

WIT ICT Skills:

*Higher Diploma Computer Science*

Continuous Assessment:

*Databases 2016 | Bodyweight Fitness (BWF) Database  
(Application Express Workspace: IE\_A176\_SQL01\_S14)*

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### 3) Project Introduction

Bodyweight Fitness (BWF) is an online site that offers a variety of health and fitness services to its users, which are mainly tracking-related at present. For example, BWF allows users to record and monitor the details of their exercise workout sessions, their day-to-day dietary food intake, and their various body measurements with which to track their progress.

BWF presently stores its sites user data in a manner no longer fit for purpose, and their desire is to implement a relational database solution with which to house their data in an effective and efficient way that that will support the businesses present needs and future growth.

The following sections will focus on detailing the facets and characteristics of the business through various conceptual modelling tools resulting in a set of table mappings that will serve as the blueprint for the implementation and creation of the database through SQL.

Specifically, the following sections will outline:

- a more detailed description of the business
- an Enhanced Entity Relationship (EER) model drawn from that business description
- database tables that meet normalisation standards
- table mapping descriptions for each database table
- frequently used queries by database users
- the various users the database will need to cater to and the respective database privileges required

## 4) Business Overview

### 4.1 Description of Business

Bodyweight Fitness (BWF) is an online site that allows users to monitor various health and fitness-related activities, such as workouts or dietary intake. Users track the activities they would like, or none at all, and choose to start or stop tracking activities at any point they wish.

Currently, BWF stores data on its users, the workouts they record, the daily dietary intake users record, and the various body measurements users keep to monitor progress. BWF would like to maintain all this data efficiently and also in a manner which will scale well as the site grows.

In becoming a user of the site, a person will choose a unique username and a password. They will also provide their email address, date of birth, gender and height, which are mandatory, and optionally their name, country and current weight.

If a user chooses to record one of their workouts, they're asked for the date and time of the workout, and the exercises performed during that workout. All exercises are either cardio-based, or a form of resistance training.

Cardio users track the time of their cardio exercise, and optionally either intensity or distance also, but always one or the other and also optionally a note too.

Site users who track resistance workouts are instead concerned with sets of exercises. Each user performs one or more sets of their chosen exercises, with each set always having a number of repetitions and optionally a weight. Some users also optionally record the intensity of their sets, and like cardio users may also attach a note to each set.

Aside from tracking workouts, users also use the site to track their dietary intake. They do this through recording the meals they eat, each of which must have a date and time, a meal name, and the items of food eaten in that meal. Each item of food contains the name of the food item, its overall calorie content, as well as its protein content, carbohydrate content and amount of fat in the food item.

Lastly, many users use the site to track their progress by monitoring various body measurements. At present BWF allows its users record their bodyweight or body fat percentage, or both, along with the date the measurement was taken.

In summary, BWF is an online site which allows its users to record the details of their workout sessions, dietary intake, and their progress.

## 4.2 Benefits of implementing a DB for the business

The benefits of implementing a relational database system for BWF are manifold. Prime amongst them is the need for a data storage solution that is efficient and scaleable, as the business has active plans to increase both its user base and the range of services it offers to users.

At present, the business stores its data in an inefficiently designed database with a lot of redundancy. With planned growth and low tolerance of any lag time or errors by users, data retrieval and data consistency are key concerns for BWF, and a well-designed RDMS has been identified as the preferred solution.

Another key dimension for BWF is user access. At any given time, any number of users will be simultaneously retrieving, adding and updating data to the database, and it's important any implementation will facilitate this in an efficient manner without any data integrity issues.

Other benefits of opting for an RDMS system for the business include privilege control features to allow the business to securely differentiate between different user needs from the database. In addition, the network access capabilities of a relational database suit the business perfectly, with users able to access and manipulate their user data online through the site interface or the web app.

Lastly, the built-in and automated maintenance features to test, repair and backup the database are quite welcome, in addition to the ability to use SQL to manage, query and edit the database.

### 4.3 Entities and Relationships

From the business description of BWF, a number of entities representing the key functions of the business were identified. These entities comprised users, workouts, exercises, body goals, meals, food items, dietary goals, and body measurements.

