

PEC2_SAID_BOUATRA_BELOUAFI.R

saidbouatra

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```
getwd()
```

```
## [1] "/Users/saidbouatra/Statistical_software/statist_R_dev_git/StatS_P2"
```

```
setwd("/Users/saidbouatra/Statistical_software/statist_R_dev_git/StatS_P2")
```

```
# Ejercicio 1: Una técnica operatoria tiene un 4% de complicaciones.
```

```
# ¿Cuál es la probabilidad de que si se realiza la técnica 96 veces haya 2 complicaciones?
```

```
dbinom(2, size = 96 , prob = 0.04)
```

```
## [1] 0.1572464
```

```
# ¿Cuál es la probabilidad de que si se realiza la técnica 101 veces haya más de 4 complicaciones?
```

```
pbinom(4 , size = 101 , prob = 0.04 , lower.tail = FALSE)
```

```
## [1] 0.3791115
```

```
# Ejercicio 2: La duración media de la estancia hospitalaria de una enfermedad es de  $9 \pm 3$  días (media y desviación estándar).
```

```
# Suponiendo que se trata de una distribución normal, calcula la probabilidad de que una estancia dure más de 15 días.
```

```
pnorm(15,9,3) - pnorm(8,9,3)
```

```
## [1] 0.6078085
```

```
# Hallar el valor crítico de t para el que el área bajo la cola derecha de la f. de densidad de la variable t sea 0.05.
```

```
qt(0.05 , 16 , lower.tail = FALSE)
```

```
## [1] 1.745884
```

```
## Sección 2. Teorema Central del Límite.
```

```
# Ejercicio 4 (Demostración): A. Genera 100,000 valores aleatorios de acuerdo a una distribución uniforme.
```

```
set.seed(1234567)
```

```
a <- runif(100000 , min = 1 , max = 5)
```

```
c <- matrix(a,ncol = 20)
```

```
par(mfrow = c(3,3))
```

```
par(mar = c(1,1,1,1))
```

```
hist(c[,1],col = "orange")
```

```
hist(c[,2],col = "red")
```

```
hist(c[,3],col = "blue")
```

```
hist(c[,4],col = "pink")
```

```
hist(c[,5], col = "yellow")
```

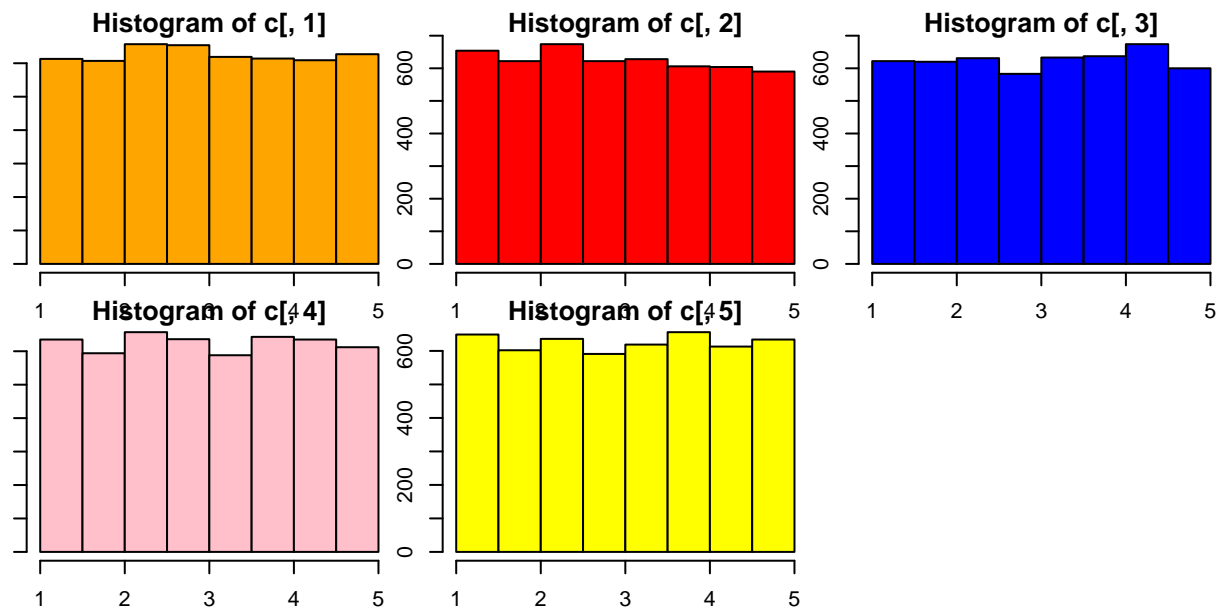
```
# C. Crea un vector que guarde la suma de los valores por fila.
```

