

1. `xyplot(height ~ weight | gender)`

sometimes produces the message

Error: could not find function "xyplot"

Why?

2. Write code to:

(a) create the matrix **M** using `cbind`

$$\begin{pmatrix} 1 & 6 & 4 \\ 3.4 & 0 & 9 \\ 6 & 4 & 2 \end{pmatrix}$$

(b) create a list **L** with three components

i. The matrix **M**

ii. The matrix **M** with 10 added to each entry

iii. The inverse of the matrix **M**

(c) extract the second component of the list as a matrix.

(d) calculate the sum of the entries in each matrix using `sapply`

3. Suppose **D** is a data frame with  $m$  columns of numeric data, some of which contain missing values. It is desired to impute the missing values. Firstly by the mean of the corresponding column and then using a more general prediction.

(a) Create a matrix of logical values named **isMissing**, indicating whether or not the corresponding entry in **D** is missing.

(b) Calculate a vector of column means for the data frame using `sapply`.

(c) Create a numeric matrix, called **Means**, the same dimensions as **D**, containing the relevant column mean for each entry, i.e  $\text{Means}[i, j] = \sum_j D[i, j]$  (Use the functions `matrix`, and `rep`, the latter with the `each` option.)

(d) Assign the entries in **Means** corresponding to true values in **isMissing** to the missing values in **D**.

4. Extend Q3 to a more sophisticated method of imputation: suppose **myPredictor** is a function with three arguments: a data frame, a row number and a column number, which returns a predicted value for the entry in that row and column based on the remaining data. (An example would be a predicted value from a linear regression of each column in turn on the others.)

Write a function which uses the ideas of the answer to Q3 but constructs the imputations by calls to **myPredictor**. For the purposes of this question, nested `for` loops are acceptable, although more elegant methods are possible. Your function should have a single argument, a data frame, with no default value, and return the same data frame after replacing any missing values by the imputation.