



University of Cape Town

Department of Information Systems

INF4001N – 2023

Entrance Exam Full-time Honours 2023

Instructions to Candidates

For the purpose of the Entrance Exam, you are tasked to deliver a first iteration of a race event management system for the Pedal Power Association.

Submission date/time: Friday, 9th December 2022 @ 23:55

1. Please submit a zipped folder with your system. This should include a ReadMe document with instruction of how to get access to the code for evaluation purposes.
2. Please submit your online database separately with a username and password that we can use to access the database (see the requirements section of this paper, pages 6 and 7). You could use a SQL Database or a NoSQL Database.

Please read the case study below and the tasks that we want you to complete for this application very carefully. It is important to first understand the context of the case study and then focus on the tasks that are described under the requirements for the first delivery of the system (pages 6 and 7).

CASE STUDY – Pedal Power Association (PPA)

(Most of the information below is obtained from the PPA website:

<http://www.pedalpower.co.za/>; Those sections marked in Italics were taken from the website unchanged)

Background

Founded in 1976, the PPA is a Public Benefit Organisation committed to promoting cycling and the interests of cyclists. Recreational cycling (on- and off-road), development through cycling, safe cycling and advocacy are among the PPA's priorities.

The Pedal Power Association (PPA) is the largest cycling organisation in South Africa. It currently has some 13 000 paid-up members, spread all over the country, although the largest component is in the Western Cape, where the Association has its headquarters. The Pedal Power Association came into being as a result of the running of the first Cycle Tour that was to develop into the now world famous Cape Town Cycle Tour (previously the 'Cape Argus Pick 'n Pay Cycle Tour').

The main purpose and object of the Association is to promote cycling and the interests of cyclists. The Association has the following ancillary objectives:

- To be a representative body for the furtherance of the interests of cyclists.*
- To promote cycling as a recreational activity, a sport and as a means of transportation.*
- To improve conditions for cyclists with particular regard to their safety.*
- To arrange and organise cycle tours, fun rides and outings.*
- To co-ordinate cycle tours, fun rides and outings organised by other bodies and to assist them in their efforts.*
- To establish contact and liaison with and where appropriate affiliate with other organisations having similar interests and objectives.*

An elected committee of 12 persons, who meet once per month, governs the Association. The PPA Office is staffed by fourteen employees, who administer the day-to-day running of the Association and its members, provide guidance to event organisers on the extensive PPA funride calendar, organise the PPA-own events, and run the various PPA campaigns like the COOL KID ON A BIKE, SAFE CYCLING and Bike4All campaigns.

Events on the PPA calendar are split between (a) events owned and organised by the Association (including the One Tonner, Tietoria Elgin Valley MTB, Maluti Double90, The MTB Challenge, Medihelp Stellenbosch Cycle Tour, Tour de PPA, Mangaung Cycle Tour and various social rides and tours), and (b) events that are owned and organised by various service organisations and clubs as fundraisers for a charitable or cycling-related cause.

Amongst others, the Association provides the 'external' organisers with guidance in the form of a reference manual and logistical guidance, hands-on assistance before and at the event, and more.

The PPA expends considerable effort in the field of development of the sport in the poorer, previously disadvantaged areas and supports several clubs and cycling projects in this regard.

In 2011 the Association embarked on a robust national SAFE CYCLING campaign, raising awareness around the vulnerability of cyclists on the road; the need for mutual respect and awareness amongst road users, and making motorists aware of the need to pass cyclists with 1m or more (the STAY WIDER OF THE RIDER campaign).

The Association's income stems from membership fees and from a share in the profit of the Cape Town Cycle Tour. Income from membership fees are used to run the Association.

The Association's headquarters are found in property in Mowbray owned by the Association in Cape Town. Additionally, a satellite service is provided at each of the weekend events where staff is on hand to deal with membership and related queries.

From the above excerpt it is apparent that PPA, in addition to maintaining its member base, is also involved in several projects, campaigns and events. ***For the purpose of this entrance exam the focus will only be on managing the members and the events.***

PPA Members

The Pedal Power Association recognised the impact that COVID-19 has had on budgets of current and potential members. They are also looking to attract many new cyclists and hence decided to have a special under-18 membership for only R50; a family membership of R300 and R200 per person for an individual membership for the 2022/2023 membership year. This membership will run until 30 June 2023.

This membership is critical for them to be able to support cycling and the interests of cyclists. These contributions help fund their activities, as well as giving PPA credibility as an organisation representing thousands of cyclists.