```
v <- apply(c,1,sum)
```

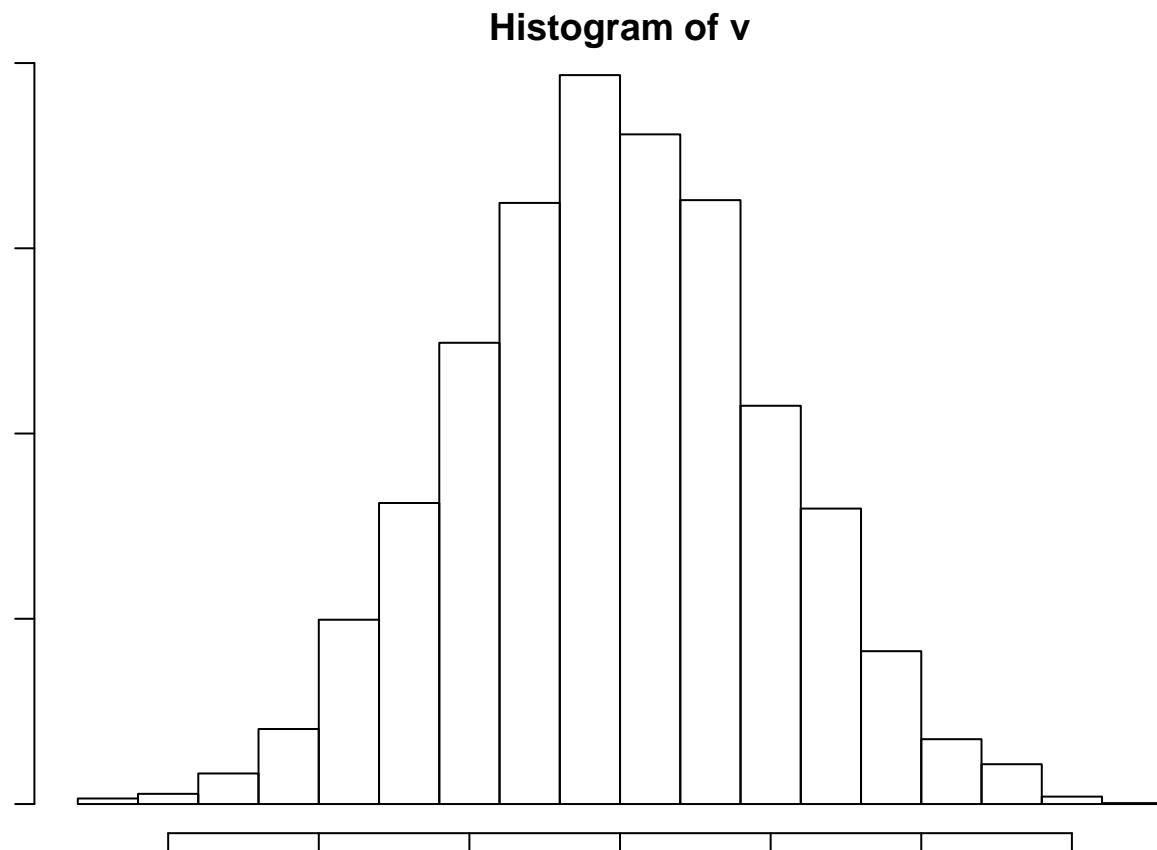
```
head(v,5)
```

