Module Interface Specification for Software Engineering

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1 Revision History

Date	Version	Notes
Jan 3, 2024	1.0	Added MIS for TeamT, GameT, PlayerT, Backend
Jan 14, 2024	1.1	Added MIS for Season and Standing Record Modules
Jan 17, 2024	1.2	Added sections 2,3,4
Apr 4, 2025	1.3	Rev1 Revisions From Feedback

2 Symbols, Abbreviations and Acronyms

See SRS Documentation at https://github.com/dcheung11/team-6-capstone-project/blob/main/docs/SRS-Volere/SRS.pdf

symbol	description
AC	Anticipated Change
DAG	Directed Acyclic Graph
M	Module
MG	Module Guide
MIS	Module Interface Specification
OS	Operating System
R	Requirement
SRS	Software Requirements Specification
UC	Unlikely Change
RBAC	Role-Based Access Control
JSON	JavaScript Object Notation
API	Application Programming Interface

Contents

3 Introduction

The following document details the Module Interface Specifications for Pitch Perfect McMaster GSA Softball League Platform. The platform is a web-based application designed to streamline league management. It enables users to create and join teams, schedule and reschedule games, track standings, and manage player rosters. With features like automated scheduling, announcements, and preferences for game timings, the platform simplifies league operations for players, captains, and administrators.

Complementary documents include the System Requirement Specifications and Module Guide. The full documentation and implementation can be found at https://github.com/dcheung11/team-6-capstone-project.

4 Notation

The structure of the MIS for modules comes from Hoffman and Strooper (1995), with the addition that template modules have been adapted from Ghezzi et al. (2003). The mathematical notation comes from Chapter 3 of Hoffman and Strooper (1995). For instance, the symbol := is used for a multiple assignment statement and conditional rules follow the form $(c_1 \Rightarrow r_1|c_2 \Rightarrow r_2|...|c_n \Rightarrow r_n)$.

The following table summarizes the primitive data types used by Software Engineering.

Data Type	Notation	Description
character	char	a single symbol or digit
integer	$\mathbb{Z}$	a number without a fractional component in (-∞, ∞)
natural number	$\mathbb{N}$	a number without a fractional component in [1, ∞)
real	$\mathbb{R}$	any number in (-∞, ∞)
multiple assignment	:=	multiple assignment statement
set	{ ... }	collection of unique elements
not in set	$\setminus$	element not in set
union	$\cup$	union of two sets
intersection	$\cap$	intersection of two sets

The specification of Software Engineering uses some derived data types: sequences, strings, and tuples. Sequences are lists filled with elements of the same data type. Strings are sequences of characters. Tuples contain a list of values, potentially of different types. In addition, Software Engineering uses functions, which are defined by the data types of their inputs and outputs. Local functions are described by giving their type signature followed by their specification.

5 Module Decomposition

The following table is taken directly from the Module Guide document for this project.

Level 1	**Level 2**
Hardware-Hiding Module	
Behaviour-Hiding Module	User Interface Module
	Authentication Module
	Team Management Module
	Game Management Module
	Announcements Module
	Scheduling Module
	Standings Module
	Waiver Module
	PlayerT Module
	TeamT Module
	GameT Module
Software Decision Module	Database Module
	Notification Module
	Scheduling Algorithm Module

Table 1: Module Hierarchy

References

Carlo Ghezzi, Mehdi Jazayeri, and Dino Mandrioli. *Fundamentals of Software Engineering*. Prentice Hall, Upper Saddle River, NJ, USA, 2nd edition, 2003.

Daniel M. Hoffman and Paul A. Strooper. *Software Design, Automated Testing, and Maintenance: A Practical Approach*. International Thomson Computer Press, New York, NY, USA, 1995. URL http://citeseer.ist.psu.edu/428727.html.

6 MIS of User Interface Module (M1)

6.1 Module

User Interface Module

6.2 Uses

- Backend Module: To retrieve and send data for rendering views and processing user inputs.
- Authentication Module: For user login and role verification.
- Game Management Module: To display and update game information.
- Team Management Module: To display team information
- Scheduling Module: To display schedules
- Standings Module: To display league standings and updates.
- Announcements Module: To display Announcements
- Notification Module: To display interface for creating notifications

6.3 Syntax

6.3.1 Exported Constants

- None

6.3.2 Exported Access Programs

Name	In	Out	Exceptions
renderView	View	-	InvalidViewException

6.4 Semantics

6.4.1 State Variables

- **currentView**: Stores the identifier for the currently displayed view.
- **userRole**: Stores the role of the currently logged-in user (e.g., player, captain, commissioner).

6.4.2 Environment Variables

- Browser environment: The module interacts with the user's browser, including DOM manipulation and event handling.
- Network connection: Required for fetching and sending data to the backend.

6.4.3 Assumptions

- Users will have a modern web browser that supports the required JavaScript features.
- A stable network connection is available during interactions requiring backend communication.

6.4.4 Access Routine Semantics

renderView(view):

- transition: `currentView` := `view`.
- exception: Throws `InvalidViewException` if `view` is unsupported.

6.4.5 Local Functions

- None

7 MIS of Scheduling Module

7.1 Module

Scheduling Module: Behaviour-Hiding Module

7.2 Uses

- Scheduling Algorithm Module
- TeamT Module
- GameT Module

7.3 Syntax

7.3.1 Exported Constants

- **DEFAULT_WEEK_COUNT: Integer**
  Default number of weeks in the season.

