# Assignment #7

*Problem Solving and Programming in C++*
***Department of Computer Science***
***Old Dominion University***

**Objective:** The main objective of this assignment is checking the students' ability to work with **ADT**s. In this week's assignment, you will be writing the interface of an **ADT** in order to conform to the requirements of a larger application.

**Description**: Soccer is one of the most popular sports in the world – it is played by at least 300 million players in different countries. Most soccer playing nations have a domestic league. The English Premier League is one of the most successful and popular soccer leagues in the world. In a sports season, every team plays twice against all other teams (one game at home city, and one game away). At the end of the season, the club (team) which secures the most points wins. A game is scored based on the number of goals. Points are used to determine the club's standing within the league. For this assignment you will be implementing a simple competition in which every club plays all other clubs (once at home city, then one game away). The results are randomly decided as well as the scores (goals). Even though, the results are randomly decided some clubs have a better chance of winning over others based on their **historicWinPercent** and **historicLossPercent** (see below for more details). The file ***clubs.txt***, which is provided, contains some information for each club, as follow:

```
clubName   historicWinPercent   historicLossPercent
```

The first line in the ***clubs.txt*** file states the number of records in this file. The rules of receiving (gaining) points are calculated as follows:

When two clubs (**A** and **B**) play, the possibilities are:

1. The club "team" that wins (scores more goals) a game receives three points
2. The club "team" that losses (scores less goals) will receive zero point (no points)
3. Draw (the two teams scored the same number of goals) is worth one point

   ***Example:*** if a team in a twenty game league season won 5, drew 5 and lost ten games, they would have accumulated 20 points in total.

**Task:** For this assignment, you will write a C++ with appropriate ADTs to implement the described competition.

**Help:** The best start, for this assignment, is identifying (naming) the **ADT**s – this is the most critical step. Good decisions (choices) naming the ADTs facilitate the implementation of the soccer competition and/or any other application (*even the very complicated tasks*). Please spend enough time thinking about the possible names of the ADTs, which you can use to implement the soccer competition. The ADTs you will use are provided below but before getting to those, try to think about what ADTs you would use if you were to do this assignment without the provided ones. Please spend enough time thinking before you proceed.

You will need to implement four different **ADT**s – each **ADT** is represented by a class, as follows:

Class **Club:**

**Club.h**

1. The club ***name***: a string
2. ***points***: an integer – which keeps track of the club's points as they play games. For example, if a club play 3 games and wins 1, losses 1, and draws 1, ***points****:* 3 + 0 + 1 = 4
3. ***formGuide****:* a string which keeps track of wins losses. For example, if a club plays 3 games and wins the first 2 and losses the last game, the ***formGuide***: "WWL"
4. ***historicWinPercent/historicLossPercent***: this value is used by the `playGame()` function to decide if a club has won a game. Description of the `playGame()` function is provided below.

**Club.cpp**

This file contains the following minimum (*you need to come up with other supporting functions*) set of member functions:

1. The function `playGame()` is responsible for deciding which team wins a game played between 2 clubs. The home team invokes the function and a win is decided as follows: the function generates a random number **N**, if **N** is between 1 and the **historicWinPercent** of the home team, the home team wins. If **N** is between **historicWinPercent + 1** and **historicWinPercent + HistoricLossPercent,** the home team loses. If **N** is out of both ranges, then the game is draw. After a call to `playGame()`, there must be a call to `printGameSummary()` to print the result of the game.

2. The function `printGameSummary()` is invoked by the home team and is responsible for printing the following data:

   `homeTeam  homeTeamScore - awayTeamScore  awayTeam`

   Example: *Arsenal 3 - 0 Chelsea*, where Arsenal and Chelsea are the home and away teams respectively. Arsenal won this game by 3 to 0.

### Class **GoalsGenerator:**

**GoalsGenerator.h/GoalsGenerator.cpp**

This class is used by the **Club** class to assign random goal scores to teams when they win, lose or draw. The implementation details are left for the student to decide. However, you must follow the following guideline:

1. The range of possible winning goals is from 1 goal to 7 goals (please note in soccer games, the teams don't usually score a lot of goals unlike Basketball).
2. The range of possible losing goals is from 0 to 6.
3. A win/loss/draw goal scores are randomly decided.
4. When picking goals, there is a:
   - 20% chance of picking 1 goal and 25% chance of picking 2 goals.
   - 15% - 3 goals, 15% - 4 goals, 13% - 5 goals, 6% - goals, 6% - 7 goals.