```
## [1] 54.85704 54.97234 66.87867 64.64131 64.21087
```

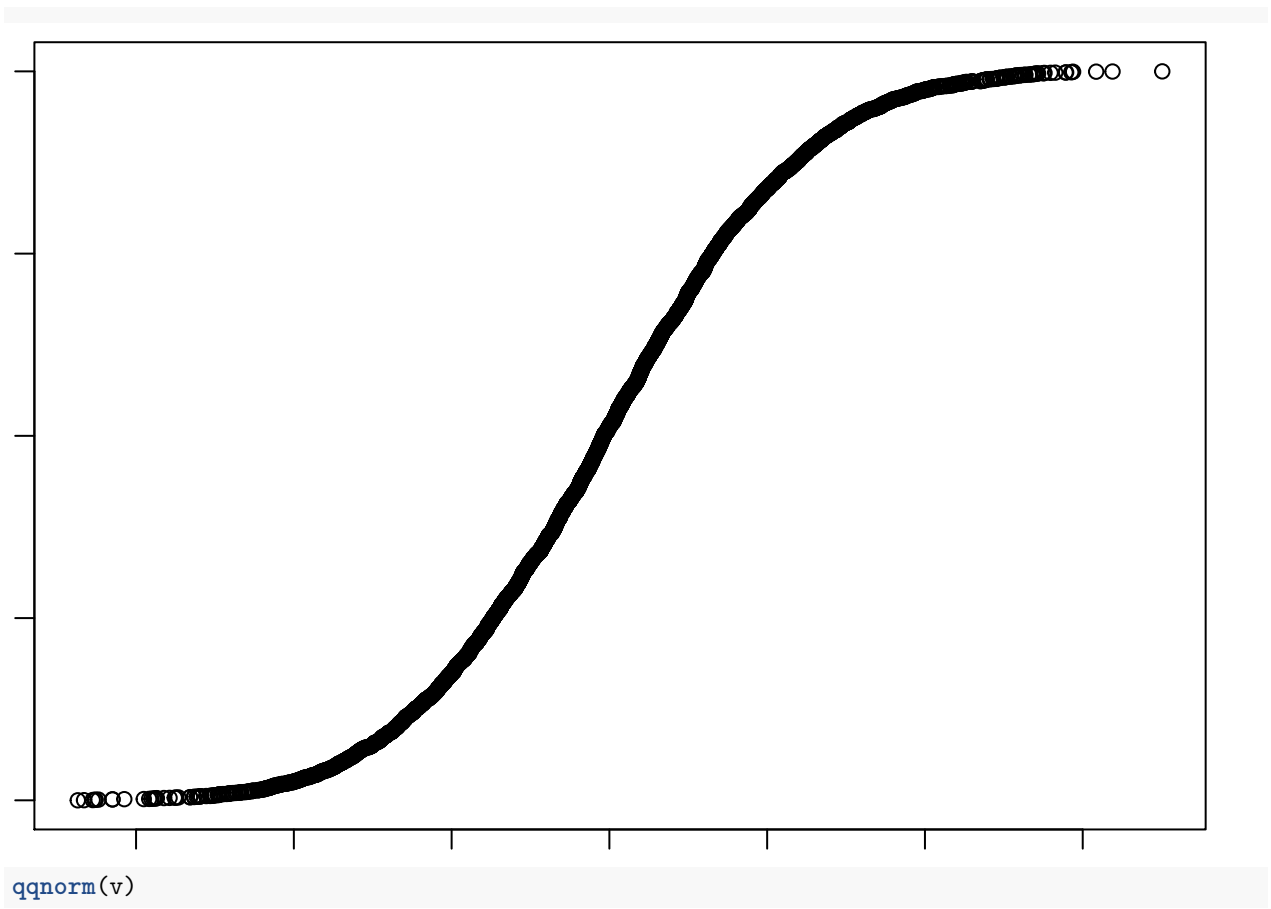
```
#Realiza un histograma con referencia a la distribución normal.
par(mfrow = c(1,1))
```

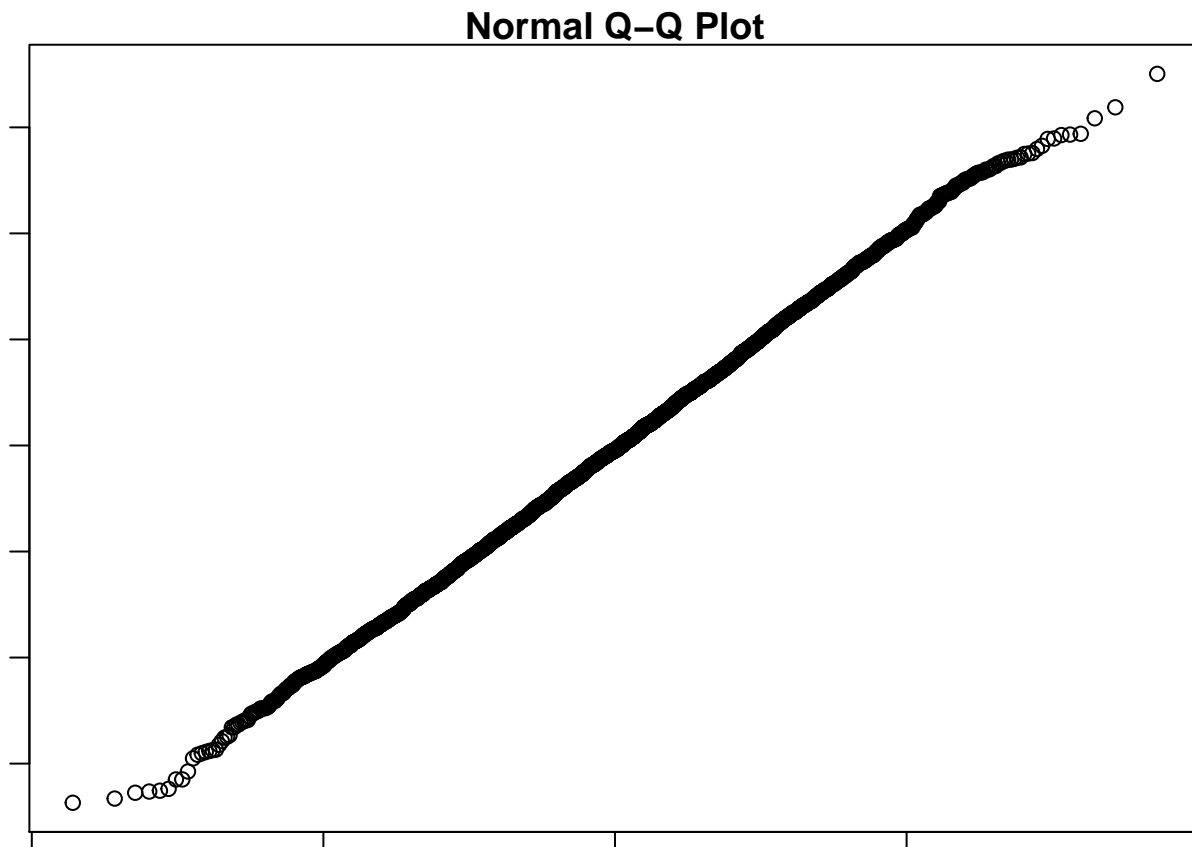