In addition to the above, exercises was recognised as an entity with two sub-types, cardio and resistance exercises. For the purposes directly below (in the ERDish), cardio and resistance exercises have not been considered, as any relationship between them and other entities is the same as the relationship other entities will have with the exercise entity.

To help model the above relationships they have been described using ERDish below:

- Each USER may perform one or more WORKOUTs
- Each WORKOUT must be performed by one USER
- Each WORKOUT must include one or more EXERCISEs
- Each EXERCISE must be part of one WORKOUT

- Each USER must have one LOGIN
- Each LOGIN must belong to one USER

- Each USER may maintain one set of DIET\_GOALs
- Each DIET\_GOAL must be the target of one USER

- Each USER may record one or more MEALs
- Each MEAL must be eaten by one USER
- Each MEAL must contain one or more FOOD\_ITEMs
- Each FOOD\_ITEM must be part of one MEAL

- Each USER may target one set of BODY\_GOALs
- Each BODY\_GOAL must be the target of one USER

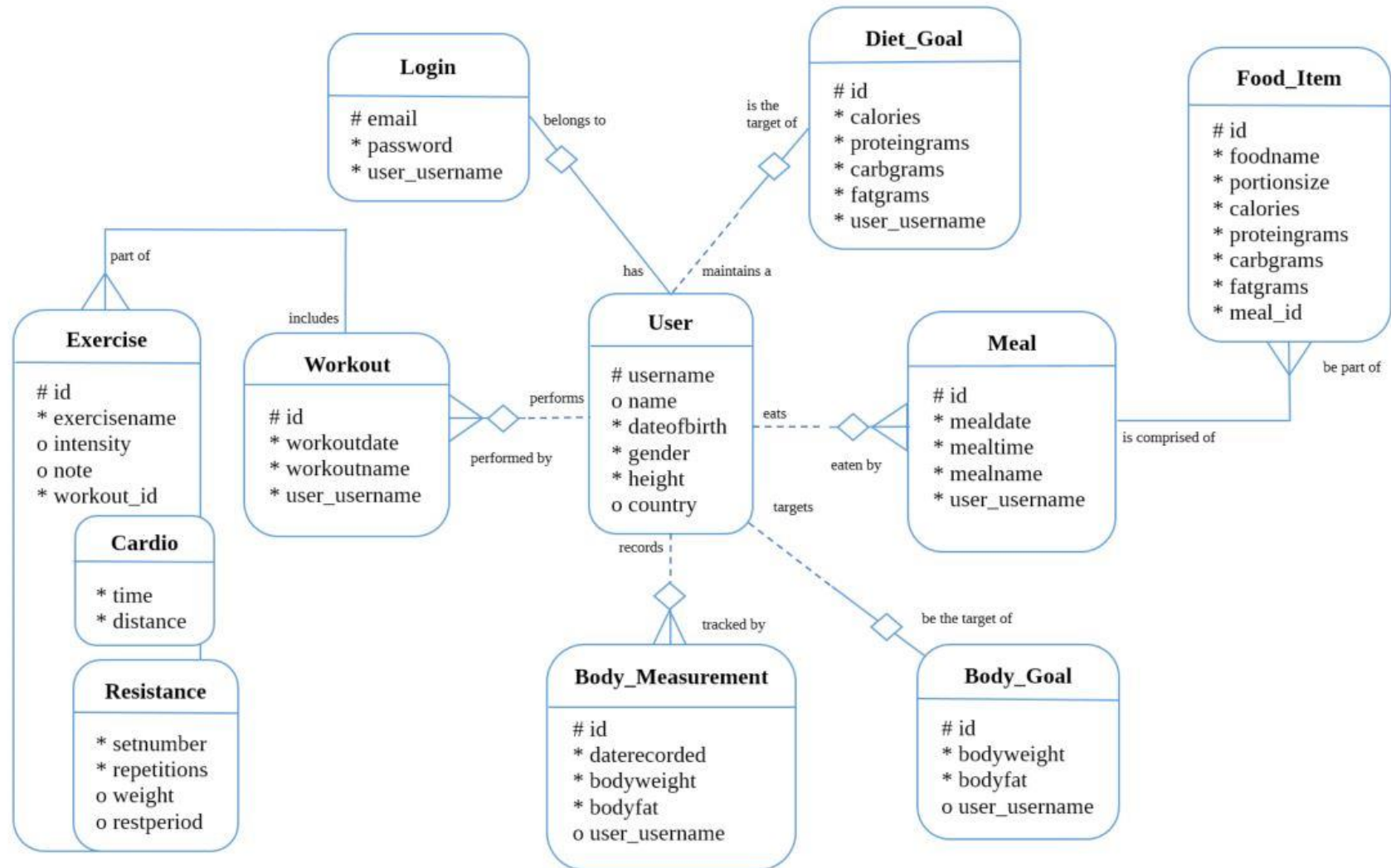
- Each USER may record one or more MEASUREMENT\_RECORDs
- Each BODY\_MEASUREMENT must be tracked by one USER

