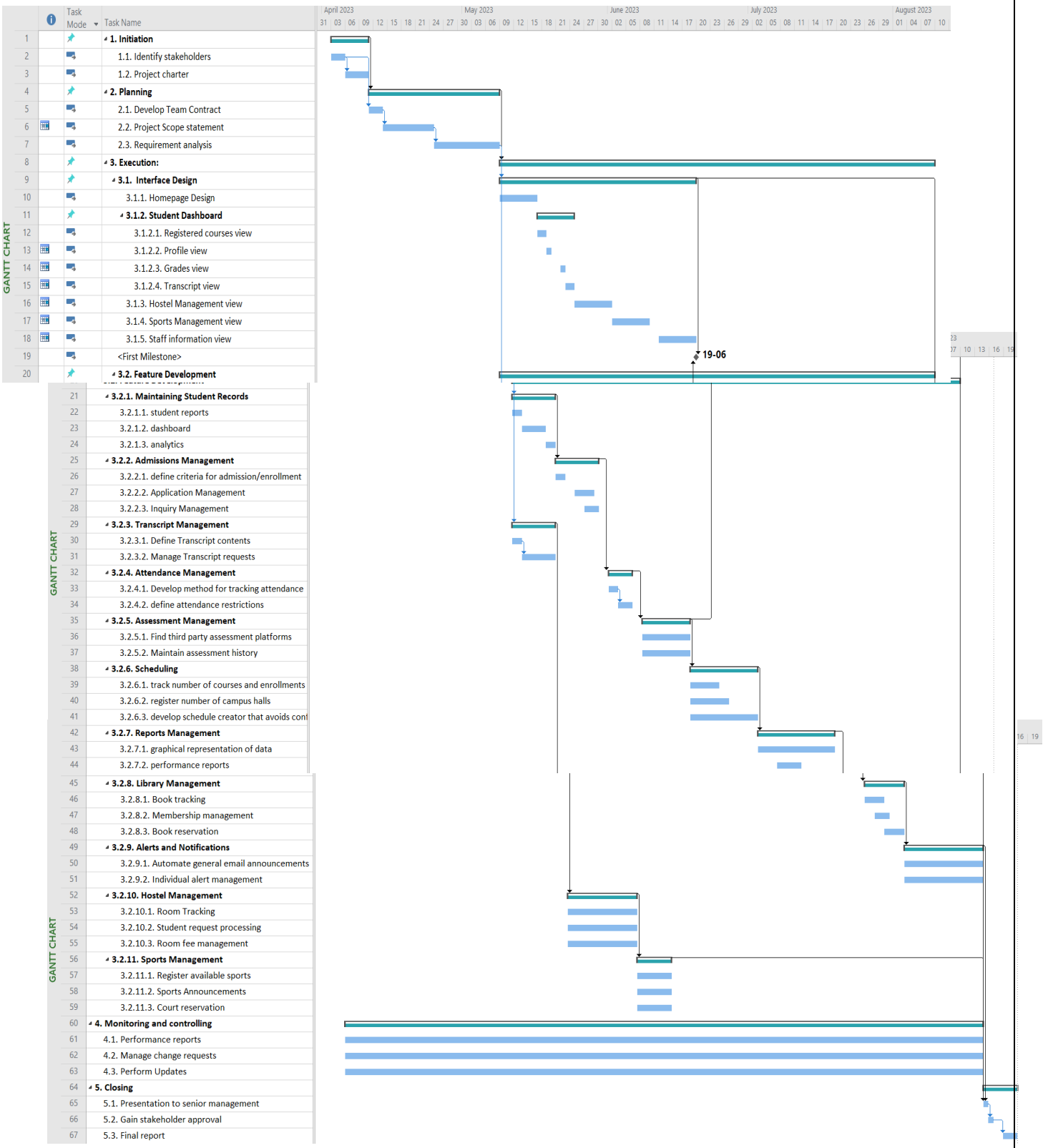
Schedule (more detailed part 2):

20		3.2. Feature Development	67 days	Tue 09-05-23	Wed 09-08-23	
21		3.2.1. Maintaining Student Records	7 days	Tue 09-05-23	Wed 17-05-23	7
25		3.2.2. Admissions Management	7 days	Thu 18-05-23	Fri 26-05-23	21
29		3.2.3. Transcript Management	7 days	Tue 09-05-23	Wed 17-05-23	7
32		3.2.4. Attendance Management	5 days	Mon 29-05-23	Fri 02-06-23	25
35		3.2.5. Assessment Management	8 days	Mon 05-06-23	Wed 14-06-23	32
38		3.2.6. Scheduling	10 days	Thu 15-06-23	Wed 28-06-23	35
42		3.2.7. Reports Management	12 days	Thu 29-06-23	Fri 14-07-23	38
45		3.2.8. Library Management	6 days	Mon 17-07-23	Mon 24-07-23	42
49		3.2.9. Alerts and Notifications	12 days	Tue 25-07-23	Wed 09-08-23	45
52		3.2.10. Hostel Management	10 days	Thu 18-05-23	Wed 31-05-23	29
56		3.2.11. Sports Management	5 days	Thu 01-06-23	Wed 07-06-23	52

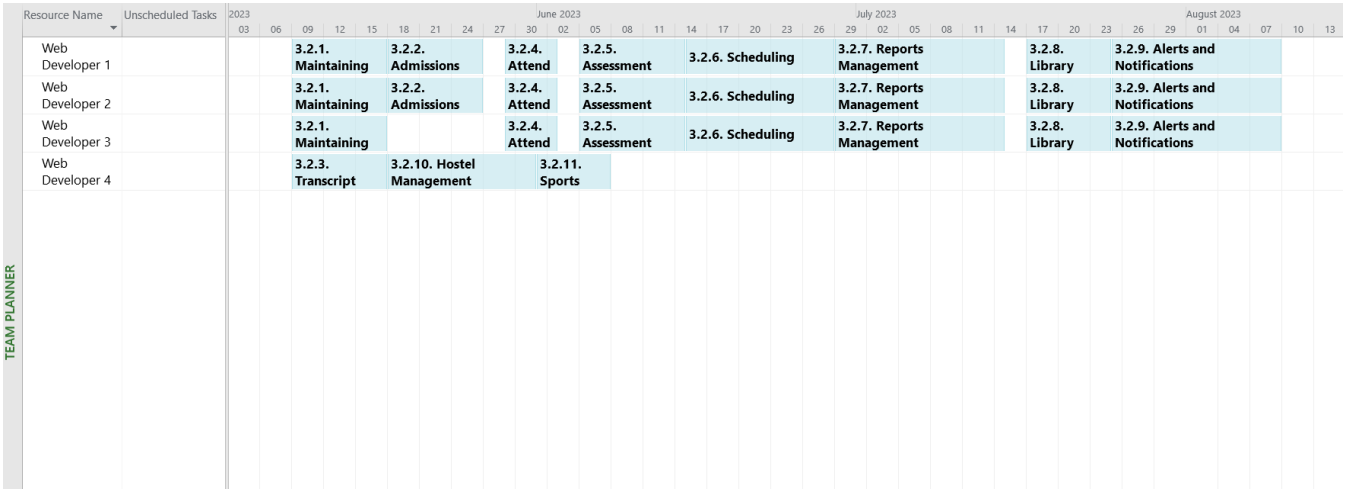
Gantt Chart (high level):