Amongst others, a member will have the following benefits:

- Discounted entries to all PPA own events (once events resume)
- A free annual seeded funride number (road)
- A guaranteed entry to the 2023 Cape Town Cycle Tour with preferential entry time
- Newsletters to stay up to date with events and the world of cycling
- Preferential seeding at funrides
- Several discounts and membership benefits from our external partners, as listed on their website which will be updated regularly!

PPA Events

PPA coordinates several events throughout the year and they also assist other bodies in their organisation with similar events. The events included in the yearly calendar of PPA are funrides, mountain bike rides (MTB-rides), Social rides, and PPA league events for the more competitive cyclists.

PPA's main function is to facilitate the organisation of funrides that usually take place on the weekends. PPA members, as well as non-members, attend these funrides. These funrides are organised by various organisations, but are facilitated by PPA. PPA ensures that traffic permissions for each and every funride are granted, that officers are present on the day to man intersections and follow the race that PPA marshals are present to co-ordinate the start of the funride and provide the infrastructure needed for the funride to run smoothly.

A company called RaceTec, the same company that is responsible for the timing of the Cape Town Cycle Tour, times PPA funrides. Each PPA member in possession of a timing chip will receive a time for each funride he/she rides. Timing chips are provided by RaceTec. These times are then uploaded to a results database which resides with a provider and members can look up their ride results on the PPA website.

Members of the Association are entitled to reduced funride entry fees (including the Cape Town Cycle Tour). A members also receive a seeded cloth number based on their funride times, which they wear on their backs during all funrides. These seeded numbers run from A-Z and a member will be placed in one of these groups depending on ability, "A" being the fastest riders and so on. At the funrides members line up in their categories (groups) and leave at 1 min intervals from A-Z. Non-members leave right at the back. Members also receive a calendar of events and funride information throughout the year.

Members can update their memberships from the PPA website. They enter and pay for funrides online. Once they paid for the fun ride, the member will receive a sticker via email to put on their helmet indicating that they have paid. Buying PPA merchandise online is out of scope for this exam.

Broad PPA System Requirements (Final System)

As a service organisation PPA is committed to keep their systems current, providing PPA members with up to date member information and details of the events on their yearly calendar.

The immediate need is a system that will ensure that member and event information will be communicated effectively and that will allow members and PPA to interact with the system. You are tasked to design a system for PPA that comprises a member management sub-system and an event management sub-system. These sub-systems should integrate seamlessly with one another and with an online database.

Member Management

Licensed riders (**Members**) need to have a member number (ID), FirstName, Surname, email, MemberType (see categories below), a chip number (as the company RaceTec will link the member's race time with the chip number) and also the member's average race time per km. This will be used for seeding purposes. You can add other attributes for a member that you might need in your system. Each member will have a **Subscription**. A subscription will indicate the type of subscription a member has, date joined and whether it is paid or not. In the case of a family subscription the main member needs to be indicated.

Members can take part in PPA league events in different categories depending on their age (elites; sub veterans; veterans; masters; junior scholars; senior scholars and ladies). League events have specific rules and riders also receive prizes after each race.

Members need to be able to register on the system, with the default subscription status being non-paid up. A paid-up member can register for any event (race entry). A **RaceEntry** is linked to a member. A member can view /her race entry, but is not able to edit it. An administrator is able to edit the race entries.

PPA Administrators need to be able to edit members subscriptions to indicate if they are paid-up. (In future this will be automated by linking to a SnapScan system).

Event Management

Most events have some common attributes. Every **Event** has a code, name, an event date, a start venue, a route description, distance and an event format. Some events are seeding events and some are not. In addition to these attributes an event will have a winning time, adjusted winning time and **a collection of participants (race entries)**, once it is completed. A participant (race entry) is linked to a member and records the race number and a time for the particular race. A participant can also be a non-member that receives a temporary number as well as a time (***for this activity we will not include non-members, but the code should allow for this at a later stage***).

Licensed riders take part in **PPA league events** in different categories (elites; sub veterans; veterans; masters; junior scholars; senior scholars and ladies). League events have specific rules and riders also receive prizes after each race. ***For the purpose of this exercise we will just consider funrides. However, your system should also allow that this can be extended to include the other types of events.***

Cyclists participating in **funrides** need to comply with specific rules regarding organisers (marshals and others); fellow cyclists, road traffic regulations and personal safety guidelines. All funrides are seeding events and riders are grouped. Every seeded event has a specific race count, used in seeding calculations. Each funride has a PPA coordinator and a grant organisation that uses the proceeds of the ride for charitable or cycling-related cause. Each funride has an entry fee and provides some discount for PPA members. The race number of the rider will indicate in which group he/she starts.