### Class **Competition:**

**Competition.h/Competition.cpp**

This class is responsible for organizing a tournament between all participating clubs. The primary operations of this class are as follows:

1. Read club data from **clubs.txt** and create **Club** objects for each club record
2. Setup a tournament in which all clubs play all other club (once at home city, and one game away). This means if we have 3 clubs A, B and C, the tournament will be as follows:

   **Stage 1**: **A** vs **B**, **A** vs **C**, and **B** vs **C**
   **Stage 2**: **B** vs **A**, **C** vs **A**, and **C** vs **B**

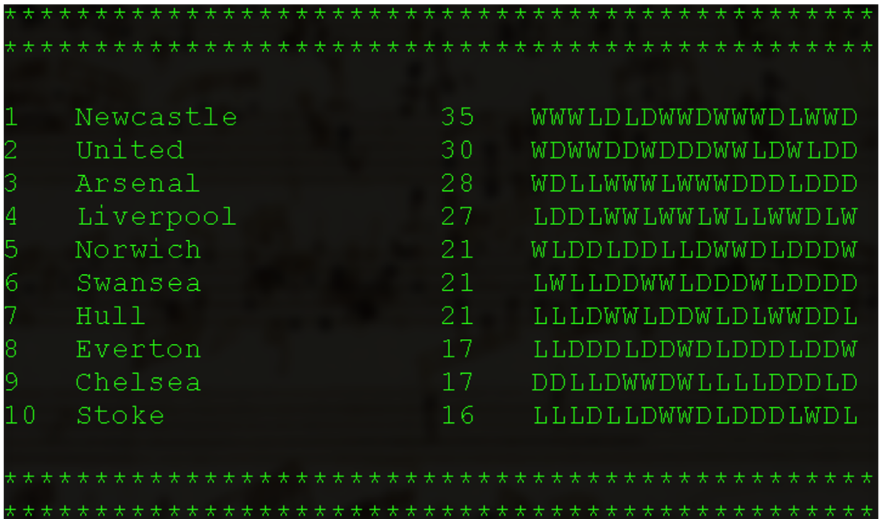
### Class **Table:**

**Table.h/Table.cpp**

This class is responsible for the following operations:

1. use class **Competition** to create/engage a competition
2. Create/print a sorted (from highest points to lowest points) table with the following fields:

`Rank ClubName TotalPoints FormGuide`, for example see the table below:



```
************************************************


1    Newcastle                    35    WWWLDLDWWDWWWDLWWD
2    United                       30    WDWWDDWDDDWWLDWLDD
3    Arsenal                      28    WDLLWWWLWWWDDDLDDD
4    Liverpool                    27    LDDLWWLWWLWLLWWDLW
5    Norwich                      21    WLDDLDDLLDWWDLDDDW
6    Swansea                      21    LWLLDDWWLDDDWLDDDD
7    Hull                         21    LLLDWWLDDWLDLWWDDL
8    Everton                      17    LLDDDLDDWDLDDDLDDW
9    Chelsea                      17    DDLLDWWDWLLLLDDDLD
10   Stoke                        16    LLLDLLDWWDLDDDLWDL

************************************************
************************************************
```

**main.cpp**

This is the entry point of the application and is responsible for:

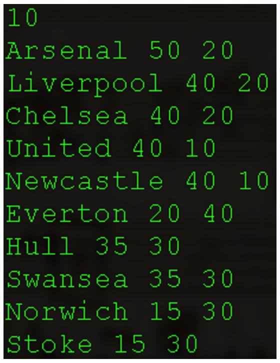
- Creates an instance of **Table**
- Starts the season tournament.

**<u>Note:</u>** Feel free to add additional member functions where you see fit, but you must maintain the same four Classes (Club, Competition, GoalsGenerator, and Table).

**<u>Submission notes</u>:**

- Zip the entire Code::Blocks project containing all the .cpp, .h, .cbp files name the zipped file "Assg7_cslogin.zip", where the cslogin is your login ID for the computers at the Department of Computer Science at ODU.
- Submit the zipped file using the appropriate Blackboard link.