7.3.2 Exported Access Programs

Name	In	Out	Exceptions
create schedule	TeamT[], Slot Object[], Integer	Schedule Object	-
addGame	GameT	Boolean	InvalidInput
removeGame	String	Boolean	GameNotFound
updateGameSlot	String, GameslotT	Boolean	GameNotFound
rescheduleGame	String, GameT, GameT	Boolean	GameNotFound, SlotNotFound

7.4 Semantics

7.4.1 State Variables

$$\text{schedule} \subseteq \mathcal{T} \times \mathcal{S} \times \mathcal{G}$$

where:

- $\mathcal{T}$: Set of all teams.
- $\mathcal{S}$: Set of available slots.
- $\mathcal{G}$: Set of all game identifiers.

7.4.2 Environment Variables

None.

7.4.3 Assumptions

- $\forall t \in \mathcal{T},\ \exists s \in \mathcal{S},\ t$ is scheduled exactly once per week.
- Valid team ($t \in \mathcal{T}$) and slot ($s \in \mathcal{S}$) data are provided for schedule creation.

7.4.4 Access Routine Semantics

createSchedule(teams, slots, seasonLength):

transition: schedule := generateSchedule($teams, slots, seasonLength$)
output: out := schedule
constraint: $\forall t \in \mathcal{T},\ \exists s \in \mathcal{S},\ t$ plays once per week.
exception: None.

addGame(details):

transition: schedule := schedule $\cup \{(t_1, t_2, s) \mid t_1, t_2 \in \mathcal{T},\ t_1 \neq t_2,\ s \in \mathcal{S}\}$
output: out := true if details are valid, false otherwise.
exception: InvalidInput if details are incomplete or invalid.

removeGame(gameId):

transition: schedule := schedule $\setminus \{g \mid g \in \mathcal{G},\ g.\text{id} = \text{gameId}\}$
output: out := true if gameId exists in schedule, false otherwise.
exception: GameNotFound if gameId does not exist.

updateGameSlot(gameId, newSlot):

transition: schedule := schedule $\setminus \{g \mid g \in \mathcal{G},\ g.\text{id} = \text{gameId}\}$
$\cup \{(t_1, t_2, \text{newSlot})\}$
output: out := true if the update is successful.
exception: GameNotFound if gameId does not exist.

rescheduleGame(gameId, newSlot, oldSlot):

transition: schedule := schedule $\setminus \{(t_1, t_2, \text{oldSlot}) \mid t_1, t_2 \in \mathcal{T}\}$
$\cup \{(t_1, t_2, \text{newSlot})\}$
output: out := true if the reschedule is successful.
exceptions:
$$\begin{cases} \text{GameNotFound} & \text{if gameId does not exist.} \\ \text{SlotNotFound} & \text{if oldSlot or newSlot does not exist.} \end{cases}$$

7.4.5 Local Functions

None.

8 MIS of PlayerT Module

8.1 Module

PlayerT: Abstract Player Module.

8.2 Uses

TeamT

- **GameT**: The Player module interacts with the Game module to track player participation in games.
- **TeamT**: The Player module is connected to the Team module, as players are assigned to teams.

8.3 Syntax

8.3.1 Exported Constants

8.3.2 Exported Access Programs

Name	In	Out	Exceptions
PlayerT	String, String, String, String, Bool, String	-	-
getPlayerId		String	-
getName		String	-
getEmail		String	-
getWaiverStatus		Bool	-
getTeam		Bool	-
setWaiverStatus	Bool	-	-
setTeam	String	-	-

8.4 Semantics

8.4.1 State Variables

isLoggedIn: Boolean

8.4.2 Environment Variables

None

8.4.3 Assumptions

None

8.4.4 Access Routine Semantics

PlayerT(id, n, e, p, w, t):

- transition: playerId, name, email, password, waiverStatus, team := id, n, e, p, w, t
- output: out := self
- exception: None

getPlayerId():

- output: out := playerId
- exception: None

getName():

- output: out := name
- exception: None

getEmail():

- output: out := email
- exception: None

getWaiverStatus():

- output: out := waiverStatus
- exception: None

getTeam():

- output: out := team
- exception: None

setTeam(t):

- transition: team := t
- exception: None

setWaiverStatus(w):

- transition: waiverStatus := w
- exception: None

8.4.5 Local Functions

9 MIS of GameT Module

9.1 Module

GameT: Abstract Game Type

9.2 Uses

TeamT

9.3 Syntax

9.3.1 Exported Constants

9.3.2 Exported Access Programs

Name	In	Out	Exceptions
GameT	String, String, Date, String, String, Integer, Integer, String	–	–
getGameId	–	String	–
getTeamsInGame	–	TeamT[]	GameNotFound
getGameDetails	–	Object	GameNotFound
getStatus	–	String	GameNotFound
getField	–	String	GameNotFound
setStatus	String	–	InvalidStatus
setField	String	–	InvalidField
setScore	Integer, Integer	–	InvalidScore

9.4 Semantics

9.4.1 State Variables

9.4.2 Environment Variables

None

9.4.3 Assumptions

- A game must have two teams assigned to it.
- A game must have a field assigned to it.

- A game's score can only be updated after the game is completed.
- The game status must be updated to reflect its current state (e.g., scheduled, completed).