Gantt Chart (more detailed):



Team Planner:



Note:

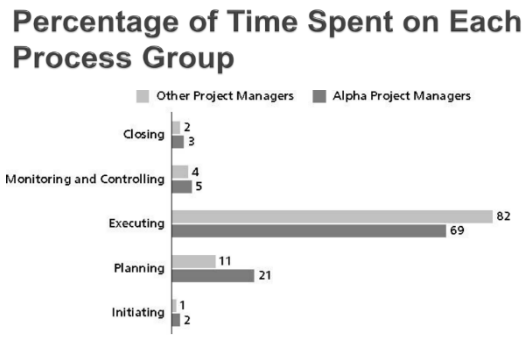
- To avoid assigning two tasks to the same developer at once, a team planner must be formed.

Assumptions:

- we assumed that the weekends are Saturday and Sunday.
- So, we have 98 working days from the third of April till the sixteenth of August.

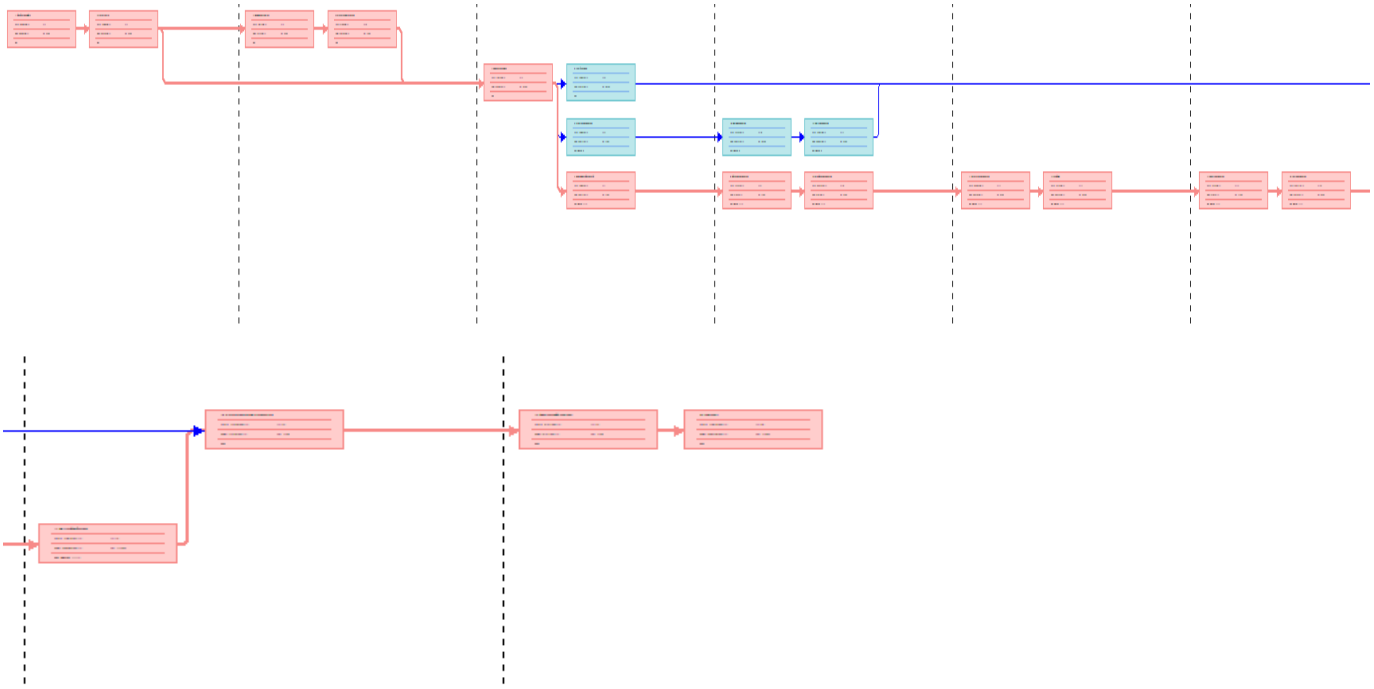
Justifications:

- We worked upon the "**Alpha Project Managers**" model. So according to that model, here are the percentage of work distribution among project groups:
    - Initiating 2%
    - Planning 21%
    - Executing 69%
    - Monitoring and Controlling 5%
    - Closing 3%

