NAME: . . . .

STUDENT NUMBER: . . . .

Question 1 (5 marks)

Consider the sequence of natural numbers: $1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, \ldots$

Removing every second number produces: $1, 3, 5, 7, 9, 11, 13, \ldots$

Now removing every third number produces: $1, 3, 7, 9, 13, \ldots$

If this process continues indefinitely then the numbers that remain are said to be LUCKY.

Write down an R function that takes an integer n as an input parameter and returns a vector of all LUCKY natural numbers that are $\leq n$.

Question 2 (5 marks)

Sketch the output plot from the following R script.

```
shuffle <- function(str){
  n <- nchar(str)
  chars <- substring(str,first=1:n,last=1:n)
  evenChars <- chars[1:n %% 2 == 0]
  oddChars <- chars[1:n %%2 != 0]
  return(paste(c(evenChars,oddChars),sep="",collapse=""))
}


draw <- function(topic){
  t <- seq(-pi/2,pi/2,len=100)
  r <- 1 - sin(t)
  x <- r * cos(t) * log(1 + abs(t+pi/2))
  y <- r * sin(t)
  plot(c(-2,2),c(-2,2),type=’n’,axes=FALSE,xlab=’’,ylab=’’)
  lines(x,y)
  lines(-x,y)
  text(0,-1/2,shuffle("lwoev e"),cex=2.5)
  text(0,-1,topic,cex=2.5)
}

draw(shuffle("idnaitnagm"))
```

Question 3 (10 marks)

A football league table is stored in a comma separated file in the current working directory. The table is loaded into a `data.frame` using the following command:

```
> ( league <- read.csv("league.csv",header=TRUE,row.names=1) )

                         P  W  D  L GF GA  GD PTS
Manchester United       28 23  2  3 68 31  37  71
Manchester City         28 17  8  3 51 24  27  59
Tottenham Hotspur       29 16  6  7 51 36  15  54
Chelsea                 28 15  7  6 56 30  26  52
Arsenal                 28 13  8  7 53 32  21  47
Liverpool               29 12  9  8 56 36  20  45
Everton                 28 11 12  5 44 35   9  45
West Bromwich Albion    29 13  4 12 40 38   2  43
Swansea City            29 10 10  9 40 36   4  40
Fulham                  28  8  9 11 39 44  -5  33
Stoke City              29  7 12 10 27 35  -8  33
West Ham United         28  9  6 13 32 41  -9  33
Newcastle United        29  9  6 14 40 50 -10  33
Norwich City            29  7 12 10 27 45 -18  33
Sunderland              29  7  9 13 32 41  -9  30
Southampton             29  6 10 13 39 51 -12  28
Aston Villa             29  6  9 14 28 54 -26  27
Wigan Athletic          28  6  6 16 33 55 -22  24
Reading                 29  5  8 16 35 56 -21  23
Queens Park Rangers     29  4 11 14 24 45 -21  23
```

Column names have been loaded from the first line of the csv file and row names have been loaded from the first column using the `row.names=1` parameter so that the club name becomes the row name of the data.frame. Column names are the usual names associated with a football league.

`P`	games played
`W`	games won
`D`	games drawn
`L`	games lost
`GF`	goals for
`GA`	goals against
`GD`	goal difference
`PTS`	points (`PTS = 3 W + D`)

Note that the table is sorted on decreasing points value with goal difference as a tie-breaker.

Now on any particular day a number of matches may be played and the results for that day arrive as comma separated file which can be loaded into a `data.frame` using the following command:

```
> ( results <- read.csv("results.csv",header=TRUE) )

                    A AG                 B BG
1     West Ham United  2      Swansea City  4
2 Queens Park Rangers  3 Manchester United  0
3              Fulham  2           Chelsea  2
4           Liverpool  0 Tottenham Hotspur  1
5             Arsenal  2        Stoke City  1
```

Each row in the results data.frame records the names of two clubs involved in a match and the goals scored by each club in that match. Note that this time row names are integers. Also if you are a *Manchester United* fan then note how they just got whipped by bottom of the league *Queens Park Rangers*.

Your task is to construct an R script that loads the two data frames and updates the records in the league table according to the information stored in the results table and then outputs a new **ordered** league table. You may assume that both csv input files are clean and that club names that appear in the results file also occur in the league file. Thus you are **not** expected to do any error checking.

write your question 3 script on this page

more space for your script if you need it