9.4.4 Access Routine Semantics

GameT(id, t1, t2, d, t, s1, s2, f):

- transition: gameId, team1Id, team2Id, gameDate, gameTime, scoreTeam1, scoreTeam2, field := id, t1, t2, d, t, s1, s2, f
- output: out := self
- exception: None

getGameId():

- output: out := gameId
- exception: None

getGameDetails():

- output: out := Object containing game details: gameId, team1Id, team2Id, gameDate, gameTime, scoreTeam1, scoreTeam2, status, field
- exception: Game not found if the game ID does not exist.

getTeamsInGame():

- output: out := Array of Teams participating in the game
- exception: Game not found if the game ID does not exist.

getStatus():

- output: out := status
- exception: Game not found if the game ID does not exist.

getField():

- output: out := field
- exception: Game not found if the game ID does not exist.

setStatus(status):

- transition: status := status

- exception: Invalid status if the provided status is not valid.

setField(field):

- transition: field := field
- exception: Invalid field if the provided field is not valid.

setScore(score1, score2):

- transition: scoreTeam1 := score1, scoreTeam2 := score2
- exception: Invalid score if the provided scores are not valid integers.

9.4.5 Local Functions

- **validateGameDetails()**: A function to validate the input details when creating a new game.

10 MIS of TeamT Module

10.1 Module

TeamT Module: Abstract Team Module

10.2 Uses

PlayerT, GameT

10.3 Syntax

10.3.1 Exported Constants

10.3.2 Exported Access Programs

Name	In	Out	Exceptions
TeamT	String, String, String, PlayerT[], PlayerT	-	-
getTeamId	-	String	-
getTeamName	-	String	-
getDivision	-	String	-
getRoster	-	PlayerT[]	-
getCaptain	-	PlayerT	-
addPlayer	PlayerT	-	InvalidPlayer
removePlayer	PlayerT	-	PlayerNotFound

10.4 Semantics

10.4.1 State Variables

10.4.2 Environment Variables

None

10.4.3 Assumptions

- Each team must have a unique team ID.
- A team can belong to one division at a time.
- The team roster must be an array or list of players (with unique player identifiers).

10.4.4 Access Routine Semantics

TeamT(id, n, d, r, c):

- transition: teamId, teamName, division, roster, captain := id, n, d, r, c
- output: out := self
- exception: None

getTeamId():

- output: out := teamId
- exception: None

getTeamName():

- output: out := teamName
- exception: None

getDivision():

- output: out := division
- exception: None

getRoster():

- output: out := roster
- exception: None

getCaptain():

- output: out := captain
- exception: None

addPlayer(player):

- transition: roster := roster + player
- exception: Invalid player if the player is invalid or already in the roster.

removePlayer(player):

- transition: roster := roster - player
- exception: Player not found if the player is not in the roster.

10.4.5 Local Functions

None

11 MIS of Backend Module

11.1 Module

Backend/Database

11.2 Uses

PlayerT, GameT, TeamT

11.3 Syntax

11.3.1 Exported Constants

11.3.2 Exported Access Programs

Name	In	Out	Exceptions
createPlayer	String, String, String, String, Bool, String	-	PlayerCreationError
getPlayer	String	PlayerT	PlayerNotFound
updatePlayer	String, String, String, String, Bool, String	-	PlayerNotFound
deletePlayer	String	-	PlayerNotFound
createTeam	String, String, String, PlayerT[], PlayerT	-	TeamCreationError
getTeam	String	TeamT	TeamNotFound
updateTeam	String, String, String, PlayerT[], PlayerT	-	TeamCreationError
deleteTeam	String	-	TeamNotFound
createGame	String, String, Date, String, String, Integer, Integer, String	-	GameCreationError
getGame	String	GameT	GameNotFound
updateGame	String, String, Date, String, String, Integer, Integer, String	-	GameCreationError
deleteGame	String	-	GameNotFound
getAllPlayersForTeam	String	PlayerT[]	TeamNotFound
getAllGamesForTeam	String	GameT[]	TeamNotFound

11.4 Semantics

11.4.1 State Variables

None

11.4.2 Environment Variables

None

11.4.3 Assumptions

- The backend is connected to a database
- Each database operation (CRUD) will be encapsulated in a backend method to ensure separation of concerns
- Data consistency and integrity are maintained by the backend during each operation.

11.4.4 Access Routine Semantics

createPlayer(name, email, password, waiverStatus, team):

- transition: playerId, name, email, password, waiverStatus, team := name, email, password, waiverStatus, team
- exception: "Player Creation Error" if player cannot be created

getPlayer(playerId):

- output: out := player (retrieves player object based on playerId)
- exception: "Player Not Found" if player does not exist

updatePlayer(playerId, name, email, password, waiverStatus, team):

- transition: name, email, password, waiverStatus, team := name, email, password, waiverStatus, team (updates player's details)
- exception: "Player Not Found" if player does not exist

deletePlayer(playerId):

- transition: player := null (deletes the player from the database)
- exception: "Player Not Found" if player does not exist

createTeam(teamName, division, captain, roster):

- transition: teamId, teamName, division, captain, roster := teamName, division, captain, roster
- exception: "Team Creation Error" if team cannot be created

getTeam(teamId):

- output: out := team (retrieves team object based on teamId)
- exception: "Team Not Found" if team does not exist

updateTeam(teamId, teamName, division, roster):

- transition: teamName, division, roster := teamName, division, roster (updates team's details)
- exception: "Team Not Found" if team does not exist

deleteTeam(teamId):

- transition: team := null (deletes the team from the database)
- exception: "Team Not Found" if team does not exist

createGame(teams, date, time, field, score):

- transition: gameId, teams, date, time, field, score := teams, date, time, field, score (creates a new game)
- exception: "Game Creation Error" if game cannot be created (e.g., scheduling conflict)

getGame(gameId):

- output: out := game (retrieves game object based on gameId)
- exception: "Game Not Found" if game does not exist

updateGame(gameId, updates):

- transition: gameId, updates := gameId, updates (updates the game's details)
- exception: "Game Not Found" if game does not exist

deleteGame(gameId):

