COS 221 Practical Assignment 5

- Date Issued: **4th May 2022**
- Date Due: **1st June 2022** before **11:00 (in the morning)**
- Submission Procedure: **Upload to ClickUP**
- Submission Format: **zip or tar + gzip/bzip2 archive**
- This assignment consists of **9 tasks** for a total of **270 marks**.
- There are **10 marks** assigned to group cohesion for this practical assignment.

1 Overview

This last practical assignment in COS221 serves to expose you to projects and activities that will be required of you in the second semester of your second year as well as on third year level, especially COS301. This project is a group based project which will require you to use all of your obtained knowledge in COS221 plus the effort of your group to complete this assignment. This assignment has minimal specifications as to allow you to implement all you have learnt, but also discover and showcase to the lecturers and yourself what you as a Computer Science student of the University of Pretoria is capable of delivering. For this assignment you are welcome to do and implement more than what is required, but not less. Where specifications might seem vague to yourself or your group, make the required decisions and assumptions, logging them in your uploaded PDF. This process is your first introduction of what will be required of you in your final year and industry as a University of Pretoria graduate.

2 Introduction

The International Press Telecommunications Council (IPTC), refer to `https://iptc.org` for more information, was established by a group of news organisations in the 1970s and currently consists out of 60 members including the BBC News (UK), Adobe Systems (USA), Austria Presse Agentur (Austria), Deutsche Presse-Agentur (Germany), Kuwait News Agency (Kuwait), Qatar News Agency (Qatar), Visual China Group (China) and various others. The IPTC's goal is to ensure and safeguard the telecommunications interests of the world's press. The activities of the IPTC lately focuses on developing and promoting industry standards for the exchange of news data of all common media types. Some of the standards that the IPTC developed, maintains and promotes include Photo Metadata ("The global standard to described pictures"), News Architecture ("A high-level model for the news ecosystem"), ninjs ("News in JSON - for APIs, mobile apps and more") and various other standards. For this practical assignment you will be making use of the SportsML ("Data model and format for sports") standard located here `https://iptc.org/standards/sportsml-g2/`.

The SportsML standard is an open, flexible standard for the interchange of sports data between various parties, which can include, organisations, systems and people. The SportsML standard can be used to represent all sports from Athletics to Zui Quan. The standard is currently being used by all major news organisations to cover sports such as the Olympics, Football World Cups on an international level to sports statistics on a local level, such as sporting events between schools.

The reasons that SportsML is used include the following:

- Avoid vendor lock-in by using an open and universal standard

- Anybody can contribute to the standard, including University of Pretoria students

- Simple, intuitive and consistent data model that is easy to adopt

- Represents standard report types

For this assignment you will be making use of the SportsDB that is provided by The Sports Standard Alliance to implement your practical assignment. A schematic representation of the SportsDB that you will make use of can be found at: `http://www.sportsdb.org/modules/sd/assets/downloads/sportsdb-29.jpg`. The current database dump provided by The Sports Standard Alliance only provides schema definitions for the sports of Baseball, American Football, Basketball, Ice Hockey, Tennis, Motor Racing and Soccer.

After successful completion of this assignment you should be able to:

- analyse and understand database exclusion from other sources;
- be able to execute a connection to an RDBMS from a programming language;
- query and manipulate a relational database from a programming language;
- build a Graphical User Interface (GUI);
- utilise the GUI to query and manipulate a relational database;
- be able to understand and interpret query execution plans; and
- optimise query execution plans.

3 Constraints

1. You must complete this assignment in groups of 5 - 7 students (no less and no more). Make sure you register your teams on the CS portal before 12:30 on 11 May 2022.
2. You may ask the Teaching Assistants for help but they will not be able to give you the solutions.
3. The PDF, database dump, source code, GUI and git history will be marked.
4. The GUI interfaces:
   (a) which run and perform what they are supposed to do get full marks
   (b) which run but do not perform as required, will receive partial marks
   (c) which do not run will be allocated partial marks based on the functionality they would have exhibited.
5. You need to use your MariaDB, MySQL Workbench, Composer and PHP to complete the practical assignment.
6. You may utilise any text editor or IDE, upon an OS of your choice.
7. You **ARE REQUIRED** to use git source code revision for this practical assignment.

