UNIVERSITY OF
WATERLOO

ECON 474/673: Numerical Methods for Economists

Assignment 1:
(Due date: January 16 before 11:30 pm in Learn drop box)

You must submit the .Rnw file only. For an introduction on how to produce Latex-Sweave documents go through the Appendix B of the lecture notes. Also, try to print the codes only when it is necessary so that the pdf file only includes important results and text. Since I have access to the .Rnw file, I can easily look at the codes. You have 3 types of options you can add to the chunk command that allow you to control the output:

- << echo=false >>=: Print the results but not the codes.
- << eval=false >>=: Print the codes but do not run the commands. This is useful when you cannot figure out the errors and the chunk does not run.
- << fig=true, width=10, height=7 >>=: If you produce a graph that needs to be inserted.
- A combination of the above options or just nothing.

The drop box will close at 11:30 pm. I do not accept late submissions. Therefore, do not wait until the last minute to complete it.
You are not allowed to use any packages unless I tell you to do so. Use only the function included in R.

1 Matrix manipulation

To answer the questions, you will need the file GoalData.rda which is included on Learn. The file contains the matrix "res" with the records of all goals for seasons 2001-2002 to 2012-2013 (Notice that the last season was shorted and there is no season 2004-2005 because of lockouts). Here is the first few rows of the table:

The first column is the Game ID. The first 4 characters refer to the season. For example, 2002 means season 2001-2002. The last 4 characters form the game number which is set by the NHL. There are 1230 games per year (720 in 2012-2013), which means that the Game ID for the season 2002-2003 goes from "20030001" to "20031230". The second column is the date of the game, the third and fourth columns contain the names of the home and away teams, the fifth is the time of the goal in minutes and seconds from the beginning of the period, the sixth is the period, the seventh is the name of the team who scored, and the last is the time of the goals in minutes from the beginning of the game.

You want to create an object of class "team". Is contains the observations from "res" for a particular team. Here is the function to create the object (the function also clean the data of some irregularities):

	Game_id	Date	Home	Away	Time	Period	Goal_Team	Time_Min
1	20020001	20011003	TORONTO MAPLE LEAFS	OTTAWA SENATORS	2:29	1	OTTAWA SENATORS	2.48333333333333
2	20020001	20011003	TORONTO MAPLE LEAFS	OTTAWA SENATORS	7:46	1	TORONTO MAPLE LEAFS	7.76666666666667
3	20020001	20011003	TORONTO MAPLE LEAFS	OTTAWA SENATORS	14:53	1	OTTAWA SENATORS	14.8833333333333
4	20020001	20011003	TORONTO MAPLE LEAFS	OTTAWA SENATORS	1:26	2	TORONTO MAPLE LEAFS	21.4333333333333
5	20020001	20011003	TORONTO MAPLE LEAFS	OTTAWA SENATORS	2:54	2	OTTAWA SENATORS	22.9
6	20020001	20011003	TORONTO MAPLE LEAFS	OTTAWA SENATORS	15:21	2	OTTAWA SENATORS	35.35
7	20020001	20011003	TORONTO MAPLE LEAFS	OTTAWA SENATORS	19:28	2	TORONTO MAPLE LEAFS	39.4666666666667
8	20020001	20011003	TORONTO MAPLE LEAFS	OTTAWA SENATORS	8:18	3	OTTAWA SENATORS	48.3
9	20020001	20011003	TORONTO MAPLE LEAFS	OTTAWA SENATORS	18:51	3	TORONTO MAPLE LEAFS	58.85
10	20020002	20011003	PITTSBURGH PENGUINS	COLORADO AVALANCHE	1:51	2	COLORADO AVALANCHE	21.85
11	20020002	20011003	PITTSBURGH PENGUINS	COLORADO AVALANCHE	9:28	2	COLORADO AVALANCHE	29.4666666666667
12	20020002	20011003	PITTSBURGH PENGUINS	COLORADO AVALANCHE	8:12	3	COLORADO AVALANCHE	48.2
13	20020002	20011003	PITTSBURGH PENGUINS	COLORADO AVALANCHE	13:01	3	PITTSBURGH PENGUINS	53.0166666666667
14	20020003	20011003	CALGARY FLAMES	EDMONTON OILERS	6:13	3	CALGARY FLAMES	46.2166666666667
15	20020004	20011004	BOSTON BRUINS	ANAHEIM DUCKS	5:38	1	BOSTON BRUINS	5.63333333333333

```r
makeTeam <- function(data, team)
    {
        team <- match.arg(team, unique(data[,"Home"]))
        which <- data[,"Home"] == team | data[,"Away"] == team
        obj <- data[which,]
        chk <- obj[,"Period"] %in% c(1:4,"OT","SO")
        obj <- obj[chk,]
        obj[obj[,"Period"]=="4","Period"] <- "OT"
        class(obj) <- "team"
        attr(obj, "team") <- team
        obj
    }
```