- transition: game := null (deletes the game from the database)
- exception: "Game Not Found" if game does not exist

getAllPlayersForTeam(teamId):

- output: out := players (retrieves all players associated with the team)
- exception: "Team Not Found" if team does not exist

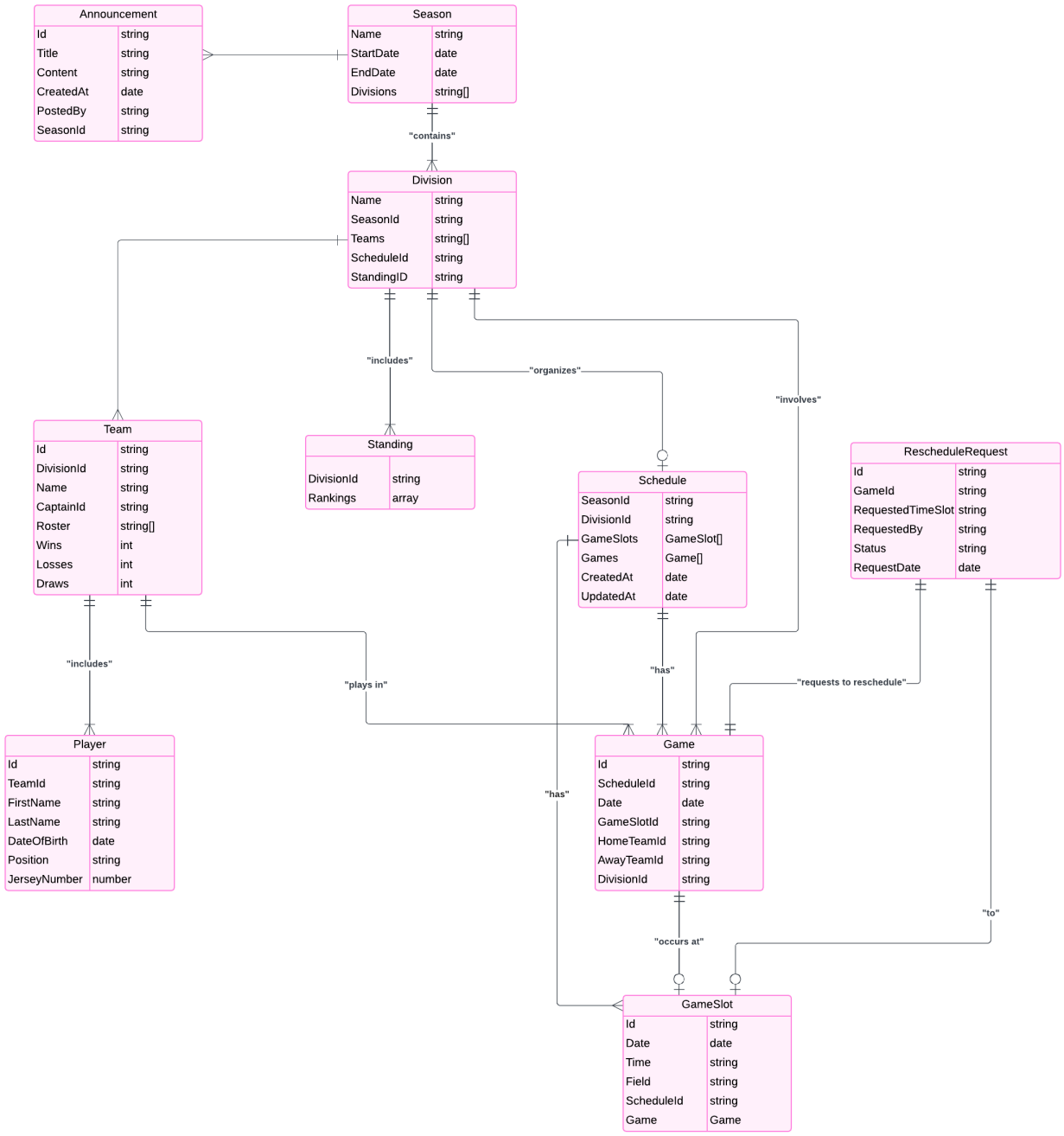
getAllGamesForTeam(teamId):

- output: out := games (retrieves all games associated with the team)
- exception: "Team Not Found" if team does not exist

11.4.5 Local Functions

None

11.4.6 ERD for Database



12 MIS of Waiver Module

12.1 Module

Waiver

12.2 Uses

- None

12.3 Syntax

12.3.1 Exported Constants

- None

12.3.2 Exported Access Programs

Name	In	Out	Exceptions
createWaiver	Waiver details	Waiver ID	InvalidInputException
getWaiver	Waiver ID	Waiver details	WaiverNotFoundException
signWaiver	User ID, Waiver ID	Boolean	WaiverNotFoundException, AlreadySignedException
listWaivers	User ID	List of waivers	-

12.4 Semantics

12.4.1 State Variables

- waiverList: A collection of all waivers, including details and user signatures.

12.4.2 Environment Variables

- Database: For storage of waiver details and signatures.

12.4.3 Assumptions

- All users accessing the waiver module are authenticated.
- Waiver text complies with the legal requirements of the university softball league.

12.4.4 Access Routine Semantics

`createWaiver`(details):

- transition: Adds a new waiver to `waiverList`.
- output: Returns a unique identifier for the created waiver.
- exception: Raises `InvalidInputException` if the waiver details are incomplete.

`getWaiver`(waiverID):

- output: Retrieves details of the specified waiver.
- exception: Raises `WaiverNotFoundException` if the waiver does not exist.