```
hist(v,breaks = "Sturges")
hist(dnorm(a), mean(a),sd(a),add = TRUE ,col = "red")
```



```
# diagrama cuantil-cuantil (qq.plot) con referencia a la distribución normal.
qqplot(v,a)
```





```
# Sección 3. Funciones y estructuras de control.
# Ejercicio 6
check_natural <- function(x) {
  divisores <- c()
  if (as.integer(x) == x) {
    cat(x, " es natural y sus divisores son:", "\n")
    for (i in (1:x)) {
      if (x %% i == 0) {
        divisores <- c(i)
        cat(divisores, sep = "\n")
      }
    }
  } else {
    warning(x, " no es un numero natural")
  }
}

# ejecutamos dos numeros para verificar la funcion check_natural.
check_natural(6)
```

```
## 6 es natural y sus divisores son:
## 1
## 2
## 3
## 6
```

```
check_natural(5.5)
```

```
## Warning in check_natural(5.5): 5.5 no es un numero natural
```

Ejercicio 7

```
my_fibo <- function(n) {  
  fibonacci <- numeric(n)  
  fibonacci[1] <- fibonacci[2] <- 1  
  for(i in 3:n) {  
    fibonacci[i] <- fibonacci[i - 2] + fibonacci[i - 1]  
    print(fibonacci[i])  
  }  
}  
my_fibo(12) # solo para verificar la funcion.
```