#### 4.4 Structural and procedural rules requiring programming

The operating practices of the business have tried to be modelled as closely as possible with the various tools available with our RDMS, however some facets of the business will be unable to be reflected via these tools and mechanisms and thus will require bespoke programming to enforce.

At present the main item that has been identified as requiring such programming is the encryption required around the storage of each user's login details.

## 5) Enhanced Entity Relationship (EER) Model of proposed RDMS solution





## 6) Normalised Tables

USER (USR)

<b><i>Username</i></b>	<b><i>Name</i></b>	<b><i>DateOfBirth</i></b>	<b><i>Gender</i></b>	<b><i>Height</i></b>	<b><i>Country</i></b>
smck	stella	01-01-1994	female	170	Ireland
jjo	john	01-01-1983	male	185	Ireland
arido	ari	01-01-1991	female	155	Ireland
mfoy	mike	01-01-1987	male	180	Ireland
grig	greg	01-01-1983	male	172	Ireland
dmo	damien	01-01-1979	male	175	Ireland

LOGIN (LGN)

<b><i>Email</i></b>	<b><i>Password</i></b>	<b><i>User_Username</i></b>
<a href="mailto:stella@mckay.com">stella@mckay.com</a>	passw	smck
<a href="mailto:john@talljohn.com">john@talljohn.com</a>	asswo	jjo
<a href="mailto:ari@downey.com">ari@downey.com</a>	sswor	arido
<a href="mailto:mike@foy.com">mike@foy.com</a>	sword	mfoy
<a href="mailto:greg@obv.com">greg@obv.com</a>	wordp	grig
<a href="mailto:damien@murphy.com">damien@murphy.com</a>	ordpa	dmo

MEAL (MLS)

<b><i>Id</i></b>	<b><i>MealDate</i></b>	<b><i>MealTime</i></b>	<b><i>MealName</i></b>	<b><i>User_Username</i></b>
1	18/Mar/2016	13.15	Lunch	mfoy
2	23/Mar/2016	18.00	Dinner	smck
3	23/Mar/2016	16.00	Snack	arido
4	23/Mar/2016	19.30	Supper	arido
5	24/Mar/2016	13.45	Lunch	dmo
6	24/Mar/2016	16.20	Snack	dmo

FOOD\_ITEM (FDS)

<b><i>Id</i></b>	<b><i>FoodName</i></b>	<b><i>PortionSize</i></b>	<b><i>Calories</i></b>	<b><i>ProteinGrams</i></b>	<b><i>CarbohydrateGrams</i></b>	<b><i>FatGrams</i></b>	<b><i>Mls_Id</i></b>
1	Bolognese Sauce	1.5 cups	325	40	15	12	1
2	Pasta	50g	350	9	35	19	1
3	Green Salad	2 cups	70	4	12	1	2
4	Pork Chop	2, fried	325	40	5	16	2
5	Baby Potatoes	1 cup	250	11	40	5	2
6	Apple	1 large	100	3	20	1	3
7	Sweet Potato	1 large	275	13	45	5	4
8	Salmon	1 medium fillet	225	35	0	9	4
9	Chicken Curry	1.5 cups	325	30	40	5	5
10	Rice	1 cup	350	12	55	9	5
11	Banana	1 large	130	5	25	1	6