`signWaiver`(playerID, waiverID):

- transition: Updates `waiverList` to record the user's signature for the specified waiver.
- output: Returns `true` if the signature is successful.
- exception: Raises `WaiverNotFoundException` if the waiver does not exist or `AlreadySignedExceptio` if the user has already signed the waiver.

`listWaivers`(userID):

- output: Returns all waivers associated with the user.

12.4.5 Local Functions

- None

13 MIS of Notification Module

13.1 Module

Notification

13.2 Uses

- None

13.3 Syntax

13.3.1 Exported Constants

- MAX_NOTIFICATION_LENGTH: Maximum allowed characters in a notification message.
- NOTIFICATION_RETRY_LIMIT: Maximum retry attempts for failed notifications.

13.3.2 Exported Access Programs

Name	In	Out	Exceptions
send	NotificationID, playerID	Boolean	InvalidPlayerID, SendFailure
schedule	NotificationID, DateTime	Boolean	InvalidDateTime
status	NotificationID	Status	InvalidNotificationID

13.4 Semantics

13.4.1 State Variables

- pendingNotifications: List of notifications yet to be delivered.
- deliveredNotifications: List of successfully delivered notifications.

13.4.2 Environment Variables

- Email Gateway: For sending email notifications.
- SMS Gateway: For sending SMS notifications.

13.4.3 Assumptions

- Users have valid email addresses or phone numbers stored in the database.
- Gateway APIs are operational and accessible.

13.4.4 Access Routine Semantics

send(NotificationID, playerID):

- transition: Moves the notification from pendingNotifications to deliveredNotifications if successfully sent.
- output: true if the notification is successfully sent; false otherwise.
- exception: InvalidPlayerID if the playerID is not found; SendFailure if the notification fails to send after retries.

schedule(NotificationID, DateTime):

- transition: Adds the notification to the pendingNotifications queue with the scheduled delivery time.

- output: `true` if the scheduling is successful; `false` otherwise.
- exception: `InvalidDateTime` if the DateTime is in the past or improperly formatted.

`status`(NotificationID):

- transition: None.
- output: The status of the notification (e.g., Pending, Delivered, Failed).
- exception: `InvalidNotificationID` if the NotificationID is not found.

13.4.5 Local Functions

- `validateNotification(NotificationID)`: Ensures the notification exists and is properly formatted.
- `retryFailedNotifications()`: Attempts to resend notifications marked as failed.

14 MIS of Authentication Module

14.1 Module

Auth (M2) - Abstract object for handling user authentication and session management.

14.2 Uses

- **User Interface Module** (M1) - For collecting user credentials (username, password) and displaying authentication feedback.
- **Backend Module** (M13) - For verifying credentials, managing tokens, and storing authentication data.

14.3 Syntax

14.3.1 Exported Constants

- `SESSION_TIMEOUT` - Integer representing session timeout in minutes (default: 30).

14.3.2 Exported Access Programs

Name	In	Out	Exceptions
`login`	String, String	Boolean	`InvalidCredentials`
`logout`	String	Void	`SessionNotFound`
`registerUser`	String, String, String	Boolean	`DuplicateUserError`
`verifyToken`	String	Boolean	`TokenExpiredError`
`generateToken`	String	String (Token)	`UserNotFound`

14.4 Semantics

14.4.1 State Variables

- **userSessions**: Map of active session tokens to user IDs.
- **userData**: Map of user IDs to credentials and roles.

14.4.2 Environment Variables

- **Database Connection**: Used for storing and retrieving user authentication data.
- **SSL/TLS Connection**: Required for secure communication between client and server.

14.4.3 Assumptions

- All passwords are stored as securely hashed values.
- Token expiration is managed based on `SESSION_TIMEOUT`.

14.4.4 Access Routine Semantics

- `login(username, password)`
  - **Transition**: If the username and password match, generate a session token and add it to `userSessions`.
  - **Output**: Returns `true` if successful, otherwise throws `InvalidCredentials`.
  - **Exception**: Throws `InvalidCredentials` if the username or password is incorrect.
- `logout(token)`
  - **Transition**: Removes the token from `userSessions`.
  - **Output**: None.
  - **Exception**: Throws `SessionNotFound` if the token is invalid or expired.
- `registerUser(username, password, role)`
  - **Transition**: Adds a new entry to `userData` with hashed password and role.
  - **Output**: Returns `true` if registration is successful.
  - **Exception**: Throws `DuplicateUserError` if the username already exists.
- `verifyToken(token)`
  - **Output**: Returns `true` if the token is valid, otherwise throws `TokenExpiredError`.
  - **Exception**: Throws `TokenExpiredError` if the token is expired.
- `generateToken(userID)`
  - **Output**: Generates a unique token linked to the `userID`.
  - **Exception**: Throws `UserNotFound` if the user ID does not exist.

14.4.5 Local Functions

- `hashPassword(password)`: Converts a plaintext password into a securely hashed value.
- `validatePassword(inputPassword, storedHash)`: Compares an input password to the stored hashed password.
- `generateUniqueToken(userID)`: Generates a cryptographically secure token linked to a user ID.

15 MIS of Team Management Module

15.1 Module

Team Management

15.2 Uses

- Waiver Module
- Notification Module

15.3 Syntax

15.3.1 Exported Constants

- None

15.3.2 Exported Access Programs

Name	In	Out	Exceptions
`createTeam`	Team details	Boolean	InvalidInput
`getTeamDetails`	Team ID	String	TeamNotFound
`updateTeam`	Team ID, Updates	Boolean	TeamNotFound
`deleteTeam`	Team ID	Boolean	TeamNotFound
`listTeams`	League ID	List	-
`createPlayer`	Team ID, Player ID	Boolean	TeamNotFound
`deletePlayer`	Team ID, Player ID	Boolean	TeamNotFound, PlayerNotFound

15.4 Semantics

15.4.1 State Variables

- `teamList`: A collection of all teams, their details, and associated players.
- `leagueTeams`: A mapping between leagues and their associated teams.