```
## [1] 2  
## [1] 3  
## [1] 5  
## [1] 8  
## [1] 13  
## [1] 21  
## [1] 34  
## [1] 55  
## [1] 89  
## [1] 144
```

Ejercicio 8: Centrémonos en la familia "Apply". Explica para qué usamos estas funciones y genera un ejemplo.

*# la familia de funciones "apply" son una familia de funciones vectorizadas , que se pueden aplicar a arrays
la familia apply esta compuesta por la funciones : "apply" , "lapply" , "sapply" , "tapply", "mapply"*

empezamos con la funcion "apply" , esta funcion se define por tres argumentos :

apply(x , margin , fun)

x: es el objeto al que le aplicaremos la funcion , puede ser un array , matriz o vector .

margin : nos dice a que array aplicaremos la funcion si margin = 1 significa que lo aplicaremos a las columnas

fun : es la funcion que queremos aplicar con apply a los datos , i.e : sum , mean ,... o puede ser cualquier funcion

ejemplo :

creamos una matriz de 3x2

```
mi_matriz <- matrix(1:6,nrow = 3 , ncol = 2)  
mi_matriz
```

```
##      [,1] [,2]  
## [1,]    1    4  
## [2,]    2    5  
## [3,]    3    6
```

ahora queremos sumar los valores que hay en cada columna .

```
apply(mi_matriz,2,sum)
```

```
## [1]  6 15
```

se puede usar con otro tipo de datos , pero primero tienen que ser "coerced" con as.matrix o as.array

lapply : se diferencia de apply es que opera sobre listas , devuelve listas del mismo tamaño . tambien

creamos 3 listas (A,B,C)

```
A <- matrix(1:6 , nrow = 3, ncol = 3)
```

```
B <- matrix(6:12 , nrow = 3, ncol = 3)
```

```
## Warning in matrix(6:12, nrow = 3, ncol = 3): la longitud de los datos [7]
```

```
## no es un submúltiplo o múltiplo del número de filas [3] en la matriz
```

```
C <- matrix(12:18 , nrow = 3 , ncol = 3)
```

```
## Warning in matrix(12:18, nrow = 3, ncol = 3): la longitud de los datos [7]
## no es un submúltiplo o múltiplo del número de filas [3] en la matriz
```

```
mi_lista <- list(A,B,C)
```

```
mi_lista
```

```
## [[1]]
##      [,1] [,2] [,3]
## [1,]    1    4    1
## [2,]    2    5    2
## [3,]    3    6    3
```

```
##
## [[2]]
##      [,1] [,2] [,3]
## [1,]    6    9   12
## [2,]    7   10    6
## [3,]    8   11    7
```

```
##
## [[3]]
##      [,1] [,2] [,3]
## [1,]   12   15   18
## [2,]   13   16   12
## [3,]   14   17   13
```

```
# aplicamos lapply para extraer ,por ejemplo , datos en la primera fila y primera columna.
```

```
lapply(mi_lista,"[,1,1)
```

```
## [[1]]
## [1] 1
##
## [[2]]
## [1] 6
##
## [[3]]
## [1] 12
```

```
# una vez ejecutada , tenemos el resultado en forma de lista . con la anotacion
# [[ ]] con un numero dentro que indica su posicion en la lista .
# "[" esta anotacion hace la funcion de operador para seleccionar solamente lo que le pedimos.
```

```
# sapply : hace lo mismo que lapply , solo que en vez de devolver una lista , devuelve el resultado en
# el mismo codigo anterior (lapply), lo utilizaremos para ver un ejemplo con sapply.
```

```
mi_lista
```

```
## [[1]]
##      [,1] [,2] [,3]
## [1,]    1    4    1
## [2,]    2    5    2
## [3,]    3    6    3
```

```
##
## [[2]]
##      [,1] [,2] [,3]
```

```
## [1,]    6    9   12
## [2,]    7   10    6
## [3,]    8   11    7
##
## [[3]]
##      [,1] [,2] [,3]
## [1,]   12   15   18
## [2,]   13   16   12
## [3,]   14   17   13
```

```
sapply(mi_lista,"[,1,1)
```

```
## [1]  1  6 12
```

```
# tapply : tapply(x, INDEX, fun ) , esta funcion lo que hace es aplicar la funcion, argumento 3, (fun =
# ejemplo :
x <- seq(1, 20 ,by = 1)
y <- sample(c("black","white") , 20 , replace = TRUE)
tapply(x,y,sum)
```