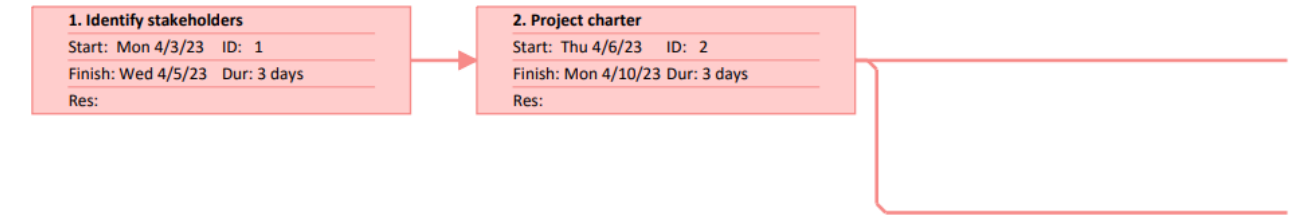


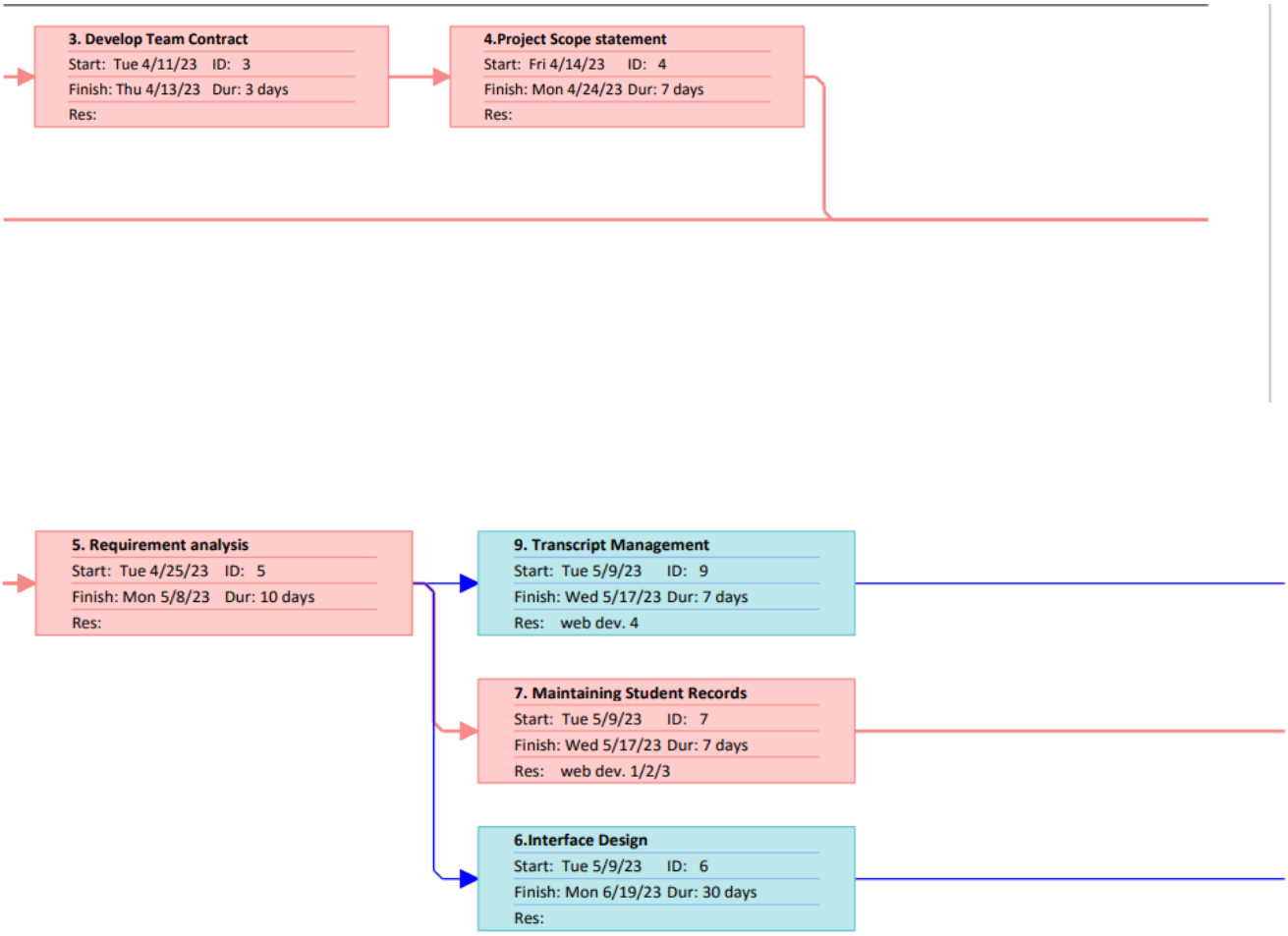
- The Monitoring and Controlling project groups occurs during all phases of the project life cycle as it affects all other process groups.
- Due to few resources (programmers), features wait for web development to end his current task, though features implementation doesn't depend on each other.
- We have **Milestone at 19/6**:
    - UI Design should be finished by this time, and some of the system features should also be finished and tested as 1) Maintaining Student Records, 2) Admissions Management, 3) Transcript Management, 4) Attendance Management, 5) Assessment Management.

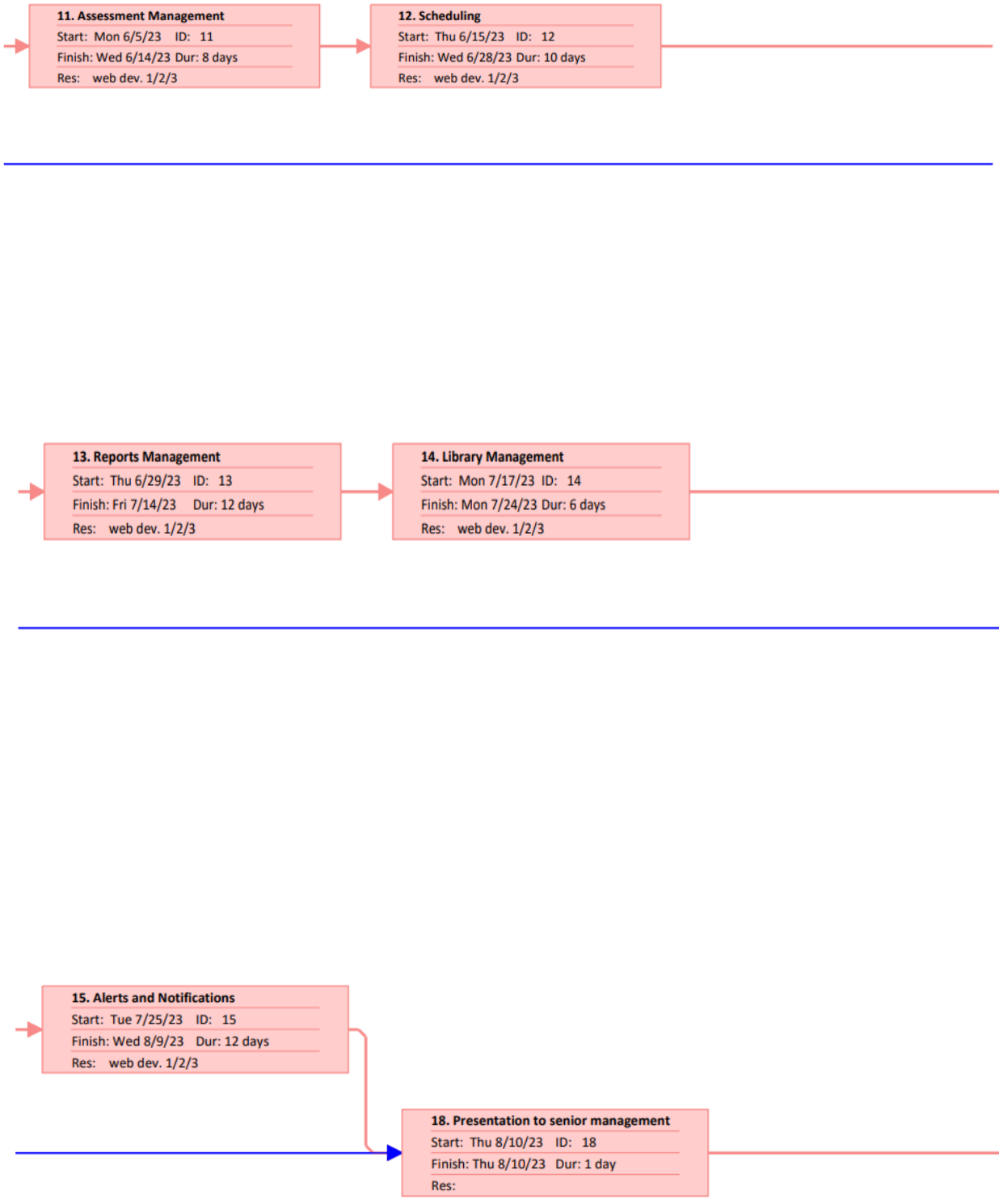
7. AON with the assigned resources to each activity