15.4.2 Environment Variables

- None

15.4.3 Assumptions

- All team operations are initiated by authorized users.
- Team details such as names and IDs are unique within a league

15.4.4 Access Routine Semantics

`createTeam`(details):

- transition: Adds a new team to `teamList`.
- output: Returns a unique identifier for the created team.
- exception: Raises `InvalidInput` if the team details are incomplete or violate constraints (e.g., duplicate team name).

`getTeamDetails`(teamID):

- output: Retrieves the details of the specified team.
- exception: Raises `TeamNotFound` if the team does not exist.

`updateTeam`(teamID, updates):

- transition: Updates the details of the specified team in `teamList`.
- output: Returns `true` if the update is successful.
- exception: Raises `TeamNotFound` if the team does not exist.

`deleteTeam`(teamID):

- transition: Removes the specified team from `teamList`.
- output: Returns `true` if the deletion is successful.
- exception: Raises `TeamNotFound` if the team does not exist.

`listTeams`(leagueID):

- output: Returns a list of all teams associated with the specified league.

`createPlayer`(teamID, playerID):

- transition: Adds a player to the specified team in `teamList`.
- output: Returns `true` if the player is successfully added.
- exception: Raises `TeamNotFound` if the team does not exist

`deletePlayer`(teamID, playerID):

- transition: Removes a player from the specified team in `teamList`.
- output: Returns `true` if the player is successfully removed.
- exception: Raises `TeamNotFound` if the team does not exist or `PlayerNotFound` if the player is not part of the team

15.4.5 Local Functions

- None

16 MIS of Announcements Module

16.1 Module

Announcements

16.2 Uses

- Notification Module
- Backend Module

16.3 Syntax

16.3.1 Exported Constants

- `ANNOUNCEMENT_TYPE_INFO`: Constant for an informational announcement type.

16.3.2 Exported Access Programs

Name	In	Out	Exceptions
`sendAnnouncement`	`Announcement` details (`text`, `type`)	`AnnouncementID`	`InvalidInput`
`updateAnnouncement`	`AnnouncementID`	`Boolean`	`AnnouncementNotFound`, `InvalidUpdate`
`deleteAnnouncement`	`AnnouncementID`	`Boolean`	`AnnouncementNotFound`

16.4 Semantics

16.4.1 State Variables

- None

16.4.2 Environment Variables

- None

16.4.3 Assumptions

- All announcement operations (create, update, delete) are performed by authorized users only.
- Users will be notified of new or updated announcements based on their notification preferences.

16.4.4 Access Routine Semantics

`sendAnnouncement`(announcementID):

- transition: Sends a notification about the specified announcement to subscribed users using send()
- output: Returns `true` if the notification was sent successfully.
- exception: Raises `AnnouncementNotFoundException` if the announcement does not exist.

`updateAnnouncement`(announcementID):

- transition: Updates the details of the specified announcement
- output: Returns `true` if the update is successful.
- exception: Raises `AnnouncementNotFound` if the announcement does not exist

`deleteAnnouncement`(announcementID):

- transition: Removes the specified announcement
- output: Returns `true` if the deletion is successful.
- exception: Raises `AnnouncementNotFound` if the announcementID does not exist.

16.4.5 Local Functions

- None

17 MIS of Scheduling Algorithm Module

17.1 Module

SchedulingAlgorithm: Software Decision Module.

17.2 Uses

- Scheduling Module
- TeamT
- GameslotT
- GameT

17.3 Syntax

17.3.1 Exported Constants

- DEFAULT_WEEK_COUNT: Integer
  Default number of weeks for scheduling.
- MAX_GAMES_PER_TEAM: Integer
  Maximum number of games per team.
- MIN_GAMES_PER_TEAM: Integer
  Minimum number of games per team.

17.3.2 Exported Access Programs

Name	In	Out	Exceptions
generateSchedule	TeamT[], GameslotT[]	Schedule object	InvalidInput
resolveConflicts	Schedule Object	Schedule Object	ConflictResolutionFailure
optimizeSchedule	Schedule Object	Schedule Object	OptimizationFailure

17.4 Semantics

17.4.1 State Variables

None

17.4.2 Environment Variables

None

17.4.3 Assumptions

- Inputs, such as the list of teams, slots, and week count, are valid and non-empty.
- Teams have all required properties, such as constraints and preferences.
- Slots are pre-validated and adhere to game capacity limits.
- Conflicts are identifiable based on provided rules (e.g., double bookings, unavailable fields).

17.4.4 Access Routine Semantics

generateSchedule(teams, slots, weekCount):

- output: out := schedule
  A schedule object generated based on team constraints, slot availability, and the given week count.
- exception: Raises InvalidInput if the input is incomplete or invalid.

resolveConflicts(schedule):

- transition: Resolves scheduling conflicts.
- output: out := updated_schedule.
- exception: Raises ConflictResolutionFailure if the conflicts cannot be resolved.

optimizeSchedule(schedule):

- transition: Refines the input schedule to improve adherence to the specified metrics.
- output: out := optimized_schedule.
- exception: Raises OptimizationFailure if optimization fails due to constraints or conflicts.

17.4.5 Local Functions

- calculateFairness(schedule): Computes a fairness metric for the schedule, ensuring balance across teams.
- detectConflicts(schedule): Identifies conflicts, such as double bookings or unavailable slots, in the schedule.
- applyOptimization(schedule, metrics): Applies optimization techniques to enhance the schedule.