DIETARY\_GOAL (DGL)

<b><i>Id</i></b>	<b><i>Calories</i></b>	<b><i>Protein</i></b>	<b><i>Carbohydrate</i></b>	<b><i>Fat</i></b>	<b><i>User_Username</i></b>
1	1800	80	258	50	smck
2	2600	120	373	70	jjo
3	1800	85	253	50	arido
4	2650	130	364	75	mfoy
5	2550	120	360	70	grig
6	2700	140	366	75	dmo

# WORKOUT (WKT)

<b><i>Id</i></b>	<b><i>WorkoutDate</i></b>	<b><i>WorkoutName</i></b>	<b><i>User_Username</i></b>
1	19/Mar/2016	Bodyweight routine	dmo
2	20/Mar/2016	Run	smck
3	21/Mar/2016	Spin class	mfoy
4	23/Mar/2016	Olympic lifting	arido
5	23/Mar/2016	Swim	grig
6	24/Mar/2016	Yoga	dmo
7	24/Mar/2016	Walk	arido
8	24/Mar/2016	Run	smck

# CARDIO\_EXERCISE (CEX)

<b><i>Id</i></b>	<b><i>ExerciseName</i></b>	<b><i>Time</i></b>	<b><i>Distance</i></b>	<b><i>Intensity</i></b>	<b><i>Note</i></b>	<b><i>Wkt_Id</i></b>
1	Running	0.30	4	6		2
2	Spinning	0.50		8.5		3
3	Swimming	0.45		7		5
4	Yoga	1.00				6
5	Walking	0.50	2.5			7
6	Running	0.35				8

#### RESISTANCE\_EXERCISE (REX)

<b><i>Id</i></b>	<b><i>ExerciseName</i></b>	<b><i>SetNumber</i></b>	<b><i>Repetitions</i></b>	<b><i>Weight</i></b>	<b><i>RestPeriod</i></b>	<b><i>Intensity</i></b>	<b><i>Note</i></b>	<b><i>Wkt_Id</i></b>
1	Squat	1	12		1.30	7		1
2	Squat	2	12		1.30	7.5		1
3	Pushups	1	10		1.30	7		1
4	Pushups	2	10		1.30	8		1
5	Rows	1	15		1.30	8		1
6	Rows	2	15		1.30	8.5		1
7	Bench Press	1	5	60	3.00	6		4
8	Bench Press	2	3	70	3.00	7		4
9	Bench Press	3	1	80	3.00	8		4
10	Deadlift	1	5	75	3.00	6.5		4
11	Deadlift	2	3	85	3.00	7.5		4
12	Deadlift	3	1	95	3.00	9		4

#### BODY\_MEASUREMENTS

<b><i>Id</i></b>	<b><i>Date</i></b>	<b><i>Bodyweight</i></b>	<b><i>Bodyfat</i></b>	<b><i>User_Username</i></b>
1	12/Jan/2016	81		dmo
2	15/Jan/2016		12	jjo
3	18/Feb/2016	80		dmo
4	01/Mar/2016	73		grig
5	24/Mar/2016	79		dmo

#### BODY\_GOALS

<b><i>Id</i></b>	<b><i>Bodyweight</i></b>	<b><i>Bodyfat</i></b>	<b><i>User_Username</i></b>
1	75		dmo
2		10.5	jjo
3	71		grig
4		15	arido

## 7) Table mapping

USER (USR)

<b>Field</b>	<b>Type</b>	<b>Size</b>	<b>Null/ Not Null</b>	<b>Default</b>	<b>Constraints</b>	<b>Index</b>	<b>Description</b>
Username	VARCHAR2	20	Not NULL		Unique	PK	Site username for person
Name	VARCHAR2	20					Persons real name
DateOfBirth	DATE	-	Not NULL				Persons date of birth
Gender	VARCHAR2	6	Not NULL				Gender of user
Height	VARCHAR2	3	Not NULL		Must not be greater than 300cm		Physical height of user in cm
Country	VARCHAR2	30					Persons identified country

LOGIN (LGN)