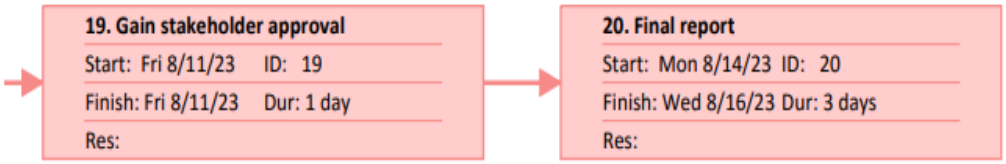


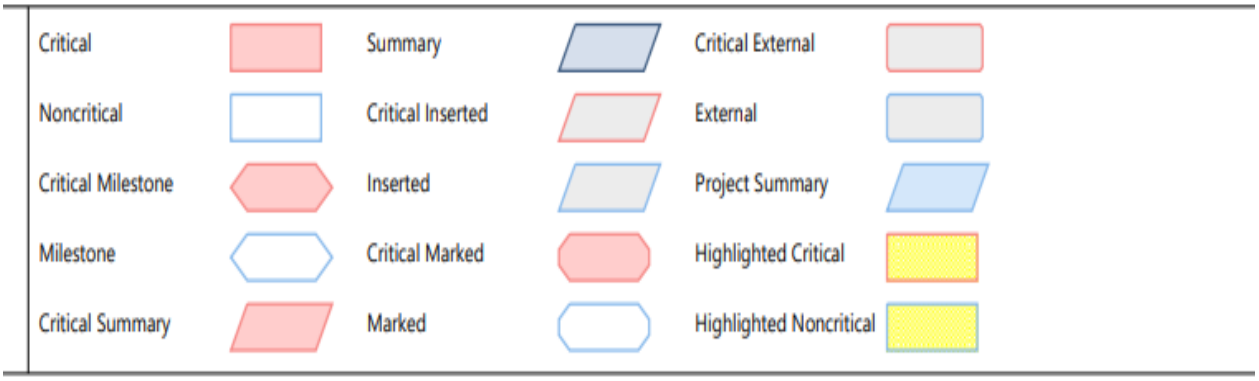
More detailed view:




3. Develop Team Contract
Start: Tue 4/11/23 ID: 3
Finish: Thu 4/13/23 Dur: 3 days
Res:
4.Project Scope statement
Start: Fri 4/14/23 ID: 4
Finish: Mon 4/24/23 Dur: 7 days
Res:
5. Requirement analysis
Start: Tue 4/25/23 ID: 5
Finish: Mon 5/8/23 Dur: 10 days
Res:
9. Transcript Management
Start: Tue 5/9/23 ID: 9
Finish: Wed 5/17/23 Dur: 7 days
Res: web dev. 4
7. Maintaining Student Records
Start: Tue 5/9/23 ID: 7
Finish: Wed 5/17/23 Dur: 7 days
Res: web dev. 1/2/3
6.Interface Design
Start: Tue 5/9/23 ID: 6
Finish: Mon 6/19/23 Dur: 30 days
Res:
16. Hostel Management
Start: Thu 5/18/23 ID: 16
Finish: Wed 5/31/23 Dur: 10 days
Res: web dev. 4
17. Sports Management
Start: Thu 6/1/23 ID: 17
Finish: Wed 6/7/23 Dur: 5 days
Res: web dev. 4
8. Admissions Management
Start: Thu 5/18/23 ID: 8
Finish: Fri 5/26/23 Dur: 7 days
Res: web dev. 1/2/3
10. Attendance Management
Start: Mon 5/29/23 ID: 10
Finish: Fri 6/2/23 Dur: 5 days
Res: web dev. 1/2/3


11. Assessment Management
Start: Mon 6/5/23 ID: 11
Finish: Wed 6/14/23 Dur: 8 days
Res: web dev. 1/2/3
12. Scheduling
Start: Thu 6/15/23 ID: 12
Finish: Wed 6/28/23 Dur: 10 days
Res: web dev. 1/2/3
13. Reports Management
Start: Thu 6/29/23 ID: 13
Finish: Fri 7/14/23 Dur: 12 days
Res: web dev. 1/2/3
14. Library Management
Start: Mon 7/17/23 ID: 14
Finish: Mon 7/24/23 Dur: 6 days
Res: web dev. 1/2/3
15. Alerts and Notifications
Start: Tue 7/25/23 ID: 15
Finish: Wed 8/9/23 Dur: 12 days
Res: web dev. 1/2/3
18. Presentation to senior management
Start: Thu 8/10/23 ID: 18
Finish: Thu 8/10/23 Dur: 1 day
Res:


19. Gain stakeholder approval
Start: Fri 8/11/23 ID: 19
Finish: Fri 8/11/23 Dur: 1 day
Res:
20. Final report
Start: Mon 8/14/23 ID: 20
Finish: Wed 8/16/23 Dur: 3 days
Res:


Critical
Noncritical
Critical Milestone
Milestone
Critical Summary
Summary
Critical Inserted
Inserted
Critical Marked
Marked
Critical External
External
Project Summary
Highlighted Critical
Highlighted Noncritical

8. PERT time estimate for each activity

A Three-Point Estimating Technique: PERT

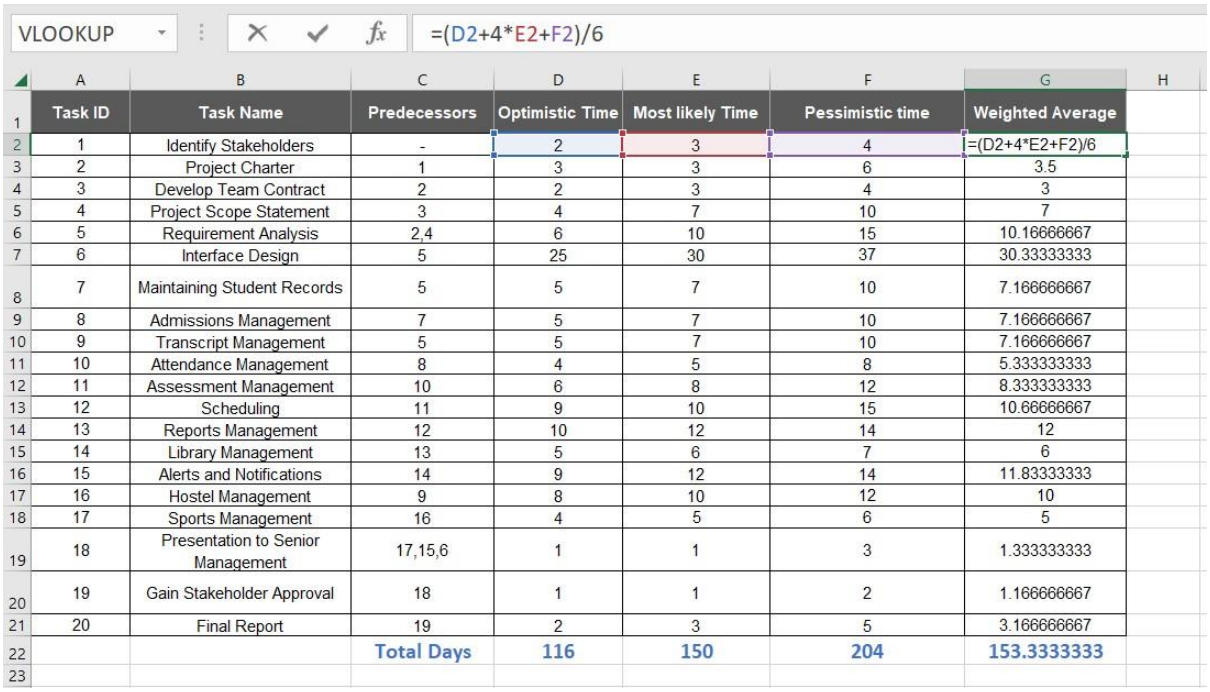
Optimistic Estimate (O)	*Estimate for all favorable conditions with no risks or changes*
Pessimistic Estimate (P)	*Estimate for all unfavorable conditions with all negative risks occurring and no mitigation of negative risks*
Most Likely Estimate (M)	*Estimate for both favorable and unfavorable conditions, with some risks occurring.*

Weighted Average = (Optimistic Time + 4 x Most Likely Time + Pessimistic) / 6

Applying PERT estimation on each task

Task ID	Task Name	Predecessors	Optimistic Time	Most likely Time	Pessimistic time	Weighted Average
1	Identify Stakeholders	-	2	3	4	3
2	Project Charter	1	3	3	6	3.5
3	Develop Team Contract	2	2	3	4	3
4	Project Scope Statement	3	4	7	10	7
5	Requirement Analysis	2,4	6	10	15	10.16666667
6	Interface Design	5	25	30	37	30.33333333
7	Maintaining Student Records	5	5	7	10	7.166666667
8	Admissions Management	7	5	7	10	7.166666667
9	Transcript Management	5	5	7	10	7.166666667
10	Attendance Management	8	4	5	8	5.333333333
11	Assessment Management	10	6	8	12	8.333333333
12	Scheduling	11	9	10	15	10.66666667
13	Reports Management	12	10	12	14	12
14	Library Management	13	5	6	7	6
15	Alerts and Notifications	14	9	12	14	11.83333333
16	Hostel Management	9	8	10	12	10
17	Sports Management	16	4	5	6	5
18	Presentation to Senior Management	17,15,6	1	1	3	1.333333333
19	Gain Stakeholder Approval	18	1	1	2	1.166666667
20	Final Report	19	2	3	5	3.166666667
		Total Days	116	150	204	153.3333333