18 MIS of Game Management Module (M4)

18.1 Module

Game Management Module

18.2 Uses

- GameT Module
- TeamT Module
- Scheduling Module
- Database Module

18.3 Syntax

18.3.1 Exported Constants

None

18.3.2 Exported Access Programs

Name	In	Out	Exceptions
reportScore	int, int, int	-	InvalidGameID, InvalidScore
updateGameStatus	int, string	-	InvalidGameID, InvalidStatus
getGameDetails	int	GameT	InvalidGameID

18.4 Semantics

18.4.1 State Variables

- `games`: A collection of all GameT objects which contain game details including game ID, participating teams, scores, and stasuses

18.4.2 Environment Variables

- Database: For storing and retrieving game records.
- User Interface Module: For allowing users to report scores and update statuses.

18.4.3 Assumptions

- Game IDs are unique and valid.
- Scores are reported accurately and honestly
- Game statuses are reported or updated accurately by only captains or administrators

18.4.4 Access Routine Semantics

`reportScore`(gameID, team1Score, team2Score):

- transition: game.score1, game.score2 := team1Score, team2Score
- exception: Throws `InvalidGameIDException` if the game does not exist. Throws `InvalidScoreException` if the scores are invalid.

`updateGameStatus`(gameID, newStatus):

- transition: game.status := newStatus
- exception: Throws `InvalidGameIDException` if the game does not exist. Throws `InvalidStatusException` if the status is invalid.

`getGameResults`(gameID):

- output: out := game (retrieves GameT object based on gameId)
- exception: Throws `InvalidGameIDException` if the game does not exist.

18.4.5 Local Functions

None

19 MIS of Division Module

19.1 Module

Division Module

19.2 Uses

TeamT Module

19.3 Syntax

19.3.1 Exported Constants

None

19.3.2 Exported Access Programs

Name	In	Out	Exceptions
getTeams	-	TeamT[]	-

19.4 Semantics

19.4.1 State Variables

teams (array of all teams in division)

19.4.2 Environment Variables

None

19.4.3 Assumptions

Teams will be evenly distributed among divisions

19.4.4 Access Routine Semantics

addTeam(team):

- transition: teams := teams + team (append team to list of teams)
- exception: TeamNotFound

removeTeam(team):

- transition: teams := teams - team (remove team from list of teams)

- exception: TeamNotFound

getTeams():

- output: teams
- exception: EmptyDivision

20 MIS of GameslotT Module

20.1 Module

Gameslot Record Module

20.2 Uses

- GameT
- Scheduling Module

20.3 Syntax

20.3.1 Exported Constants

None

20.3.2 Exported Access Programs

None

20.4 Semantics

20.4.1 State Variables

- Time
- Field
- Game

20.4.2 Environment Variables

None

20.4.3 Assumptions

Timeslots may or may not contain a game

20.4.4 Access Routine Semantics

None

21 MIS of Reschedule Request Module

21.1 Module

Reschedule Request Record Module

21.2 Uses

- GameT
- Scheduling Module

21.3 Syntax

21.3.1 Exported Constants

None

21.3.2 Exported Access Programs

None

21.4 Semantics

21.4.1 State Variables

- Requests

21.4.2 Environment Variables

None

21.4.3 Assumptions

Requests are created and seen in a timely manner

21.4.4 Access Routine Semantics

None

22 MIS of SeasonT Module

22.1 Module

Season Record Module

22.2 Uses

- TeamT
- DivisionT
- StandingT
- Scheduling Module

22.3 Syntax

22.3.1 Exported Constants

None

22.3.2 Exported Access Programs

None

22.4 Semantics

22.4.1 State Variables

- Season ID
- Start Date
- End Date
- Divisions

22.4.2 Environment Variables

None

22.4.3 Assumptions

None

22.4.4 Access Routine Semantics

None

23 MIS of StandingT Module

23.1 Module

Standing Record Module

23.2 Uses

- TeamT
- DivisionT
- SeasonT

23.3 Syntax

23.3.1 Exported Constants

None

23.3.2 Exported Access Programs

None

23.4 Semantics

23.4.1 State Variables

- Rankings
- DivisionID

23.4.2 Environment Variables

None

23.4.3 Assumptions

Standings are updated based on the outcome of games.

23.4.4 Access Routine Semantics

None

24 Appendix

Appendix — Reflection

The information in this section will be used to evaluate the team members on the graduate attribute of Problem Analysis and Design.

The purpose of reflection questions is to give you a chance to assess your own learning and that of your group as a whole, and to find ways to improve in the future. Reflection is an important part of the learning process. Reflection is also an essential component of a successful software development process.

Reflections are most interesting and useful when they're honest, even if the stories they tell are imperfect. You will be marked based on your depth of thought and analysis, and not based on the content of the reflections themselves. Thus, for full marks we encourage you to answer openly and honestly and to avoid simply writing "what you think the evaluator wants to hear."

Please answer the following questions. Some questions can be answered on the team level, but where appropriate, each team member should write their own response:

1. What went well while writing this deliverable?

   We understood the objectives of this design document quite well since we are more passionate about topics related to code writing processes, and the creation of each module includes brainstorming functions, variables, etc. Our capstone idea of a sports platform is straightforward, so many of the requirements were intuitive and discussed already with our supervisor, providing a solid foundation for our design decisions throughout this document. Thanks to the time we were given to write this document, we collaborated better compared to the previous documents. We had more meetings together as a group and discussed more through text messages, which kept everyone on track on what they were supposed to do.

