hw3_report

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HW 3 - Due Tuesday Sept 20, 2016. Upload R file to Moodle with name: HW3_490IDS_YOURNETID.R

Do Not remove any of the comments. These are marked by

The .R file will contain your code and answers to questions.

Name:

Main topic: Using the "apply" family function

Q1 (5 pts)

Given a function below,

```
myfunc <- function(z) return(c(z,z^2, z^3%/%2))
```

(1) Examine the following code, and briefly explain what it is doing.

```
y = 2:8
myfunc(y)
```

```
##  [1]   2   3   4   5   6   7   8   4   9  16  25  36  49  64   4  13  32
## [18]  62 108 171 256
```

```
matrix(myfunc(y),ncol=3)
```

```
##      [,1] [,2] [,3]
## [1,]    2    4    4
## [2,]    3    9   13
## [3,]    4   16   32
## [4,]    5   25   62
```

```
## [5,]    6   36  108
## [6,]    7   49  171
## [7,]    8   64  256
```

Your explanation

This is generating a matrix with 3 columns. First column will be y. Second column will be y^2. Third column will be (y^3)/2. #(2) Simplify the code in (1) using one of the "apply" functions and save the result as m. ###code & result

```
m = matrix(c(y,apply(matrix(c(y)), 2, function(x) x^2),apply(matrix(c(y)), 2,
function(x) x^3%/%2)), ncol=3)
print(m)
```

```
##      [,1] [,2] [,3]
## [1,]    2    4    4
## [2,]    3    9   13
## [3,]    4   16   32
## [4,]    5   25   62
## [5,]    6   36  108
## [6,]    7   49  171
## [7,]    8   64  256
```

(3) Find the row product of m.

code & result

```
apply(m, 1, prod)
```

```
## [1]     32    351   2048   7750  23328  58653 131072
```

print("32 351 2048 7750 23328 58653 131072") #(4) Find the column sum of m in two ways. ###code & result

```
print("First,use apply")
```

```
## [1] "First,use apply"
```

```
apply(m,2,sum)
```

```
## [1]  35 203 646
```

```
print("Second, use matrix multiply")
```

```
## [1] "Second, use matrix multiply"
```

```
temp <- matrix(rep(1, times = 8-2+1),nrow=1,ncol=8-2+1)
temp%*%m
```

```
##      [,1] [,2] [,3]
## [1,]   35  203  646
```

(5) Could you divide all the values by 2 in two ways?

code & result

```
print("First,use apply")
```

```
## [1] "First,use apply"
```

```
apply(m,1:2,function(x) x/2)
```

```
##      [,1] [,2]  [,3]
## [1,]  1.0  2.0   2.0
## [2,]  1.5  4.5   6.5
## [3,]  2.0  8.0  16.0
## [4,]  2.5 12.5  31.0
## [5,]  3.0 18.0  54.0
## [6,]  3.5 24.5  85.5
## [7,]  4.0 32.0 128.0
```

```
print("Second, use matrix multiply")
```

```
## [1] "Second, use matrix multiply"
```

```
temp = diag(8-2+1)/2
temp%*%m
```

```
##      [,1] [,2]  [,3]
## [1,]  1.0  2.0   2.0
## [2,]  1.5  4.5   6.5
## [3,]  2.0  8.0  16.0
## [4,]  2.5 12.5  31.0
## [5,]  3.0 18.0  54.0
## [6,]  3.5 24.5  85.5
## [7,]  4.0 32.0 128.0
```

Q2 (8 pts)

Create a list with 2 elements as follows:

```
l <- list(a = 1:10, b = 11:20)
```

(1) What is the product of the values in each element?

```
lapply(l, prod)
```

```
## $a
## [1] 3628800
##
## $b
## [1] 670442572800
```

(2) What is the (sample) variance of the values in each element?

```
lapply(l,var)
```

```
## $a
## [1] 9.166667
##
## $b
## [1] 9.166667
```

