Software Architecture and Engineering 2018
Project 1 (Part 1: UML Modeling Task)

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Your task is to design a system for managing a simplified version of the Olympic Games. The system consists of a *general part* (for all the Olympic sports) and *sport-specific parts*.

You will present your solution to this and the following project part in the exercise session in the last week of the first half of the course (9th–13th of April). The emphasis of this task is on *designing the data model* and *expressing it in UML*.

We intentionally made parts of the system description below ambiguous. It is your responsibility to clarify any ambiguities with the assistants (your "customers"). If you have questions for the customer, ask us during the project part of the exercise session or send an e-mail to sae-students@lists.inf.ethz.ch.

All the students who registered for the project have been signed up to this mailing list, so you can discuss the project with your colleagues. We will also use this mailing list to post announcements.

1 Olympic Games — General Part

In the Olympic Games there are a number of disciplines (e.g., biathlon or volleyball), each of which offers one or more events (e.g., the men's tournament and the women's tournament). Teams of one or more athletes (male or female) can participate in events. Each team represents a country; all athletes belonging to a team must be citizens of the country the team represents (but may be citizens of other countries as well).

Events consist of phases (e.g., finals, semifinals, etc.), and each phase contains at least one performance (e.g., a football match). Each such performance

is scheduled to take place at a specific location, and has a designated starting time and end time. Any location may only be used by a single performance at any given time. Performances also have a set of participating teams, and a score that determines the outcome.

One set of medals (gold, silver, or bronze) is handed out for every event. If there are no draws, an event results in one gold, one silver, and one bronze medals being handed out. Otherwise, when more teams have equal results, all of them get the same medal. If two runners, for example, finish the race in the same time and they are both on the first position, then they will both get a gold medal, and the runner after them will receive a bronze medal.

2 Sport-Specific Parts

The sport-specific parts *extend* the general part to model aspects of specific sports. *Each project team models* ***only*** *the sport it has been assigned to in addition to the general model, as described in Section 3.*

2.1 Figure Skating

In this part of the project, your task is to extend the general UML diagram for a simplified version of the Olympic sport Figure Skating.

At this year Winter Olympics, there are 4 events: Single Skating for Men and Women, Pairs Skating and Ice Dancing. The Single Skating competitions are individual events, while in Pairs Skating and Ice Dancing the athletes participate in pairs (each pair consisting of a woman and a man).

A country may have a maximum of 3 participants (individual athletes or pairs) for the figure skating discipline. They can participate in the same event or in different events. For example, a county may have 2 individual athletes in the Men's Single Skating event and a pair in Ice Dancing.

Each event has 2 phases: a short program and a free skating program. 22 participants (individual athletes or pairs) are initially registered to the short program of each event. The best 16 participants after the short program qualify to the free skating program.

The score for each performance consists of 2 components: a score for the technical part and a score for presentation. The technical score will be used to break a tie.

The athletes compete in the free skating program in the reverse order of their rankings from the short program (i.e., the athlete or pair with the best score after the short program will perform last in the free skating program).

The scores from the short program and the free skating program are summed up to determine the winners of the olympic medals.

2.2 Ice Hockey

In this part of the project, your task is to extend the general UML diagram for a simplified version of the Olympic sport Ice Hockey.

At this year Winter Olympics there are 2 events: the Men's Tournament and the Women's Tournament. A country may participate with at most one team in each event.

12 teams of 20 athletes are initially registered to each tournament, but at any time during a match, each team is allowed to have only 6 athletes on the ice.

The 12 teams are divided into 3 groups of 4 teams (named group A, group B and group C). During the preliminary round, each of the teams plays against every other team in its group.

Each group winner (A1, B1, C1) goes directly in the quarter-finals, along with the highest ranked of the remaining teams (R1). For simplicity, we consider that the number of points each team has is equal to the number of matches it won.

The remaining 8 teams form pairs (in arbitrary order) and play an eliminating qualification match to advance to the quarter-final round. Let T1, T2, T3, and T4 be the winners of the qualification matches. Then the following matches are played in the quarter-finals: A1×T1; B1×T2; C1×T3; R1×T4.

Each quarter-final winner advances to the semi-finals. The winners of the semi-finals play in the final round for the gold medal, while the losers play for the bronze.

Each match has a winner (i.e. it cannot end with a draw). You can assume that each group has a unique winner.

2.3 Ski Jumping

In this part of the project, your task is to extend the general UML diagram for a simplified version of the Olympic sport Ski Jumping.

The ski jumping discipline offers the events men's individual, women's individual, and men's team, where a team consists of four athletes. Each event has a qualifying phase, which consists of a single round, and a final phase, consisting of two rounds. In every event, out of the 50 participants (teams or individuals) in the qualifying phase, the best 40 make it into the final phase, plus ten that are pre-qualified. In the final phase, the best 30 in the first round make it into the second round. The overall winner is the team that gets the most points in both final rounds combined. Scores are ranked lists of the points each team got, which in turn consist of a distance and the number of points received from the judges. The sum of both numbers determines the ranking. For the teams contest, the points of all athletes in the team are summed up.

