OOA & UML

1 Submission Guidelines

- Individual submission.
- Use any free modelling tool to draw your diagrams (e.g.,https://online.visual-paradigm.com/)
- Upload your solutions on MS-Teams in PDF format.
- State clearly any assumption you find logical.

2 Problems

2.1 Problem 1

It is required to build a score recording system for tennis games. The tennis referee, as shown in Figure 1, uses a tablet to give the point either to player 1 or player 2 incase of single (or team 1 or team 2 in case of double) at the end of the ball exchange. The system keeps track of the score according to the tennis scoring rules, found in appendix I. After the end of each ball exchange, the system pops out a message concerning the score for the referee to speak out loud to the players and spectators. The message follows the rules explained in appendix I. The system keeps track of which player has the serve (i.e., starting the ball exchange). The tennis score board, illustrated in Figure 2, is connected to your system to display the results. Nowadays, the tennis score board is a small PC with a huge monitor. Other result consumers, such as TV sports channels (Figure 3), should be able to connect to your system and keep their displayed score in-sync (LIVE) with each score change done by the referee.

Astonishingly, ping pong, volleyball, and beach volleyball have similar scoring concepts, e.g., match, set, game, serving, etc. Yet, the devil hides in details. Each sport has its different rules for counting scores.

Now, it is desired to extend your score recording system to include these sports as well. At the beginning of the game, the referee chooses the desired sport (tennis, ping pong, volleyball, or beach volleyball) and the system loads the right set of scoring rules.

For the sake of simplicity, assume that your score recording system, the score board at the stadium and the results displayed on the TV are one virtual system. In other words, do not bother yourself about the physical communication between these systems. Consider these systems to be all running under one Java virtual machine.

Figure 1: Tennis referee using your system.

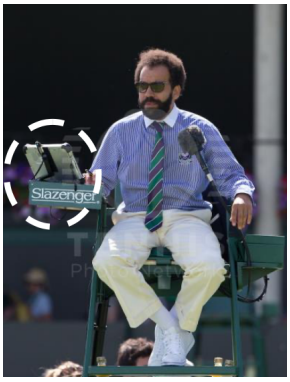

Figure 2: Tennis score board. Note the yellow dot indicating who is serving right now.

Figure 3: Results displayed on the sports channel. Note that it displays the same sort of data as in figure 2 but in different format.

2.1.1 Questions

1. Draw a simple use case diagram illustrating the interaction between the referee, your system, and the result displaying systems.

2. Draw a detailed UML class diagram.

3. Draw the state diagram for a normal game (not a tie breaker-game).

2.2 Problem 2

It is required to build our own version of the IMDb movie portal. IMDb (www.imdb.com) is the world's most popular source for movie and TV. The system stores information about movies and people working in the movie business. A movie can be a single movie (e.g., "gone with the wind"), a series (e.g., "James Bond"). TV-Shows can be a single documentary (e.g., "The Mysteries of the Pyramids") or a season (e.g. "Friends"); in which each season contains several episodes (e.g., "My first Christmas with my Friends"). Series have attributes; which are common to the whole series, such as one or more genres (i.e., types, "comedy", "thriller", etc.), a description, main actors, director(s), writer(s), etc. The single movie in a series can have its special attributes too; such as: publishing date, additional actors, special description, etc. The same applies to the episodes. For all persons in the database, and regardless of their roles, the system keeps their master information; such as name, birthdate, nationality, and place of birth. Note that a person can play several roles in a single movie. "Mel Gibson" was the director and main actor in "Braveheart".

A normal user is allowed to register him-/herself to the portal. Registered users are allowed to comment on movies. S/He can like or dislike a comment. Additionally, s/he can comment on a comment creating a thread of comments.

We want to have a single search textbox (similar to Google), in which the user can type any search term (e.g., "Smith"). The search should be forked into three separate searches: searching for the term in the movies, the persons, and the comments. The search results should be merged in one search result page having the hits from the movies first ("Mr. Mrs. Smith"), followed by the persons (e.g., the actor "Will Smith"), followed by the comments (e.g., "I would have preferred that Smith would marry Susy at the end of the movie").

Creating a movie can be done by any registered user. The creation screen is complex since all data must be filled out before the objects are created (e.g., descriptions, choosing genres, creating seasons and episodes in case of TV-shows, etc.). A newly created movie is not available at once. It is stays in the editorial area, where users with editorial rights can change the data and finally one of them approves the movie for publishing.

The site should send the user an email saying "Hi ¡username¿, you might consider watching this new movie ¡movieName¿" if a movie is published having the same genre as a movie on which he commented. The user has the option to stop these notifications.