(3) What type of object is returned if you use lapply? sapply? Show your R code that finds these answers.

```
typeof(lapply(l,var))
```

```
## [1] "list"
```

```
typeof(sapply(l,var))
```

```
## [1] "double"
```

Now create the following list:

```
l.2 <- list(c = c(21:30), d = c(31:40))
```

(4) What is the sum of the corresponding elements of l and l.2, using one function call?

```
mapply(function(x,y) x+y,x=l,y=l.2)
```

```
##        a  b
##  [1,] 22 42
##  [2,] 24 44
##  [3,] 26 46
##  [4,] 28 48
##  [5,] 30 50
##  [6,] 32 52
##  [7,] 34 54
##  [8,] 36 56
##  [9,] 38 58
## [10,] 40 60
```

(5) Take the log of each element in the list l:

```
lapply(l,function(x) log(x))
```

```
## $a
##  [1] 0.0000000 0.6931472 1.0986123 1.3862944 1.6094379 1.7917595 1.9459101
##  [8] 2.0794415 2.1972246 2.3025851
```

```
##
## $b
##  [1] 2.397895 2.484907 2.564949 2.639057 2.708050 2.772589 2.833213
##  [8] 2.890372 2.944439 2.995732
```

(6) First change l and l.2 into matrixes, make each element in the list as column,

your code here

```
l = matrix(unlist(l), ncol = 2)
l.2 = matrix(unlist(l.2), ncol = 2)
```

Then, form a list named mylist using l,l.2 and m (from Q1) (in this order).

your code here

```
mylist = list(l,l.2,m)
```

Then, select the first column of each elements in mylist in one function call (hint '[' is the select operator).

your code here

```
lapply(mylist,'[',,1)
```

```
## [[1]]
##  [1]  1  2  3  4  5  6  7  8  9 10
##
## [[2]]
##  [1] 21 22 23 24 25 26 27 28 29 30
##
## [[3]]
## [1] 2 3 4 5 6 7 8
```

Q3 (3 pts)

Let's load our friend family data again.

```
load(url("http://courseweb.lis.illinois.edu/~jguo24/family.rda"))
```

(1) Find the mean bmi by gender in one function call.

```
apply(matrix(c(family$bmi)),2,mean)
```

```
## [1] 24.57612
```

(2) Could you get a vector of what the type of variables the dataset is made of?

```
sapply(family,class)
```

```
## firstName    gender       age    height    weight       bmi    overWt
##  "factor"  "factor" "integer" "numeric" "integer" "numeric" "logical"
```

(3) Could you sort the firstName in height descending order?

```
lapply(list(family[order(family$height,decreasing = TRUE),1]),'[',1:length(fa
mily$firstName))
```

```
## [[1]]
##  [1] Joe Tom Tom Liz Jon Tim Bob Ann Dan Art Sal May Sue Zoe
## Levels: Ann Art Bob Dan Joe Jon Liz May Sal Sue Tim Tom Zoe
```

Q4 (2 pts)

There is a famous dataset in R called "iris." It should already be loaded

in R for you. If you type in ?iris you can see some documentation. Familiarize

yourself with this dataset.

(1) Find the mean petal length by species.

code & result

```
by(iris$Petal.Length, iris$Species, mean)
```

```
## iris$Species: setosa
## [1] 1.462
## ------------------------------------------------------------
## iris$Species: versicolor
## [1] 4.26
## ------------------------------------------------------------
```

```
## iris$Species: virginica
## [1] 5.552
```

(2) Now obtain the sum of the first 4 variables, by species, but using only one function call.

code & result

```
by(iris[,1:4],iris$Species,sum)
```

```
## iris$Species: setosa
## [1] 507.1
## ------------------------------------------------------------
## iris$Species: versicolor
## [1] 714.6
## ------------------------------------------------------------
## iris$Species: virginica
## [1] 857
```

Q5 (2 pts)

