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.)*

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2017 Finals: Section 1 - Information Pack

LIST OF TEAMS

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

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QUESTIONS AND ANSWERS

Question 1

How many goals did Bari score in the season? [1 mark]

A	27	**D**	36	**G**	45
B	30	**E**	39	**H**	48
C	33	**F**	42	**I**	51

Question 2 **(Free field answer)**

Which team conceded exactly 60 goals in the season? [1 mark]

_____

Question 3

How many teams finished the season with more than 50 points? [1 mark]

A	8	**D**	11	**G**	14
B	9	**E**	12	**H**	15
C	10	**F**	13	**I**	16

Question 4 **(Free field answer)**

How many points did the first ranked team finish the season with? [1 mark]

_____

Question 5 **(Free field answer)**

Which team was the first ranked team? [1 mark]

_____

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Question 6

How many teams finished the season with the same number of points as another team? [2 marks]

A	2	**D**	5	**G**	8
B	3	**E**	6	**H**	9
C	4	**F**	7	**I**	10

Question 7

What is the Check Sum value for the final ladder at the end of the season? [3 marks]

A	93673	**D**	101850	**G**	112499
B	98520	**E**	104305	**H**	116976
C	100400	**F**	108103	**I**	118973

Question 8

What is the Check Sum value for the ladder as it stood at 31 Dec 2016? (Include all games up to and including games on 31 Dec 2016, but no games after this date) [3 marks]

A	92556	**D**	101612	**G**	112510
B	96066	**E**	105491	**H**	115249
C	98250	**F**	108947	**I**	120311

Question 9 (Free field answer)

How many goals were scored from Penalty Kicks in October 2016? [1 mark]

_____

Question 10 (Free field answer)

Which team scored the most goals from Penalty Kicks in the season? [1 mark]

_____

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Question 11

Assume that all goals from Penalty Kicks are removed from the data, and the scores and results of each game are changed accordingly. Compile the end of season ladder based on this assumption. What is the Check Sum of the ladder? [3 marks]

A	84664	**D**	97715	**G**	108072
B	89058	**E**	100948	**H**	113040
C	93082	**F**	104912	**I**	117930

Question 12
(Remember to reset the filters from the previous question to their default value)

Assume that all games for the season ended at Half Time, so that only goals scored in minutes 1 to 45 inclusive are counted. Compile the ladder as of 28 Feb 2017 based on this assumption. What is the Check Sum of the ladder? [4 marks]

A	75493	**D**	88918	**G**	100956
B	79142	**E**	93118	**H**	104007
C	83960	**F**	96793	**I**	107303

Question 13 (Free field answer)
(Remember to reset the filters from the previous question to their default value)

Assume that all goals scored by the Away team player wearing Jersey number 10 are removed from the data. What is the Check Sum of the ladder? [2 marks]

_____

Question 14 (Free field answer)
(Remember to reset the filters from the previous question to their default value)

What is the Check Sum of the ladder as at 12 Oct 2016? [2 marks]

_____

Question 15 (Free field answer)

Filtering the data so that we only count games played on a Saturday or a Monday throughout the whole season, which team finishes in 7th place on the end of season ladder? [3 marks]

_____

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Question 16 (Free field answer)
(Remember to reset the filters from the previous question to their default value)

Each team has been allocated a 'Stop Time' provided in the table below.

Team	Stop Time	Team	Stop Time	Team	Stop Time	Team	Stop Time
Adrianople	76	Cherson	54	Kars	59	Prilep	31
Ani	55	Constantinople	53	Naissus	39	Samosata	32
Antioch	76	Dyrrachium	74	Nicaea	68	Sardica	56
Bari	50	Edessa	30	Nicomedia	42	Trebizond	42
Chalcedon	50	Iconium	30	Ohrid	33	Varna	45

These assumptions are also provided in the worksheet tab 'Q16'

Assume that every game stops after M minutes (so that only goals scored in minutes 1 to M inclusive are counted), where M is calculated for each game as the minimum of the two Stop Times of the two teams in the game.

Using this filter, what is the Check Sum of the ladder at the end of the season? [4 marks]

_____

Question 17 (Free field answer)

(Remember to reset the filters from the previous question to their default value)

What is the Check Sum of the ladder as at 5 Oct 2016? [2 marks]

_____

Question 18 (Free field answer)

(Remember to reset the filters from the previous question to their default value)

Assume that all goals scored by any player wearing Jersey number 15 are removed from the data. What is the Check Sum of the ladder? [2 marks]

_____

Question 19 (Free field answer)

(Remember to reset the filters from the previous question to their default value)

Every goal is scored by a player wearing a Jersey number between 1 and 22. If we remove from the data all goals scored by Jersey number N, what single value of N (from 1 to 22) will give the largest end of season ladder Check Sum? [3 marks]

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SECTION 1 – BONUS QUESTION

5 Bonus Marks Available. You must score 32/40 or better from the main questions on Section 1 to be eligible for these Bonus Marks.

Bonus Question 1

Across the 380 games in the season, every team has played every other team exactly twice (once as the home team, once as the away team). For teams A and B, the two games between A and B represent a *series*. The cumulative scores of the two games make up the result of each series. If one team has scored more goals than the other team across the series, that team wins. For example, if the game 1 score (A as home team vs B as away team) is 3-0 in favor of A, and if the game 2 score (B as home team vs A as away team) is a 2-2 draw, then A wins the series 5-2.

If the series score shows a tie, then the "Away Goals" tie-break rule is used. Whichever of the two teams scored more Away goals across the series is declared the winner. If the two teams are still tied after application of the Away goals rule, the series is declared a draw.

Go to the worksheet 'Bonus'. The table contains 190 yellow cells in the upper triangle. Each yellow cell needs to represent the overall result of the two-game series between the team shown on the left hand column and the team shown on the top row.

Populate each yellow cell with the team ID number (1 through 20) of the team that won that series. If the series was a tie, leave the cell value as zero.

In each of the 20 blue cells (main diagonal) and 190 grey cells (lower triangle) make sure the value of zero remains entered.

A shortened version of these instructions is also provided on the 'Bonus' worksheet tab.

What is the value of the Bonus Check Sum? [5 marks]

_____

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Your Name:

Answers

1	C	33
2	Free field	Antioch
3	D	11
4	Free field	78
5	Free field	Ani
6	F	7
7	G	112499
8	B	96066
9	Free field	30
10	Free field	Naissus
11	H	113040
12	E	93118
13	Free field	114284
14	Free field	98862
15	Free field	Chalcedon
16	Free field	100376
17	Free field	98996
18	Free field	113542
19	Free field	14
Bonus Question		41381