```
## black white
```

```
##    101    109
```

```
# mapply : mapply(FUN, ...,) realiza operaciones entre los matrices y devuelve una lista o un vector.
# aplica la funcion fun ( primer argumento) , por ejemplo:
```

```
mapply(sum, 1:3 , 2:4) # lo que hace mapply es sumar el primer elemnto de la matriz 1:3 (que es 1) con
```

```
## [1] 3 5 7
```

```
# vapply : es parecida a lo que hace sapply , solo que Devuelve un vector con la longitud que tiene cad
# ejemplo
```

```
x <- list(A = 1, B = 1:4, C = 1:9)
vapply(x ,FUN = sum , FUN.VALUE = 0)
```

```
##  A  B  C
```

```
##  1 10 45
```

```
# Sección 4. Gráficos.
```

```
# Ejercicio 10
```

```
# A : Diagramas de Venn.
```

```
# Un diagrama de Venn usa círculos que se superponen u otras figuras para ilustrar las relaciones lógicas
# A menudo, se utilizan para organizar cosas de forma gráfica, destacando en qué se parecen y difieren
```

```
# B :
```

```
library(gplots)
```

```
##
```

```
## Attaching package: 'gplots'
```

```
## The following object is masked from 'package:stats':
```

```
##
```

```
##      lowess
```

```
oneName <- function() paste(sample(LETTERS,5,replace = TRUE),collapse = "")
geneNames <- replicate(1000, oneName())
GroupA <- sample(geneNames, 400, replace = FALSE)
```

```

GroupB <- sample(geneNames, 750, replace = FALSE)
GroupC <- sample(geneNames, 250, replace = FALSE)
GroupD <- sample(geneNames, 300, replace = FALSE)
input <- list(GroupA, GroupB, GroupC, GroupD)
input

```