**<u>Sample clubs.txt</u>:**



```
10
Arsenal 50 20
Liverpool 40 20
Chelsea 40 20
United 40 10
Newcastle 40 10
Everton 20 40
Hull 35 30
Swansea 35 30
Norwich 15 30
Stoke 15 30
```

**Sample Output.txt:**

```
Arsenal 1 - 0 Liverpool
Arsenal 0 - 1 Chelsea
Arsenal 3 - 3 United
Arsenal 3 - 2 Newcastle
Arsenal 4 - 4 Everton
Arsenal 1 - 2 Hull
Arsenal 4 - 4 Swansea
Arsenal 2 - 1 Norwich
Arsenal 3 - 1 Stoke
Liverpool 4 - 4 Chelsea
Liverpool 2 - 2 United
Liverpool 7 - 2 Newcastle
Liverpool 3 - 3 Everton
Liverpool 1 - 1 Hull
Liverpool 2 - 2 Swansea
Liverpool 3 - 3 Norwich
Liverpool 3 - 2 Stoke
Chelsea 2 - 2 United
Chelsea 1 - 2 Newcastle
Chelsea 2 - 2 Everton
Chelsea 7 - 7 Hull
Chelsea 2 - 5 Swansea
Chelsea 5 - 2 Norwich
Chelsea 2 - 2 Stoke
United 1 - 0 Newcastle
United 1 - 1 Everton
United 6 - 1 Hull
United 4 - 1 Swansea
United 1 - 1 Norwich
United 2 - 2 Stoke
Newcastle 1 - 0 Everton
Newcastle 1 - 0 Hull
Newcastle 2 - 2 Swansea
Newcastle 1 - 1 Norwich
Newcastle 3 - 2 Stoke
Everton 3 - 7 Hull
Everton 4 - 4 Swansea
Everton 1 - 0 Norwich
Everton 3 - 3 Stoke
Hull 0 - 1 Swansea
Hull 1 - 0 Norwich
Hull 1 - 3 Stoke
Swansea 3 - 4 Norwich
Swansea 2 - 3 Stoke
Norwich 0 - 1 Stoke
Liverpool 5 - 1 Arsenal
Chelsea 2 - 3 Arsenal
United 4 - 3 Arsenal
Newcastle 1 - 2 Arsenal
Everton 1 - 0 Arsenal
Hull 1 - 5 Arsenal
Swansea 2 - 4 Arsenal
Norwich 3 - 7 Arsenal
Stoke 1 - 2 Arsenal
Chelsea 3 - 2 Liverpool
United 3 - 3 Liverpool
Newcastle 2 - 1 Liverpool
```

```
Everton 2 - 1 Liverpool
Hull 3 - 1 Liverpool
Swansea 3 - 3 Liverpool
Norwich 1 - 0 Liverpool
Stoke 2 - 2 Liverpool
United 1 - 1 Chelsea
Newcastle 5 - 5 Chelsea
Everton 1 - 0 Chelsea
Hull 1 - 0 Chelsea
Swansea 7 - 7 Chelsea
Norwich 3 - 3 Chelsea
Stoke 1 - 1 Chelsea
Newcastle 7 - 5 United
Everton 2 - 3 United
Hull 2 - 1 United
Swansea 1 - 0 United
Norwich 5 - 5 United
Stoke 4 - 4 United
Everton 1 - 2 Newcastle
Hull 1 - 0 Newcastle
Swansea 2 - 2 Newcastle
Norwich 2 - 1 Newcastle
Stoke 6 - 6 Newcastle
Hull 1 - 7 Everton
Swansea 1 - 3 Everton
Norwich 1 - 6 Everton
Stoke 4 - 4 Everton
Swansea 4 - 4 Hull
Norwich 1 - 2 Hull
Stoke 4 - 4 Hull
Norwich 3 - 4 Swansea
Stoke 0 - 1 Swansea
Stoke 1 - 1 Norwich



***********************************************
***********************************************

1   Arsenal          33   WLDWDLDWWLWLWLWWWW
2   Everton          28   DDDDLLDWDWWWLLWWWD
3   Hull             28   WDDLLWLWLLWWWWLDWD
4   Newcastle        26   LLWLWWDDWLWDWWLDLD
5   United           25   DDDWDWWDDWDDLWLLDD
6   Swansea          23   DDWLDDWLLLDDWDLDWW
7   Chelsea          19   WDDLDDLWDLWDDLLDDD
8   Stoke            19   LLDDLDWWWLDDDDDDLD
9   Liverpool        18   LDDWDDDDWWLDLLLDLD
10  Norwich          15   LDLDDLLWLLWDDWLLLD

***********************************************
***********************************************
```