<b>Field</b>	<b>Type</b>	<b>Size</b>	<b>Null/ Not Null</b>	<b>Default</b>	<b>Constraints</b>	<b>Index</b>	<b>Description</b>
Email	VAR-CHAR2	40	Not NULL		Unique	PK	User email address
Password	VAR-CHAR2	20	Not NULL				User site password
User_Username	VAR-CHAR2	20	Not NULL		Unique	FK	Username from USER table

MEAL (MLS)

<b>Field</b>	<b>Type</b>	<b>Size</b>	<b>Null/ Not Null</b>	<b>Default</b>	<b>Constraints</b>	<b>Index</b>	<b>Description</b>
Id	NUMBER	-	Not NULL			PK	auto-generated table id
MealDate	DATE	-	Not NULL				date of meal eaten
MealTime	NUMBER	4, 2	Not NULL				time of meal eaten
MealName	VAR-CHAR2	20	Not NULL				name of meal
User_Username	VAR-CHAR2	20	Not NULL			FK	Username from USER table

FOOD\_ITEM (FDS)

<b>Field</b>	<b>Type</b>	<b>Size</b>	<b>Null/ Not Null</b>	<b>Default</b>	<b>Constraints</b>	<b>Index</b>	<b>Description</b>
Id	NUMBER	-	Not NULL		Unique	PK	auto-generated table id
FoodName	VAR-CHAR2	20	Not NULL				food name
PortionSize	VAR-CHAR2	15	Not NULL				portion size of food
Calories	NUMBER	4	Not NULL				total calories in food item
Protein	NUMBER	3	Not NULL				protein content of food
Carbohydrate	NUMBER	3	Not NULL				carbohydrate content of food
Fat	NUMBER	3	Not NULL				fat content of food
Mls_Id	NUMBER	-	Not NULL			FK	Meal id from Meal table

DIET\_GOAL (DGL)

<b>Field</b>	<b>Type</b>	<b>Size</b>	<b>Null/ Not Null</b>	<b>Default</b>	<b>Constraints</b>	<b>Index</b>	<b>Description</b>
Id	NUMBER	-	Not NULL		Unique	PK	auto-generated table id
Calories	NUMBER	4	Not NULL				Daily calorie goal (kcal)
Protein	NUMBER	3	Not NULL				Daily protein target (grams)
Carbohydrate	NUMBER	3	Not NULL				Daily carb target (grams)
Fat	NUMBER	3	Not NULL				Daily fat target (grams)
User_Username	VAR-CHAR2	20	Not NULL		Unique	FK	Username from USER table

WORKOUT (WKT)

<b>Field</b>	<b>Type</b>	<b>Size</b>	<b>Null/ Not Null</b>	<b>Default</b>	<b>Constraints</b>	<b>Index</b>	<b>Description</b>
Id	NUMBER	-	Not NULL		Unique	PK	auto-generated table id
WorkoutDate	DATE	-	Not NULL	Today's date			date of workout
WorkoutName	VAR-CHAR2	20	Not NULL				name of workout
User_Username	VAR-CHAR2	20	Not NULL			FK	Username from USER table

CARDIO\_EXERCISE (CEX)

<b>Field</b>	<b>Type</b>	<b>Size</b>	<b>Null/ Not Null</b>	<b>Default</b>	<b>Constraints</b>	<b>Index</b>	<b>Description</b>
Id	NUMBER	-	Not NULL		Unique	PK	auto-generated table id
ExerciseName	VAR-CHAR2	30	Not NULL		Unique	PK	name of exercise
Time	NUMBER	3,2					duration of exercise
Distance	NUMBER	3					distance of exercise in km
Intensity	NUMBER	1					intensity of exercise
Note	VAR-CHAR2						optional personal note for exercise
Wkt_Id	NUMBER	-	Not NULL			FK	Id from WORKOUT table

RESISTANCE\_EXERCISE  
(REX)