```

## [[1]]
## [1] "CMDNR" "OYQVW" "HHLVV" "QBWCR" "SHTM" "UKALN" "ZTLKT" "ITTRD"
## [9] "HWALR" "IARAE" "AYRYR" "SFEQL" "OXFIH" "SKPKL" "DECMT" "TUMPO"
## [17] "ZMRMF" "QRZFH" "IJCWM" "IDBDX" "ELEQX" "QAAPO" "QQJIR" "PETCE"
## [25] "NTBXH" "ZVSPE" "CBHYG" "ZCAJE" "OUYDD" "EJBSI" "JEAZE" "HNSIY"
## [33] "GRHXN" "FMJAI" "RQVUE" "GBXSZ" "ZZPPS" "UONU" "BLTYT" "BCVQM"
## [41] "EOXCU" "TVDNX" "KZKGR" "HTWVK" "YZBCT" "HELSD" "HBSMR" "EBTMC"
## [49] "RVHTW" "SONMW" "HZXEY" "ZVMJH" "UKOPL" "JKNZ" "ULRJR" "NUUBH"
## [57] "BOFRG" "IKEOI" "ZPNEL" "OIJJV" "XXUWB" "LNQNG" "NWKTA" "UZMWI"
## [65] "ZNJYG" "MCOJN" "TXPOM" "NTKFC" "WSPEA" "LNVDI" "EWEVR" "GYFZG"
## [73] "QOBIG" "WNMHF" "HCHMH" "WGSNC" "IPUTZ" "IWMRA" "ZRALR" "WLIPY"
## [81] "PFNXW" "PXPDY" "ZNBWT" "GBSWT" "CFAZN" "XLLAF" "IZQZO" "QKWKN"
## [89] "PXXSD" "WXIQR" "IOLGZ" "GOLYR" "KDSOE" "OEVFJ" "VVRWS" "YGUKV"
## [97] "IIPSC" "UOQUC" "VMBEV" "CFBCH" "ANRHU" "EDKTJ" "IYOPW" "NLYEO"
## [105] "SOUJG" "ZMCHY" "YJNHY" "PIAZG" "DLRFK" "MWVIO" "JELRU" "SQALF"
## [113] "SIXUQ" "QFICL" "JJGTW" "WKIUH" "HDIKZ" "BGSKL" "EWSOF" "DUYPO"
## [121] "RKMZA" "VPXXE" "BKPXH" "EDIID" "XYTTS" "YHMDN" "BNVRY" "YTDEX"
## [129] "BGXXK" "EJLAM" "XYRWF" "XVCKO" "WZIFA" "KKSBB" "XWCYD" "BYMRZ"
## [137] "SVNGA" "GGCWH" "CXEIM" "CVLNQ" "FFXZG" "KUTYS" "YKMZF" "MQJGP"
## [145] "ETOVJ" "PUGVD" "EEDQS" "CSDNT" "KGFLU" "JPYEE" "MVNJB" "CHKAE"
## [153] "ADVLE" "XAEKI" "KCIAN" "QNJEB" "QXRDE" "ZUQSO" "WDOLG" "BASNW"
## [161] "HQZLS" "EERPJ" "ETMRR" "OUOSG" "YHZXL" "MSEDY" "QGPJQ" "NNOJF"
## [169] "OWPAK" "XXVNT" "AJQXA" "JLHMZ" "IMCHX" "XJYLP" "FVAYT" "MINQK"
## [177] "AASTM" "TBRWV" "VKAHG" "HVJXG" "GSXZE" "KGBKR" "AFOAM" "LYDJO"
## [185] "ZXODP" "MPKX" "JKRTJ" "XWBN" "ENKSB" "KKFZF" "ZIFEK" "OWTYN"
## [193] "TIZLP" "YMFNG" "QKXNP" "HUZCE" "MUUPV" "KGWJN" "XBAOW" "DZZLE"
## [201] "BSOWO" "PLZBM" "MUXMJ" "KCYBN" "NOLOQ" "DHHRU" "IKBWD" "CJZHD"
## [209] "NAQKS" "QTVUX" "HLTJV" "IGOLM" "PDVQN" "DBTET" "FPNYN" "KTFC"
## [217] "HEUTV" "FYVVB" "KZTIT" "CFHXH" "LXPIC" "TLGSD" "URXTM" "FBRHP"
## [225] "UXABX" "KJSM" "SESRG" "UYVKH" "OHRKX" "EXGJC" "VYZHZ" "VQQZI"
## [233] "LWLD" "TMLMF" "NLTI" "GZLND" "LEMP" "DFJWQ" "GCRJS" "BXXFD"
## [241] "LYMAY" "JNTBS" "QQZXB" "QKWBG" "RDBH" "NVDWG" "HRXWF" "TZIY"
## [249] "DXAQ" "BENMS" "GJIUT" "GROAP" "YRLAH" "DSAGX" "GSGWW" "KUNYV"
## [257] "OCCON" "WMNMV" "UGNVJ" "LTGJZ" "XVKWJ" "XRBQB" "RIINJ" "PCXRB"
## [265] "QTOFV" "PRBMO" "SJLSG" "JJFYJ" "EXQHE" "JWRME" "QRNNF" "LAPGA"
## [273] "LJQIV" "VZOHB" "BKSBV" "KZTYE" "XMIYE" "SGAMA" "ZCVMQ" "MNYIY"
## [281] "RBDIC" "HBQED" "VHPSN" "LRZGP" "DACSU" "BMSLY" "EXPYU" "QXCTS"
## [289] "VTYTW" "HQVPY" "CZWWT" "DLRQB" "AIECX" "GEOBO" "RPORY" "YOSPN"
## [297] "SYKNP" "EIQXW" "AGIEF" "AAKQK" "IQQIM" "SMQEB" "MUGOV" "PCEVM"
## [305] "UNPEW" "KSHXE" "VXPYC" "WFRRH" "AZNYU" "AXCBG" "FEXDQ" "COMOM"
## [313] "EQBFA" "EGOZT" "NMXUH" "GYHHA" "SVCTH" "WEGOE" "ETCIK" "HQEOJ"
## [321] "KDFDS" "QLXQY" "IMSMX" "LNRJU" "YCVCV" "PEOYJ" "VIMDV" "RHAFP"
## [329] "CTMCS" "NPOJQ" "YSVHD" "UUOWM" "XNAUB" "TYWXP" "ZGCHX" "OUZRW"
## [337] "OUXHD" "PXCED" "POMUD" "XASWB" "MBSYF" "XLRWQ" "JLSBH" "AXYAP"
## [345] "CRAES" "JTRCE" "IHPDA" "SBDFJ" "VLQMW" "OUQYQ" "PKSEF" "IBKIB"
## [353] "JANZU" "YUKXY" "IOIHQ" "QWEXJ" "YWLOQ" "AWLLU" "BWJYY" "JWYFK"
## [361] "PEURR" "QBGDV" "VSZXU" "YSAYP" "DHTMH" "EDGDB" "YCVRN" "HUXBN"
## [369] "UYVYR" "DZELD" "FWTCI" "BQIJY" "TLUSQ" "WGQAN" "QQFQZ" "FRCOU"

```