Below are two statements, their results have different structure,

```
lapply(1:4, function(x) x^3)
```

```
## [[1]]
## [1] 1
##
## [[2]]
## [1] 8
##
## [[3]]
## [1] 27
##
## [[4]]
## [1] 64
```

```
sapply(1:4, function(x) x^3)
```

```
## [1]  1  8 27 64
```

Could you change one of them to make the two statements return the same results (type of object)?

```
as.numeric(lapply(1:4, function(x) x^3),nrow=1)
```

```
## [1]  1  8 27 64
```

Q6. (5 pts) Using the family data, fit a linear regression model to predict

weight from height. Place your code and output (the model) below.

```
line = lm(family$weight ~ family$height)
print("output is Coefficients:
  (Intercept)  family$height
      -455.666          9.154 ")
```

```
## [1] "output is Coefficients:\n  (Intercept)  family$height  \n      -455.6
66          9.154 "
```

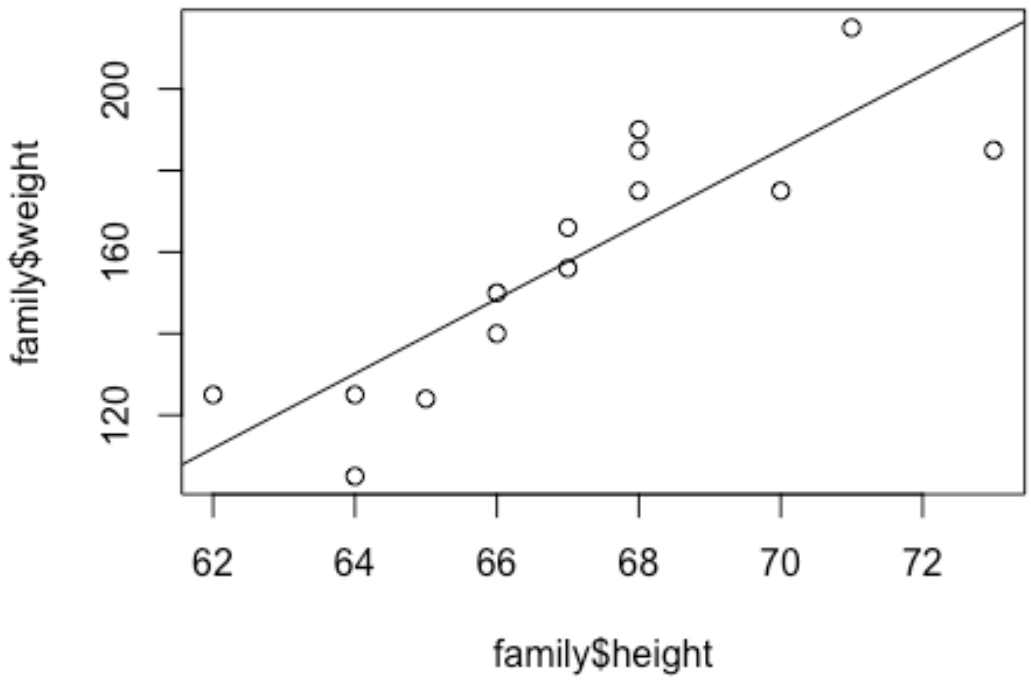
How do you interpret this model?

```
print("The coefficient is positive, it means that height and weight has posit
ive relationship,which means when height increases, weight tends to increse a
s well.")
```

```
## [1] "The coefficient is positive, it means that height and weight has posi
tive relationship,which means when height increases, weight tends to increse
as well."
```

Create a scatterplot of height vs weight. Add the linear regression line you found above.

```
plot(family$height,family$weight,type = "p")
abline(line)
```



Provide an interpretation for your plot.

```
print("This is the linear regression lien generated from weight and height. A
s we can see the weight tends to increase when height increases")
```

```
## [1] "This is the linear regression lien generated from weight and height.
As we can see the weight tends to increase when height increases"
```