<b>Field</b>	<b>Type</b>	<b>Size</b>	<b>Null/ Not Null</b>	<b>Default</b>	<b>Constraints</b>	<b>Index</b>	<b>Description</b>
Id	NUMBER	-	Not NULL		Unique	PK	auto-generated table id
ExerciseName	VAR-CHAR2	30	Not NULL		Unique	PK	name of exercise
SetNumber	NUMBER	1	Not NULL				set number of the exercise
Repetitions	NUMBER	2	Not NULL				repetitions of exercise set
Weight	NUMBER	3					weight used during exercise
RestPeriod	NUMBER	3,2					rest period of exercise set
Intensity	NUMBER	1					intensity of exercise
Note	VAR-CHAR2						optional personal note for exercise
Wkt_Id	NUMBER	-	Not NULL			FK	Id from WORKOUT table

#### BODY\_MEASUREMENTS

<b>Field</b>	<b>Type</b>	<b>Size</b>	<b>Null/ Not Null</b>	<b>Default</b>	<b>Constraints</b>	<b>Index</b>	<b>Description</b>
Id	NUMBER	-	Not NULL		Unique	PK	auto-generated table id
Date	DATE	-	Not NULL	Today's date			date measurement taken
Bodyweight	NUMBER	3					Bodyweight measurement of user in kg
Bodyfat	NUMBER	?					Bodyfat measurement of user in %
User_Username	VAR-CHAR2	20	Not NULL			FK	Username from USER table

#### BODY\_GOALS

<b>Field</b>	<b>Type</b>	<b>Size</b>	<b>Null/ Not Null</b>	<b>Default</b>	<b>Constraints</b>	<b>Index</b>	<b>Description</b>
Id	NUMBER	-	Not NULL		Unique	PK	auto-generated table id
Bodyweight	NUMBER	3					Bodyweight goal of user in kg
Bodyfat	NUMBER	?					Bodyfat goal of user in %
User_Username	VAR-CHAR2	20	Not NULL		Unique	FK	Username from USER table



## 8) Database Queries

From discussions with BWF and the businesses operations, a range of queries that will be commonly run against the database have been identified. These have been laid out in the following sections by the category of user that will require the query in question, and some of these queries have been modelled and supplied as examples in the accompanying SQL file.

### 8.1 BWF-Member Queries

- Users checking their user profile data
- Users checking/ adding/ editing/ deleting what they've eaten on a day (food list, and calorie & macro breakdown)
- Users comparing what they've eaten vs their dietary goal
- Users checking/ adding/ editing/ deleting a workout on a day (overview, and exercise breakdown)
- Users checking/ adding/ editing/ deleting the body measurements they've recorded on a day
- Users comparing where they're at with their progress (most recent measurement vs their goal)
- Users checking their progress towards their goal (to facilitate graphing of all measurements)
- Users checking/ adding/ editing/ deleting their dietary goals
- Users checking/ adding/ editing/ deleting their body goals

### 8.2 Site-Analytics Queries

- Reports checking user activity
  - o How many meals logged
  - o How many workouts recorded
  - o How many body measurements taken
- Reports monitoring growth of user base and take-up of services

## 9) Users & Privileges

Three distinct groups of users have been identified as the ultimate end users of the proposed db solution. These user groups comprise admin staff, analytics users, and site members themselves, and their required db rights specified below:

- Admin users. At present there will be just one db administrator, and as per BWFs specification, two admin accounts will be required; one with complete privileges including the dropping and altering of tables, akin to complete root access, and a second day-to-day admin account which will include all db privileges with the exception of being able to drop and alter existing tables.
- Analytics users. There will be several employees of BWF that will need to access the company's db of user data for analytics and reporting purposes. These users will not require any privileges to create, edit or modify the data within the database, but will need to be able to extract data via their own bespoke queries, for the purposes of reporting and data analysis. No restriction bar one (no access to user login data) should be put on these user's abilities to query data, but they should have no ability to otherwise create, modify or delete data within the database.
- BWF end users. Any member of the BWF site should have access to create, modify and delete their own data in the database, but have no rights whatsoever to do anything with any other user's data.

## 10) SQL Implementation (Overview)

The previous sections have outlined the design of the proposed relational database solution for BWF. A prototype of this proposed solution can be seen under the IE\_A176 workspace on Oracle Application Express under the user credentials SQL01\_S14, with sample data inserted so the database may be explored.

An SQL script file used to create this database and populate various sample data into the solutions tables accompanies this document. A range of sample queries are included in this SQL document also.