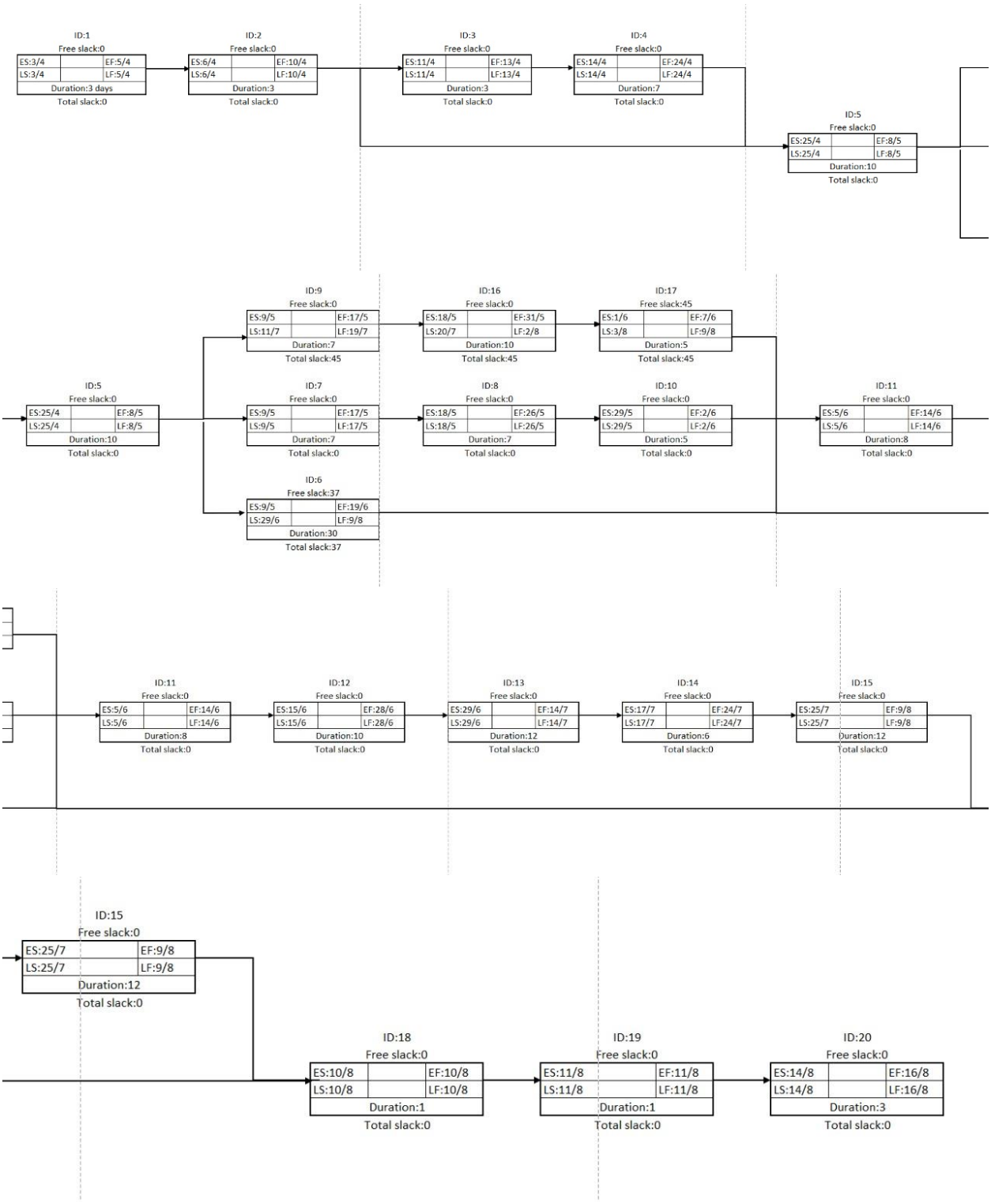
Used Function:



	A	B	C	D	E	F	G	H
1	Task ID	Task Name	Predecessors	Optimistic Time	Most likely Time	Pessimistic time	Weighted Average	
2	1	Identify Stakeholders	-	2	3	4	=(D2+4*E2+F2)/6	
3	2	Project Charter	1	3	3	6	3.5	
4	3	Develop Team Contract	2	2	3	4	3	
5	4	Project Scope Statement	3	4	7	10	7	
6	5	Requirement Analysis	2,4	6	10	15	10.16666667	
7	6	Interface Design	5	25	30	37	30.33333333	
8	7	Maintaining Student Records	5	5	7	10	7.166666667	
9	8	Admissions Management	7	5	7	10	7.166666667	
10	9	Transcript Management	5	5	7	10	7.166666667	
11	10	Attendance Management	8	4	5	8	5.333333333	
12	11	Assessment Management	10	6	8	12	8.333333333	
13	12	Scheduling	11	9	10	15	10.66666667	
14	13	Reports Management	12	10	12	14	12	
15	14	Library Management	13	5	6	7	6	
16	15	Alerts and Notifications	14	9	12	14	11.83333333	
17	16	Hostel Management	9	8	10	12	10	
18	17	Sports Management	16	4	5	6	5	
19	18	Presentation to Senior Management	17,15,6	1	1	3	1.333333333	
20	19	Gain Stakeholder Approval	18	1	1	2	1.166666667	
21	20	Final Report	19	2	3	5	3.166666667	
22			Total Days	116	150	204	153.3333333	
23								