The system administrator manages the master data such as the genres and the persons.

2.2.1 Questions

1. Draw a simple use case diagram illustrating the interaction between the normal users, editorial users, system administrator and your system.
2. Draw a detailed UML class diagram.
3. Draw the state diagram for a normal movie from creation till its publishing.

3 Appendices

3.1 Appendix I: Tennis scoring system (source Wikipedia)

A tennis match is composed of points, games, and sets. A match is won when a player or a doubles team wins the majority of prescribed sets. Traditionally, matches are either a best of three sets or best of five sets format. A set consists of a number of games (a minimum of six), which in turn consist of points, with a tiebreak played if the set is tied at six games per player. Tennis scoring rests on the premise that serving is advantageous over receiving, hence it is only possible to win a set or match by breaking the opponent's serve game at least once, before a tiebreak is required. Likewise, it is not possible to win a tiebreak without winning at least one point during an opponent's turn at serve (called a mini-break). Serving is moved to the opponent after each game.

Game score

A game consists of a sequence of points played with the same player serving, and is won by the first player to have won at least four points by two points or more over their opponent. In scoring an individual standard game of tennis, the server's score is always called first and the opponent's score second. Score calling is unique to the sport of tennis in that each point has a corresponding call that is different from its point value.

Number of points won	Corresponding call
0	"love"
1	"15"
2	"30"
3	"40"
4	"game"

When players are tied by one or two points, the score is described as "15-all" and "30-all" respectively. However, if each player has won three points, the score is described as "deuce". From this point on, whenever the score is tied, it is described as "deuce" regardless of how

many points have been played.

In standard play, scoring beyond a "deuce" score, in which both players have scored three points each, requires that one player must get two points ahead in order to win the game. This type of tennis scoring is known as "advantage scoring" (or "ads"). In this type of scoring, the player who wins the next point after deuce is said to have the advantage. If the player with advantage loses the next point, the score is again deuce, since the score is tied. If the player with the advantage wins the next point, that player has won the game, since the player now leads by two points. The referee announces the score in this format "advantage player 1".

The current point score is announced orally before each point by the referee. When stating the score, the server's score is stated first. If the referee announces the score as "30–love", for example, it means that the server has won two points and the receiver none.

The table below shows the scoring for tie breaks:

Tie break point score examples	**Corresponding call**
3-4	
4-3	
4-4, 5-5, 6-6, etc	
4-7	"set"

Set score

In tennis, a set consists of a sequence of games played with alternating serve and return roles. There are two types of set formats that require different types of scoring.

1. An advantage set is played until a player wins 6 games and that player or team has a 2-game lead over his opponent. The set continues, without tiebreak(er), until a player or team wins the set by 2 games. OR

2. A tie-break set is played with the same rules as the advantage set, except when the score is tied at 6–6, a tie-break game (or tiebreaker) is played. Typically, the tie-break game continues until one player wins seven points by a margin of two or more points.

The score of games within a set is counted in the ordinary manner, except when a player has a score of no games it is read as "love". The score is written using digits separated by a dash. This score is announced by the referee at the start of each game.

Tie break point score examples	**Corresponding call**
0-0	"love - love"
3-6	"set"

In doubles, service alternates between the teams. One player serves for an entire service game, with that player's partner serving for the entirety of the team's next service game. Players of the receiving team receive the serve on alternating points, with each player of the receiving team declaring which side of the court (deuce or ad side) they will receive serve on for the duration of the set.

Scoring a tiebreak game

At a score of 6–6, a set is often determined by one more game called a "twelve point tiebreaker". Only one more game is played to determine the winner of the set; the score of the set is always 7–6 (or 6–7). Points are counted using ordinary numbering. The set is decided by the player who wins at least seven points in the tiebreak but also has two points more than his opponent. For example, if the score is 6 points to 5 points and the player with 6 points wins the next point, he or she wins the tiebreak and the set. If the player with 5 points wins the point, the tiebreak continues and cannot be won on the next point, since no player will be two points better than his opponent.

Match score

Most singles matches consist of an odd number of sets, the match winner being the player who wins more than half of the sets. The match ends as soon as this winning condition is met. Men's singles and doubles matches may consist of up to five sets (the winner being the first to take the majority of total allocated sets) while women's singles matches are usually best of three sets.

The score of a complete match may be given the scores of each set given separately. The match winner's score is stated first. For example, Federer won by "6–4, 6–7, 6–4, 6–2)". This match was won three sets to one, with the match loser winning the second set on a tiebreaker.