2. What pain points did you experience during this deliverable, and how did you resolve them?

   Although we discussed and assigned work better, we struggled with overall cohesiveness as we worked on each module independently from one another. Hence, although one person worked on the announcements module which depends on the notifications module, they may have no idea what the notifications module contains. Since we did not schedule specific times to work on it, there was randomness in which each module was completed.

   Our solution to resolve this problem was to have several iterations of the design documentation, in which everyone took time to review modules, especially if they relied on other modules. This way, the necessary updates can be made continuously in case of new changes done to modules. There were also many merge conflicts due to these random completion times, as we were all making changes to the same document. We just had one person fix all the merge conflicts, and reviewed the final product to check if all the details were there and complete.

3. Which of your design decisions stemmed from speaking to your client(s) or a proxy (e.g. your peers, stakeholders, potential users)? For those that were not, why, and where did they come from?

   Most of our design decisions came directly from discussions with our supervisor (client), as this project was a pre-approved capstone. The rest of our design decisions came directly from our own user experiences with sports league platforms, as we were heavy users of platforms such as IMLeague for McMaster Intramurals. For example, the implementation for the game-scheduling algorithm came directly from our supervisor, as he wanted to keep the same algorithm that the league has always used.

   Similarly, we were asked to keep the user interface simple, emphasizing the importance of functionality over complexity for less tech-savvy users. Some architecture decisions, such as the backend database and choice of development framework were entirely decided based on the technical expertise of our team, which we also agreed were aligned with the industry's best practices for robustness and scalability.

4. While creating the design doc, what parts of your other documents (e.g. requirements, hazard analysis, etc), it any, needed to be changed, and why?

   Some sections of our requirements document needed to be tweaked to consider all the modules that we've created, as some of the modules were based on intuition and preference, such as wanting to use MongoDB for our database. Not all database programs function the same way, so these requirements will be a continuous process as we become more familiar with this particular database platform. We also talked with our supervisor since then to discuss new details that we've possibly missed in our requirements document.

   The hazard analysis also needed some additional revisions, as our design process may incorporate vulnerabilities related to user authentication or data security issues. We ran into a bunch of exceptions to consider when making the functionality of each module, which could potentially be a vulnerability that we forgot to add to our hazard analysis document. These changes are made to ensure that we have consistency throughout our project documentation as we continue to develop narrower goals.

5. What are the limitations of your solution? Put another way, given unlimited resources, what could you do to make the project better? (LO_ProbSolutions)

   Athletes love stats. Our current solution lacks advanced analytics and reporting features due to resource constraints, which would be the amount of time for us to figure that out. It also would not be feasible as officials would have to record data continuously on a sheet of paper, which is a flawed solution because of carelessness and lack of attention coming from our own experiences, such as intramural basketball. Also, it is an advanced feature that our client did not ask for as the main functionality is prioritized.

   Given unlimited resources, machine learning algorithms to analyze player and game data for performance insights, such as determining an MVP would be interesting. Other

improvements could be made to improve our project's scalability to accommodate new teams, but again, that would be extremely unnecessary given the scope of the project.

The limitations of our design itself lie within the fact that it is not necessarily scalable to a large number of users. Our designs were based on the assumption that the number of users would not be too large since there are only a handful of participants in the league as it is now, and so we assumed that the number of teams would be manageable. Our design also does not strictly track player payments, score submissions, and waivers, but only allows for a trust-based system that assumes that the users are honest about their reports.

6. Give a brief overview of other design solutions you considered. What are the benefits and tradeoffs of those other designs compared with the chosen design? From all the potential options, why did you select the documented design? (LO_Explores)

   When considering design solutions, the main discussion was between time versus control. We wanted to maintain autonomy while considering the time constraints of the project. Autonomy was a big deal because we want our client to be able to use the project independently long-term without needing to update libraries or troubleshoot issues with third-party providers. If one of our external libraries stopped updating its source, that could potentially lead to an issue that our client didn't ask for.

   For example, instead of using normal CSS, we chose to use Material UI as it is a library that is continuously up to date and won't be disappearing any time soon. By using this react component library, we save time and efficiency by not needing to reinvent the wheel every time we want to style a component. We wanted to create the other design solutions from scratch, such as the game scheduling algorithm, as that would be the best possible solution to prevent raised concerns about the long-term sustainability of the project.

   Other design solutions will be created with an open mind so that the platform can evolve according to specific league requirements. For example, we could choose to hard code the minimum or maximum number of players on the team, in case the client wants to easily change it in the future by replacing the value with another value. It is something that a new developer can easily understand and acknowledge, instead of needing to dive into reading documentation or in the worst case, the entire code base.

   In addition to these decisions, we carefully decomposed our system into distinct logical modules—such as the announcements module, scheduling module, team management module, and user authentication module. This modular approach allowed us to focus on solving specific problems in isolation, streamline the development process, and plan for long-term maintainability. Compared to a monolithic design or a microservices approach, our MVC-based modular decomposition struck the right balance between simplicity and flexibility, ensuring that each component could be updated independently without impacting the entire system. This design choice was driven by our goal to maintain autonomy for our client, allowing them to operate and extend the system independently over time.

24.1 Revision 1 Traceability

The following table tracks all significant changes made to the document based on feedback, requirements changes, and improvements:

Table 2: Traceability of Revision 1 Changes

Change ID	**Description of Change**	**Affected Section(s)**	**GitHub Issue**
REV1.1	Added incomplete section (was todo)	8 - MIS of PlayerT Module	Issue 511
REV1.2	cleaned up multi-character variables in math and cleaned up overflowing tables	All except first 5	Issue 511