2.4 Taekwondo

In this part of the project, your task is to extend the general UML diagram for a simplified version of the Olympic discipline Taekwondo.

Consider four events within this discipline: men's heavyweight, men's featherweight, women's heavyweight, and women's featherweight. Each event is a single elimination tournament that starts with the quarterfinal round. Eight contestants representing different nations participate in each of the events.

The winners of the quarterfinal round progress to the semifinal round. The winners of the semifinal round (the finalists) progress to the final contest. The winner of the final contest gets the gold medal; the loser gets the silver medal. The bronze medals are awarded to the winners of the *repechage*.

The repechage is conducted separately between the contestants who have lost to the gold medalist and the contestants who have lost to the silver medalist. Overall, there are two contests in the repechage.

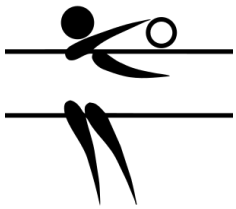
Each taekwondo contest results in one winner and one loser. There cannot be a tie.

2.5 Tennis

In this part of the project, your task is to extend the general UML diagram for a simplified version of the Olympic sport Tennis.

Tennis is a discipline with four events: Men's singles, women's singles and doubles, and mixed doubles. Each event has eight participating teams and therefore three phases, a quarterfinal, semifinal and a final phase. In each event, at most two teams may represent any given country. Participants who win a match in one phase progress to the next. In addition to the actual final's match, the finals also contains a tiebreaker match that decides third place. Since all matches are best-of-three, tennis scores consist of two or three set scores (only two if the same team wins the first two sets); a regular set has six games and must be won with a difference of two. At 6:5, a set can be won 7:5 or go to a tie breaker game at 6:6 and subsequently be won 7:6.

2.6 Volleyball



In this part of the project, your task is to extend the general UML diagram for a simplified version of the Olympic sport Volleyball.

Consider two events for this sport: the Men's Tournament and the Women's Tournament. The rules for both tournaments are the same.

12 teams representing different nations participate in this event, each team consisting of 6 athletes. The tournament is divided into four phases: the qualification round, the quarterfinal round, the semifinal round, and the final round.

During each phase, the pairs of teams compete in *matches*. Each match has exactly one winner.

In the qualification round, the 12 teams are divided into two *groups* (named group A and group B) of 6 teams. During this round, each team plays one match against all other teams in its group. As a result of the qualification round, the top four teams are determined (by the number of matches won) in group A and group B. Let us call these teams A1, A2, A3, A4 and B1, B2, B3, B4, respectively.

The four best teams from each group of the qualification round play quarterfinals. For the quarterfinals, the following matches are played: A1×B4; A2×B3; A3×B2; A4×B1.

Winners of quarterfinals play semifinals as follows:

$$(\text{A1}/\text{B4}) \times (\text{A3}/\text{B2});$$
$$(\text{A2}/\text{B3}) \times (\text{A4}/\text{B1}).$$

At the finals, winners of semifinals play for the gold, and losers for the bronze.

3 UML Model (30 points)

Create a UML class diagram of all the data structures from the general part of the Olympic Games. A developer should be able to implement your general model as a library and test it, to check if all the properties from the project description hold.

Then extend the general diagram for your specific sport. You are **not** allowed to change the general part, but you should rather extend it by *adding new classes* and *relations* and by *redefining the existing relations*. Use different colors to explicitly show which classes and relations are part of the general model and which ones are sport specific.

Include all the relevant relations and details in your UML diagram. It is **not** necessary to include methods, and your diagram should contain only the fields explicitly mentioned in the project description. In addition, document any detail that cannot be encoded in the UML class diagram. You may **not** use OCL specifications. Use the best design practices you have seen in the lectures.

4 Deliverables

Submit your solution by email to alexandra.bugariu@inf.ethz.ch. Each team should submit a single PDF file named **teamName_uml.pdf** that includes:

- The UML class diagram of the sport assigned to your team, which should be an extension of the model for the general part of the Olympic Games.
- A list of requirements from the project description that cannot be expressed in the UML model.

5 Resources

- Use Draw.IO for creating the UML diagrams: `https://www.draw.io/`. Start by copying the template file: `https://drive.google.com/file/d/1HDEtHF4cX0Zzrku3Hj1qD-sKsqWOYHkF/`. For your own diagram, please use the UML styles from this template. Export PNG renders of your diagram from Draw.IO.
- Use LaTeX, Microsoft Word, or Google Docs to create your project report (with the UML diagram, the list of requirements that cannot be expressed in UML, and additional explanations or comments). Export the report to PDF.