9. ES, EF, LS, LF, Free Float, and Total Float for each activity

Task ID	Task Name	Early Start	Early Finish	Late Start	Late Finish	Free Float	Total Float
1	Identify Stakeholders	Mon 4/3/23	Wed 4/5/23	Mon 4/3/23	Wed 4/5/23	0d	0d
2	Project Charter	Thu 4/6/23	Mon 4/10/23	Thu 4/6/23	Mon 4/10/23	0d	0d
3	Develop Team Contract	Tue 4/11/23	Thu 4/13/23	Tue 4/11/23	Thu 4/13/23	0d	0d
4	Project Scope Statement	Fri 4/14/23	Mon 4/24/23	Fri 4/14/23	Mon 4/24/23	0d	0d
5	Requirement Analysis	Tue 4/25/23	Mon 5/8/23	Tue 4/25/23	Mon 5/8/23	0d	0d
6	Interface Design	Tue 5/9/23	Mon 6/19/23	Thu 6/29/23	Wed 8/9/23	37d	37d
7	Maintaining Student Records	Tue 5/9/23	Wed 5/17/23	Tue 5/9/23	Wed 5/17/23	0d	0d
8	Admissions Management	Thu 5/18/23	Fri 5/26/23	Thu 5/18/23	Fri 5/26/23	0d	0d
9	Transcript Management	Tue 5/9/23	Wed 5/17/23	Tue 7/11/23	Wed 7/19/23	0d	45d
10	Attendance Management	Mon 5/29/23	Fri 6/2/23	Mon 5/29/23	Fri 6/2/23	0d	0d
11	Assessment Management	Mon 6/5/23	Wed 6/14/23	Mon 6/5/23	Wed 6/14/23	0d	0d
12	Scheduling	Thu 6/15/23	Wed 6/28/23	Thu 6/15/23	Wed 6/28/23	0d	0d
13	Reports Management	Thu 6/29/23	Fri 7/14/23	Thu 6/29/23	Fri 7/14/23	0d	0d
14	Library Management	Mon 7/17/23	Mon 7/24/23	Mon 7/17/23	Mon 7/24/23	0d	0d
15	Alerts and Notifications	Tue 7/25/23	Wed 8/9/23	Tue 7/25/23	Wed 8/9/23	0d	0d
16	Hostel Management	Thu 5/18/23	Wed 5/31/23	Thu 7/20/23	Wed 8/2/23	0d	45d
17	Sports Management	Thu 6/1/23	Wed 6/7/23	Thu 8/3/23	Wed 8/9/23	45d	45d
18	Presentation to Senior Management	Thu 8/10/23	Thu 8/10/23	Thu 8/10/23	Thu 8/10/23	0d	0d
19	Gain Stakeholder Approval	Fri 8/11/23	Fri 8/11/23	Fri 8/11/23	Fri 8/11/23	0d	0d
20	Final Report	Mon 8/14/23	Wed 8/16/23	Mon 8/14/23	Wed 8/16/23	0d	0d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LS:3/4 LF:5/4
Duration:3 days
Total slack:0
ID:2
Free slack:0
ES:6/4 EF:10/4
LS:6/4 LF:10/4
Duration:3
Total slack:0
ID:3
Free slack:0
ES:11/4 EF:13/4
LS:11/4 LF:13/4
Duration:3
Total slack:0
ID:4
Free slack:0
ES:14/4 EF:24/4
LS:14/4 LF:24/4
Duration:7
Total slack:0
ID:5
Free slack:0
ES:25/4 EF:8/5
LS:25/4 LF:8/5
Duration:10
Total slack:0
ID:9
Free slack:0
ES:9/5 EF:17/5
LS:11/7 LF:19/7
Duration:7
Total slack:45
ID:16
Free slack:0
ES:18/5 EF:31/5
LS:20/7 LF:2/8
Duration:10
Total slack:45
ID:17
Free slack:45
ES:1/6 EF:7/6
LS:3/8 LF:9/8
Duration:5
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Duration:10
Total slack:0
ID:7
Free slack:0
ES:9/5 EF:17/5
LS:9/5 LF:17/5
Duration:7
Total slack:0
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Free slack:0
ES:18/5 EF:26/5
LS:18/5 LF:26/5
Duration:7
Total slack:0
ID:10
Free slack:0
ES:29/5 EF:2/6
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Duration:5
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ID:11
Free slack:0
ES:5/6 EF:14/6
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LS:29/6 LF:9/8
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Free slack:0
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LS:14/8 LF:16/8
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10. Critical Chain and Critical Path(s), then find the duration of the project

Critical Path

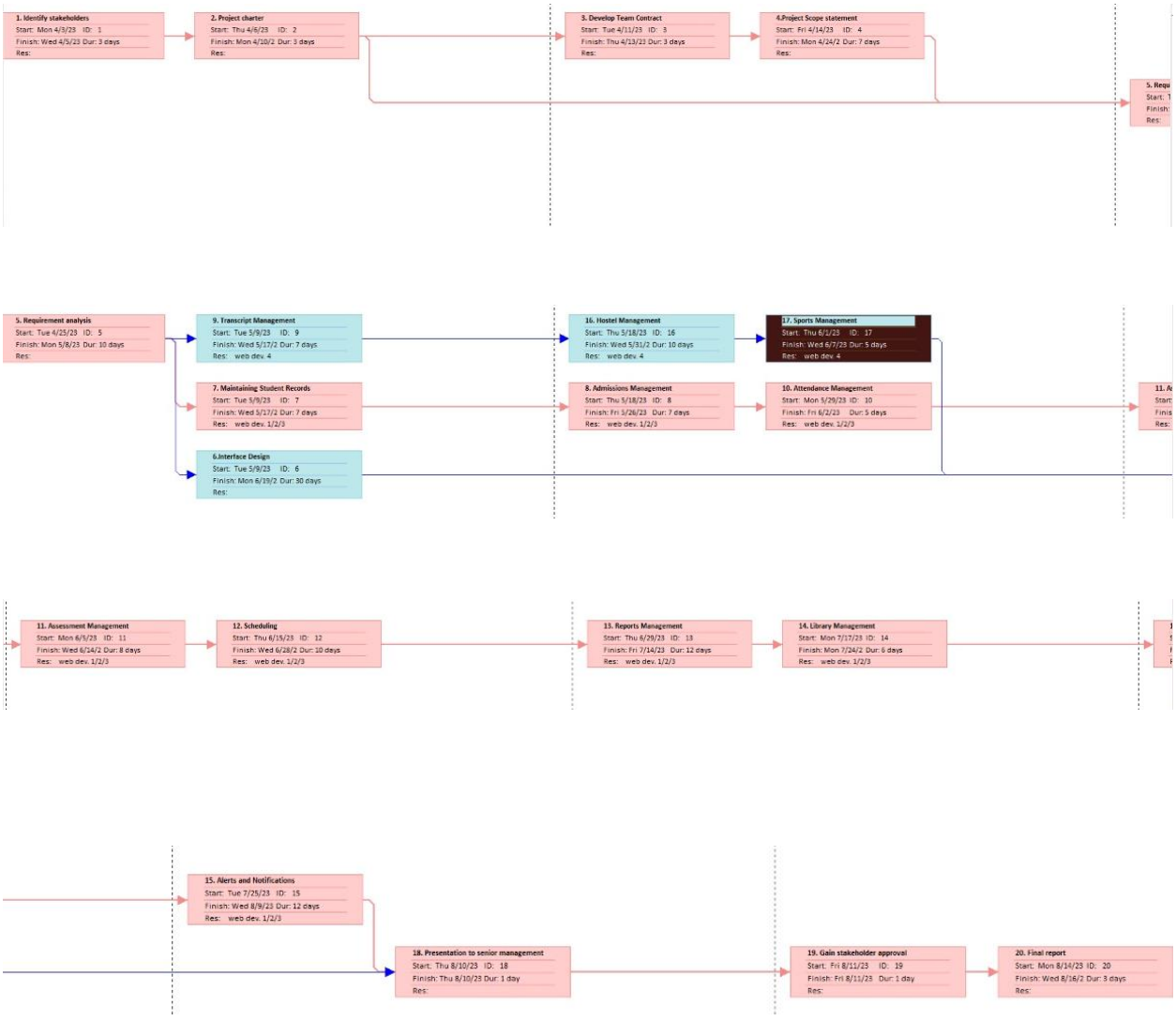
The critical path represents the longest sequence of dependent tasks that need to happen to complete a project.

Tasks included in critical path:

1, 2, 3, 4, 5, 7, 8, 10, 11, 12, 13, 14, 15, 18, 19, 20

Critical path diagram:

- Critical tasks are in red



Critical chain

Critical chain method also focuses on task dependencies and considers the resources needed to complete a project.