4 Submission Instructions

You are required to upload a single archive that includes the following files:

- An archive containing your Composer and PHP project representing your GUI application.
- A pdf containing the answers to the tasks.
- A file or files containing the SQL statements from your database dump to:
  - create your database,
  - create the tables in your database, and
  - populate the tables with the data you populated the tables with.
- Your archive containing your `.git` folder
- A **readme.txt** file informing the marker what they should do to build and execute your application.

Upload your archive to ClickUP. No late submissions will be accepted, so make sure you upload in good time.

5 Online resources

The following resources will help with creating a Java Swing application.

- Git: `https://git-scm.com`
- GitHub: `https://github.com`
- PHP: `https://www.php.net`
- MariaDB: `https://mariadb.com`
- Composer: `https://getcomposer.org`
- IPTC: `https://iptc.org`
- The Sports Standard Alliance: `http://www.sportsstandards.org/ss`
- SportsDB: `http://www.sportsdb.org/sd`
- Getting Started with MariaDB at: `https://mariadb.com/get-started-with-mariadb/`
- To download MariaDB and access the documentation on your computer. Use the official MariaDB site – `https://www.mariadb.com/`
- There are many other resources online for example Stack overflow – `https://stackoverflow.com/` a platform for developers to learn, share knowledge and build career.

6 Rubric for marking

Research	**20**
General overview and explanation	4
Team or single sport explained	4
Actions	4
Location/Date/Time	4
Sport structure e.g. federation/regions/teams/players	4
(E)ER-diagram	**30**
Entities and Attributes	10
Complex and Derived Attributes	10
Relationships and Cardinality	10
Mapping	**30**
Regular Entity Types	3
Weak Entity Types	3
1:1 Relationships	3
1:N Relationships	3
M:N Relationships	3
Multivalued Attributes	3
N-ary Relationships	3
Specialisation and Generalisation	3
Unions	3
Correctness	3
Relational Exclusion	**35**
Visual	10
Primary, Secondary and Foreign keys	5
Constraints	5
Types and constraints (e.g. nullable, length) if applicable	5
Checks on applicable fields	5
Correctness	5
Web Management	**50**
Player Management	10
Sport Hierarchy Management	10
Media Management	10
Score Management	10
Statistics Query	10
Sample Data	**20**
Exaplaination	5
Script/Manual Data Entry	5
Data	10
Analyse and Optimise	**20**
Exaplanation	5
Optimisation	5
Interpretation	10
Development	**25**
Git usage	5
README	5
Overall quality and impression	15
Demo	**40**
Group Cohesion	**10**
Total	**280**

7 Assignment Instructions

Task 1: Research ....(20 marks)
You are required to select a new sport for which the SportsDB schema currently does not cater for, i.e. you are not allowed to select any of the following sports Baseball, American Football, Basketball, Ice Hockey, Tennis, Motor Racing and Soccer. You are then required to write up in your PDF an explanation of your chosen sport using the points given below as guidance. You can reference the existing sports schema to assist you ensuring you cover all required aspects for your sport of choice. You are free to choose your structure for the discussion. Your explanation should include an overview of how the sport works, how winners are determined, and any other relevant information. For a list of sports, you can reference the following Wikipedia page for inspiration: `https://en.wikipedia.org/wiki/List_of_sports`.

Make sure that your description of your chosen sport includes information about the following points below. For more guidance, be sure to use the developer site of the IPTC for the SportsML documents that can be found at: `http://dev.iptc.org/SportML-Getting-started`.

- Is it a team or single sport? This will be used to ensure that you cover the <team> and <team-metadata> tags for a team sport, or <player> tag for a single sport.

- Describe the various actions that can occur in your sport of choice. Here are examples of actions for some sports to assist you in defining your own actions:

  - Soccer: At what time interval was a kick to goal attempted by a player. Was the goal successful or not.

  - Cricket: Each ball bowled can be seen as an action, with various participants involved, and what occurred as a result of the ball being bowled, LBW, crease, caught etc.