All road events on the PPA calendar, excluding the Cycle Tour and Cycle Tour seeding series use PPA seeded numbers. All PPA road and MTB events are taken in consideration for reseeding. A cyclist would need results from three long routes, or more results if they have only done the short or medium routes. Upcountry events are excluded from PPA seeding, except the Cycle Tour seeding series events, where the long route is used for seeding. Seeding numbers can change from one season to the next. In some cases the seeding index may change for all groups, with the "front groups" becoming substantially smaller. This might mean that a cyclist can drop down one or more groups despite the fact that his/her overall time has improved. He/she will however still be riding with people of the same ability.

Seeding Management (Seeding algorithm)

To simplify the seeding for this first iteration we can assume that there will only be three groups for each race. Group A will be the top group; Group B, the middle group and then Group C. As the numbers grow the number of groups can be increased. Members will be seeded according their average times for previous races. From the best to the worst time per kilometer (km). The top third participants will be in Group A; the next third participants in Group B , then group C.

System Requirements

For the purpose of the first delivery (first iteration) of the system, we simplified some of the processes for you to be able to deliver the system within the given timeframe. *Please also note that, although you can already make provision for payments to happen at a later stage (by including some variables), you do not have to add any payment processes for this iteration.* **Please use the guidelines given below to create the first iteration of the PPA event Management System.** Create a system that will have the following objectives:

Members and Administrators (for now one admin will suffice)

1. Your system should allow user two roles – admin and members (Both member and a PPA admin will inherit from this user role)
2. Your system should allow a **member** to join/register – create a profile and a subscription. This would involve completing a form with personal details. PPA should be able to determine in which category a member full participate in (veterans, masters, etc.). A PPA membership must be renewed on an annual basis and the system should send out a notification to a specific member as a reminder a month before the expiry date. For this iteration a subscription will only comprise an individual membership. Although, the subscription class can make provision for payment to be added. Payment will be excluded for now.
3. A **member** should be able to see their profile and can edit their profile.
4. A **member** should be able to generate a member card that will include the member's ID, name and surname as well as the emergency contact person and the contact number of that person.
5. A **member** should be able to view all the events (races) that they participated in as well as the results of these races. For now we will only focus on Funrides.
6. A **member** should also be able to see the upcoming events.
7. A **member** should be able to view all their own results.
8. A user in an admin role should be able to list all members or search for a specific member.

Events

1. An admin should be able to add an **event**. For this system you should have an Event base class. For the coding activity you will only have one type of an event i.e. a funride (MTB rides, social rides and a league events like the Cape Town Cycle Tour are out of scope).
2. An Admin should be able to list all events or filter and search for one or more events.

Entries

1. A member should be able to enter for a particular race online (**RaceEntry**). An Admin would also be allowed to enter one or more members for a race.
2. For the first iteration an admin will close an event to accept no more entries. Once this is done the seeding process will be activated. Each participant will

receive a race number. The race number will indicate in which group the participant will start, using A, B or C followed by a three digit number.

3. A member should be able to list all the entries for a race that he/she participated in, after the race (event) has been completed. A member should be able to list all their own race entries over a specific period of time (also listed under the member management).
4. Once the race is completed, an admin should start an automated process that will generate race times for each participant. You can be innovative and use some algorithm. This process must update the race entry of each participant, with that participant's race time. The process must also update the average race time for each participant. This will ensure that the next time the seeding process is run, the correct average race time will be used for each participant.

Database

For the purpose of this exercise you have to use an online database for us to be able to view the data. The database tables must be populated with a good selection of relevant data. You must at least have 30 members added to your database Members table and 5 to 10 race events. For the submission you have to submit the database separately and provide us with login details, to give us access to the database.

SQL: <https://somee.com> /or <https://www.phpmyadmin.net/>

nosql: (Firebase)

<https://firebase.google.com/docs/firestore> or
Mongo DB: <https://www.mongodb.com>

Assessment :

It is important that your system should demonstrate good coding principals. Evidence of advanced concepts and the implementation of Object Oriented features (for example: encapsulation, composition of classes and objects as well as the interdependencies of object and modules) are of great important. **Please provide an analysis class diagram to depict the structure of the system and the entities that will play an important role.**

Attention much be given to scalability and maintainability of code.

Should you be successful with your submission, you will invited for a 15 minutes online presentation of your system, where we will consider the following:

- Functionality
- User Interface
- Ease of navigation
- Evidence of effort
- Sophistication, complexity
- Consistency
- Quality, attention to detail
- Controls and security
- Evidence of Ingenuity