Resources in the University information system include:

- Developers
- Equipment
- Third-Party software license
- Office space

There are different types of Buffers commonly used in critical chain methodology

- Project buffers: The extra time that's placed between the final task and the end of the project. This gives team members a chance to catch up on any project tasks they couldn’t get to earlier.

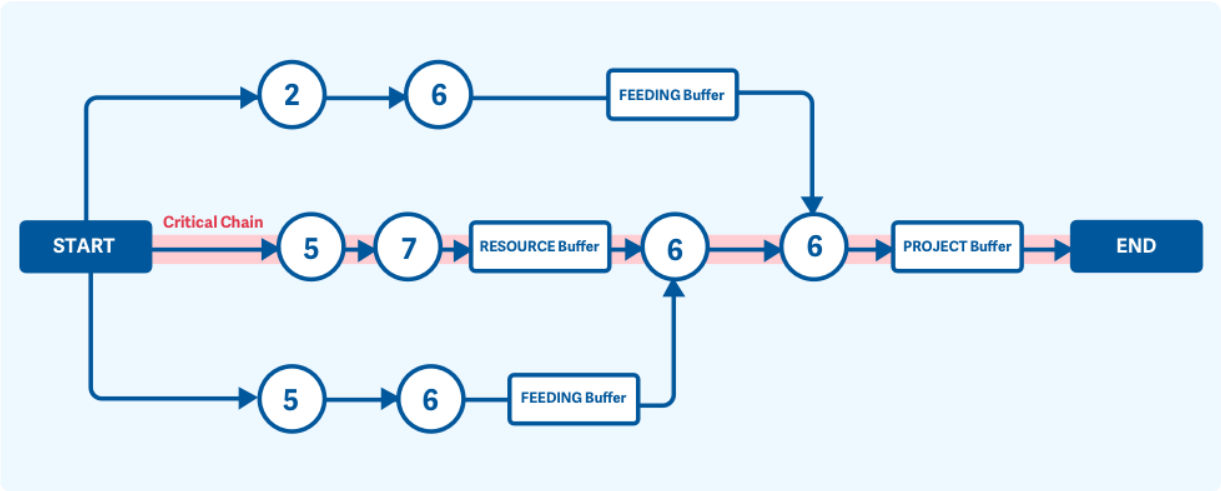
- Feeding buffers: The extra time that's placed between the feeding chain (chain of dependent tasks that need to run concurrently with the critical path but do not belong to critical path) and the critical chain. Adding this buffer into the timeline prevents any delays from the feeding chain affecting the critical chain.

- Resource buffers: These are literal resources you set aside in case they are needed. Such as extra team members, equipment…etc.

11. Feeding Buffers and Project Buffer, and the justification of having them

Adding Project Buffer:

A unique and single buffer that is added at the end of the project between the last activity and the project deadline, protects project deadline against violation in the critical chain



Project buffer is in between last critical activity & project deadline.

Let's add a project buffer to our project,

-consider the critical tasks & duration listed in the table here

Task-id	Duration
Task-1	3
Task-2	3
Task-4	7
Task-5	10
Task-7	7
Task-8	7
Task-10	5
Task-11	8
Task-12	10
Task-13	12
Task-14	6
Task-15	12
Task-18	1
Task-19	1
Task-20	3

Consider the critical chain sequence is the top-down sequence in the table.

How to calculate Project buffer?

-project buffer has a lower limit; it shouldn't go under 20% of critical path chain length.

-there are two methods to calculate it:

1st method -Simple method:

$$critical\ path\ length = sum\ of\ durations\ for\ all\ tasks\ in\ the\ citical\ path$$

$$\begin{aligned} &critical\ path\ length \\ &= 3+3+3+7+10+7+7+5+8+10+12+6+12+1+1+3 \\ &= 98\ days \end{aligned}$$

And by calculating the lower limit (20% of the critical path):

$$Project\ Buffer = 0.2 * 98 = \ 20\ days$$

by calculating the upper limit (50% of the critical path):

$$Project\ Buffer = 0.5 * 98 = 49\ days$$

2nd method -SSQ-(square root of the summation of the squares):

$$\begin{aligned} &SSQ \\ &= \sqrt{3^2+3^2+3^2+7^2+10^2+7^2+7^2+5^2+8^2+10^2+12^2+6^2+12^2+1^2+1^2+3^2} \\ &= 29\ days \end{aligned}$$

Based on the above calculations:

-20 days buffer, is not efficient with our project, it's not preferable to consider buffer size 20% of critical path.

-49 days buffer, also isn't efficient with our project, as it's a very long time to be considered as a buffer, not suitable with our project size & project deadline, so to consider buffer size 50% of critical path method not good here.

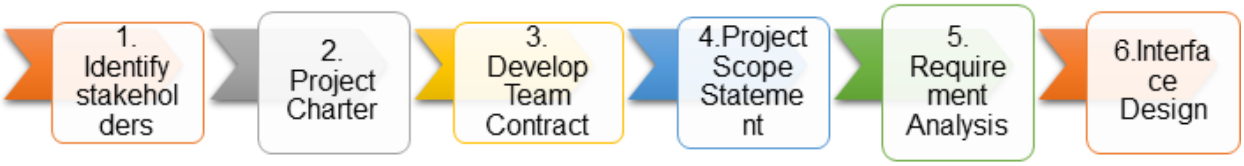
-**the most efficient & suitable buffer size to our work** is 29 days, **the SSQ -method, so we will consider this method.**

Our project buffer is 29 days, using SSQ-method.

Feeding Buffer

Any path of activities merging into the critical chain is called a feeding chain. A feeding buffer protects the critical chain against violations in the feeding chain. Basically, feeding buffers are added to the non-critical chains so any delay in non-critical chains does not affect the critical chain.
Therefore, in our project, it will be added before **18. Presentation to senior management task** but we have 2 non-critical paths with the same late finish but the early finish of **6. Interface Design** which is 6/19/23 is greater than the early finish of **17. Sports Management** which is 6/7/23 and those 2 tasks will affect on our critical task (18) so we will take the feeding path which depends on the **Interface Design task**

The Feeding Path:



Feeding Path Calculations:

50%(3+3+3+7+10+30)=28 days FB before entering **18. Presentation to senior management task**

12. References

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