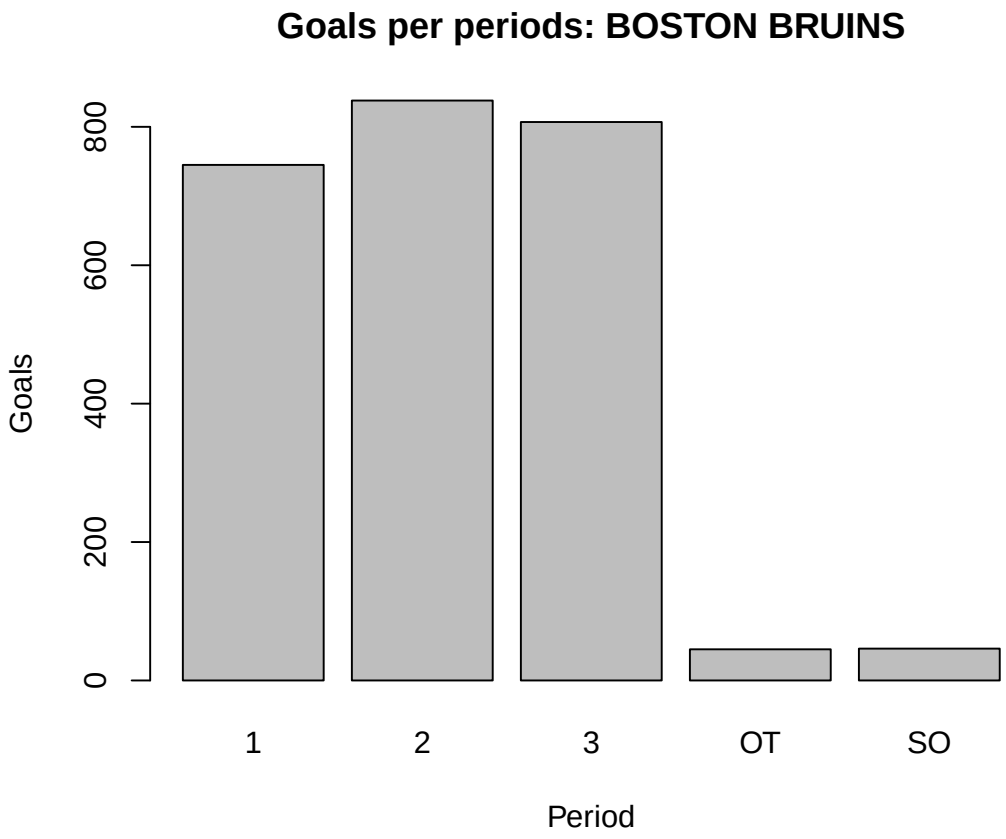
a) Create a print method for the object of class “team” which produces the following:

```r
Boston <- makeTeam(res, "BOSTON BRUINS")
Boston
```

```
## Goal Data for: BOSTON BRUINS
## ************************************
##
## Games played: 865
## Seasons: 2001-2002 to 2012-2013
```