  - Triathlon: For each participant, we may want to record the actions such as if there was a crash when cycling, or when a transition occurred between two different sports.

  - eSports (CS): The time when a take-over of a base was initiated and whether it was successful or not.

- Ensure to discuss the location and date-time metadata that is associated with your sports. For some sports the location might be a single location in one day or multiple locations over multiple days (think a single cricket match vs a 3 day tournament), or maybe multiple locations on a single day (e.g. triathlon), and whether the locations are physical or virtual (eSports such as CS, WoW, DOTA, etc.).

- Be sure to discuss the tournament structure around your sport.

Task 2: (E)ER-Diagram ....(30 marks)
After you have conducted your research in Task 1, you are now required to construct an (E)ER-diagram of your sport and provide the final model in your uploaded PDF. You are required to mention all assumptions you have made during your modelling and any other information you deem necessary. If you made multiple iterations to get to your final (E)ER-diagram, be sure to include all iterations, as well as notes as how each iteration improves on the previous.

Task 3: (E)ER-diagram to Relational Mapping ....(30 marks)
Using the steps for conversion from (E)ER-diagram to the Relational model as was discussed in detail in Lecture 14, provide a relational mapping of your (E)ER-diagram in your uploaded PDF. Be sure to indicate the conversion for each step, as well as the assumptions you have made and choice you have made if the conversion could provide multiple solutions.

Task 4: Relational Exclusion ....(35 marks)
Provide a designed relational database extension for all your relational mappings obtained in Task 3 in the form of both a visual diagram and SQL statements targeted towards MariaDB. Ensure that you include, where applicable, all of the following:

- Primary, Secondary and Foreign keys

- Constraints

- Types and constraints (e.g. nullable, length) if applicable

- Checks on applicable fields

Important to note, that your designed sport must make use of the existing SportsDB schema. Do not incorporate schemas in your design that are already present in SportsDB.

Task 5: Web Management . . . . (50 marks)
In COS216 you have learnt how to create a web application using PHP, HTML5, CSS and JavaScript. For this Task you are required to implement a web application to manage and query your sport of choice. Your web application must at a minimum be able to:

- Login and manage users

- Manage organisations, teams, and players for your sport

- Manage sites, addresses and locations of where your sports will be played

- Capture scores for a tournament, event, player etc.

- Upload media for a tournament, event, player etc.

- Produce statistics for a tournament, event, player etc.

Task 6: Sample Data . . . . (20 marks)
You are required to populate your database with a sample of at least 5 tournaments/events with a minimum of 5 teams or 10 players in each tournament/event. You are free to decide how to capture the information, whether that is by hand, a sample PHP script that creates artificial data, a PHP script that parses an API or loading the data with XML files from some website/feed/API. You are however required to explain your choice of method and reason in your uploaded PDF file.

Task 7: Analyse and Optimise . . . . (20 marks)
You are required to make use of the MariaDB database and tools to analyse **three** of your query execution plans and report on the performance to execute said queries in your uploaded PDF. Thereafter you are required to explain how you would optimise your query in your PDF, implement your proposed optimisation and report on the performance gains/losses achieved. You are also required to explain why you believe the gain/loss in performance was observed.

Hint: Ensure that you have sufficient data in your database, else you might not observe the gain/loss.

Task 8: Development . . . . (25 marks)
Your project will be assessed, not only on the functionality it provides, but also on your overall development practices such as:

- Usage of git

- Data validation

- Usage of a package manager

- Ease of understanding, spelling and grammar and structure in your code, git commit messages, uploaded PDF, README etc.

- Quality of overall delivered solution

Task 9: Demo . . . . (40 marks)
Your team will be required to demo your solution to the lectures of COS221 on the **1st of June 2022**. Booking slots will be opened closer to the time. Note, that all teams members are required to be present for the demo to receive marks. In addition each team member is to explain in the uploaded PDF all their contributions to the project.

IMPORTANT NOTE(S):
- Please refer to the rubric for the detailed allocation of marks.

- Plan your study time and start well in advance with this practical.