Section 1: Ladder Up

40 marks plus 5 Bonus marks available in this Section – Available time is 80 minutes

INTRODUCTION

Being the keen football (soccer) fan that you are, you were excited to learn that in the 2016/17 season there was a football league played between 20 cities of the ancient Byzantine Empire. The format was a double round-robin with each team playing all other teams twice, once at home and once away, for a total of 38 games per team.

You have been provided data for all 380 games. 10 data fields are provided for each game. They are:

Field Name	Description
Date	The date of the game, given as text in the format yyyymmdd.
Round	The number of the round (between 1 and 38)
Team_H	The name of the home team.
Team_A	The name of the away team.
Score_H	The number of goals scored by the home team.
Score_A	The number of goals scored by the away team.
Time_HG	Which minute in the game (between 1 and 95) each home goal was scored. This is given as a single text string with each goal separated by a comma (,). Minute values followed by an asterisk (*) denote that the goal was from a Penalty Kick. If there were no home goals, "---" is the value given.
Time_AG	Which minute in the game (between 1 and 95) each away goal was scored. Other details are as per the Time_HG field.
Player_HG	The jersey number of the goal scorer (between 1 and 22) of each home goal. This is given as a single text string with each goal separated by a comma (,). The first value corresponds to the first home goal scored, the second value to the second home goal scored, and so on. If there were no home goals, "---" is the value given.
Player_AG	The jersey number of the goal scorer (between 1 and 22) of each away goal. Other details are as per the Player_HG field.

The winner of each game is the team that scores the most goals. If the score is tied, the game is a draw.

Your task is to build a model of the league ladder, but this model will need to be flexible to answer all of the questions. **Read through the questions first to get a sense of what flexibility is required.**

LADDER RULES FOR RANKING TEAMS

For each game, teams receive **3 points for a win, 1 point for a draw and 0 points for a loss.** Teams are ranked on the ladder according to the following criteria, in this order:

1) Highest number of points
2) For teams on equal points, rank by highest goal difference (total goals scored less total goals conceded)
3) For teams on equal points and goal difference, rank by highest total goals scored
4) If two or more teams are still equal after (3), rank those teams equally, but list the equally ranked teams in alphabetical order. *(For avoidance of doubt, if M teams are equally ranked in position N, the next best team will have rank N+M, not rank N+1.)*

LIST OF TEAMS

Adrianople	Kars
Ani	Naissus
Antioch	Nicaea
Bari	Nicomedia
Chalcedon	Ohrid
Cherson	Prilep
Constantinople	Samosata
Dyrrachium	Sardica
Edessa	Trebizond
Iconium	Varna

This list of teams is also provided in column B of the worksheet 'Check_Sum'.

For any questions where the answer is one of the teams, give the Team name, and not the team ID number.

THE CHECK_SUM WORKSHEET

You should add your own worksheets to the provided data file to perform your calculations and model your league ladder. Some of the questions will ask you for the value of the Check_Sum of a given ladder. For these questions, you should **link cells D3:D22 and E3:E22 to your calculated ladder**, and then submit the value in the green cell at cell F25. The use of the Check Sum is designed simply to be a way to easily assess if all of your ladder ranking positions are correct.

You can also use the list of team names from cells B3:B20. You should not use this Check Sum worksheet for anything else, nor make any edits to it except for the yellow cells D3:E22.

Instructions on how to sort your ladder:

Like any traditional sporting league, your ladder should be sorted by rank, with rank 1 (the highest placed team) at the top and rank 20 (the lowest placed team) at the bottom. If a ladder contains two or more teams on equal rank (see point 4 in 'Ladder Rules for Ranking Teams), equally ranked teams should then further be sorted alphabetically by team name for display purposes, but still given an equal rank value.

Note that a different displayed sort order will give a different Check sum value from the intended answer.

QUESTION SUMMARY

Questions 1 to 7 are based on the complete data set, with no filtering required.

Questions 8 to 19 may require you to compile a ladder assuming that some goals and/or some games have been filtered out of the data. After answering each question, **remove the effects of any filtering** before proceeding to the next question.

Answer all questions by writing on the provided Question and Answer Sheet