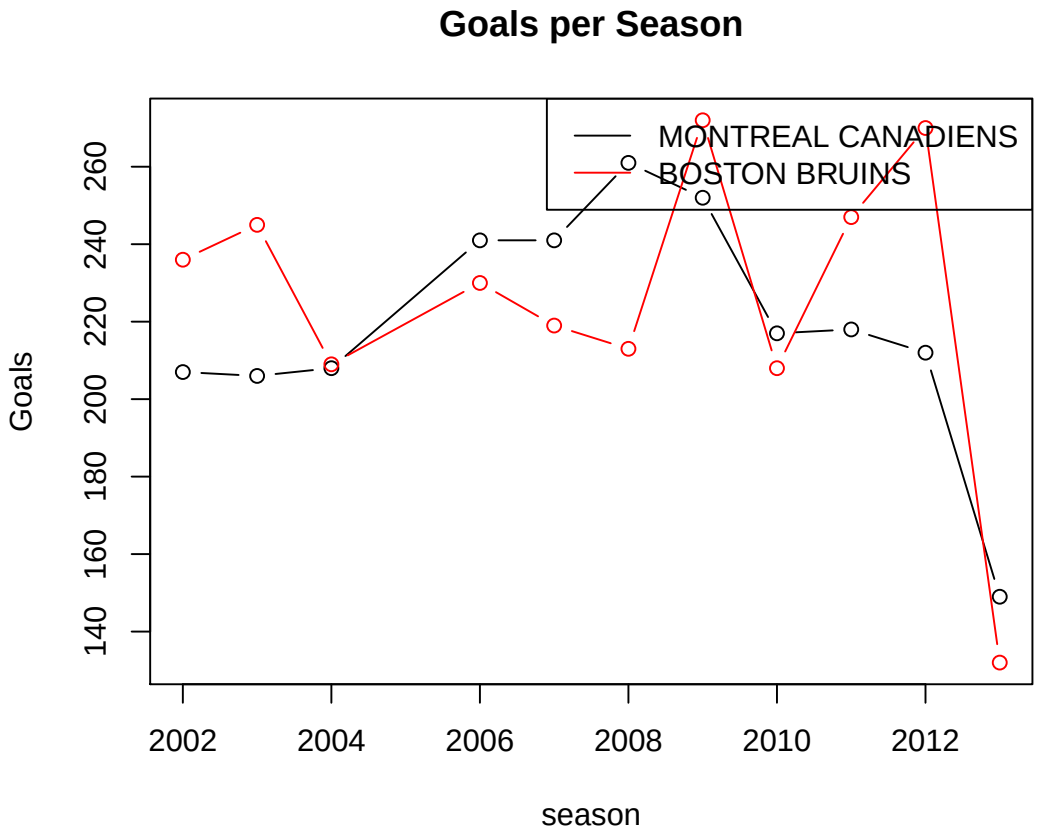
b) Write a plot method for objects of class “team” that produces the following graph

```r
plot(Boston)
```



c) Create a function compare(team1, team2) which plots a time series of the total number of goals per season for the two teams on the same graph. The function should produce the following:

```
Montreal <- makeTeam(res, "MONT")
compare(Montreal, Boston)
```



To test your function, do it for two pairs of teams.

d) Write a function numWin(team, season), that returns the number of wins in a given season, where "team" is the object created by makeTeam() (Hint: each game has a different game id, Tip: First, write a function isWin(gameid, team) which returns TRUE if the team wins and False otherwise, and use that function in numWin()). For example

```
Montreal[1:10,c(1,7)] # Montreal won 6 to 4

##       Game_id    Goal_Team
##  [1,] "20020006" "MONTREAL CANADIENS"
##  [2,] "20020006" "MONTREAL CANADIENS"
##  [3,] "20020006" "OTTAWA SENATORS"
##  [4,] "20020006" "MONTREAL CANADIENS"
##  [5,] "20020006" "MONTREAL CANADIENS"
##  [6,] "20020006" "OTTAWA SENATORS"
##  [7,] "20020006" "OTTAWA SENATORS"
##  [8,] "20020006" "MONTREAL CANADIENS"
##  [9,] "20020006" "OTTAWA SENATORS"
## [10,] "20020006" "MONTREAL CANADIENS"
```

```
isWin("20020006",Montreal)

## [1] TRUE
```

Also, the numWin() function should returns:

```
numWin(Montreal, "2003-2004")

##        wins gamesplayed
##          41          82
```

e) Create a (number of seasons)×3 table that shows the number of wins for three teams of your choice per season. Example:

	MONTREAL CANADIENS	BOSTON BRUINS	PITTSBURGH PENGUINS
2001-2002	36	43	28
2002-2003	30	36	27
2003-2004	41	41	23
2005-2006	40	29	22
2006-2007	38	35	47
2007-2008	46	41	47
2008-2009	41	51	45
2009-2010	39	39	46
2010-2011	44	46	49
2011-2012	30	49	50
2012-2013	29	28	36

Hint: I created a function getAllWins that produces the following:

```
getAllWins(Montreal)

##             2001-2002 2002-2003 2003-2004 2005-2006 2006-2007 2007-2008
## wins               36        30        41        40        38        46
## gamesplayed        82        82        82        82        81        81
##             2008-2009 2009-2010 2010-2011 2011-2012 2012-2013
## wins               41        39        44        30        29
## gamesplayed        82        82        82        82        48
```

f) Create a summary method for objects of class “team” and a print method for the object created by summary. You should get the following:

```
summary(Montreal)

## Goal Data for: MONTREAL CANADIENS
## ***********************************
##
## Games played: 866
```

```
## Seasons: 2001-2002 to 2012-2013
## The best season is 2012-2013 with a ratio wins to games played of 0.6
## The worst season is 2002-2003 with a ratio wins to games played of 0.37
```

```
summary(Boston)
```

```
## Goal Data for: BOSTON BRUINS
## **********************************
##
## Games played: 865
## Seasons: 2001-2002 to 2012-2013
## The best season is 2008-2009 with a ratio wins to games played of 0.63
## The worst season is 2005-2006 with a ratio wins to games played of 0.35
```