```

## [377] "FVVLR" "MNFSJ" "VLMBN" "VMBIE" "QBTMJ" "FAWDJ" "RVQLO" "SAYXT"
## [385] "ANGJM" "MIHIM" "FTAJ0" "SCWOV" "EFQFM" "OKCFQ" "IYYYG" "IPXTA"
## [393] "YIFTI" "EWPEN" "BQU00" "YADFU" "ZCXNQ" "OYETP" "CJLLT" "IWZTJ"
##
## [[2]]
## [1] "WZIFA" "FBRHP" "OWPAK" "XCLPO" "NLPSF" "UAWRX" "ITTRD" "IPXTA"
## [9] "RJFYU" "EJUXD" "KYOBN" "FVAYT" "BENMS" "OEVFJ" "IMSMX" "SGPIW"
## [17] "FGNKR" "XNAUB" "XSPYA" "NPKYL" "SYUAH" "BQU00" "CBOMC" "ZSJJO"
## [25] "MWDQF" "QZRDY" "NNUFF" "DJCTQ" "WDWSD" "IUYIS" "UFCST" "ZVOFG"
## [33] "YZBCT" "MTBOK" "SGJEL" "NYBTR" "CMDNR" "VKAHG" "PEURR" "JELRU"
## [41] "RBDIC" "IKMCR" "SFDHY" "CKTMQ" "ORYFJ" "YPISM" "EOIPX" "MHMEW"
## [49] "IYYYG" "ELEQX" "IBHAG" "KAGKC" "XTNJU" "AWTAI" "NUUBH" "OONAD"
## [57] "XJYLP" "MOFTD" "LHBZO" "YTDEX" "AKJID" "GHPXP" "KREPC" "OMIPL"
## [65] "BTPHV" "UNPEW" "OPARJ" "TLDES" "HZXEY" "YUWFH" "WKIUH" "RKMZA"
## [73] "KDMLD" "EHXZB" "IWRIU" "DXFJY" "BGXXK" "JCDRP" "LPLVS" "FVVLR"
## [81] "IIPSC" "QVVFJ" "IOIHQ" "BWIDQ" "HEUTV" "HORPS" "VZOHB" "DSAGX"
## [89] "RDBBH" "PEOYJ" "YCVRN" "NLWHF" "ONKTO" "PNCYV" "IWTGR" "RJCON"
## [97] "PSCAP" "PFWCC" "PUGVD" "ZWZHW" "URGSA" "ZAM0J" "ZLAZK" "URXTM"
## [105] "ESVXX" "PLZBM" "YHMQM" "KSHXE" "PSDGI" "EXMXQ" "ZIFEK" "ZTLKT"
## [113] "OYETP" "EDIID" "FEXDQ" "MBSYF" "QKTJW" "XYRWF" "TQRIU" "OCYKX"
## [121] "ROBQV" "VIMDV" "XUDBK" "QXCTS" "CXKNE" "UONUI" "WOUYR" "NYGQH"
## [129] "YWUBM" "UAAIP" "NOSOR" "ADVLE" "LWTEM" "ENVBV" "SSLHS" "QTOFV"
## [137] "RCPEJ" "CLJDJ" "HQVPY" "NKWTQ" "EPROV" "CVMAH" "XRBQB" "ICSIG"
## [145] "RHEWE" "GJIUT" "VMBIE" "FRCOU" "VLWMQ" "XMIYE" "KDFDS" "BKNPY"
## [153] "NWMBH" "CFGZH" "QOBIG" "BYMRZ" "EETVV" "ANGJM" "SOUJG" "YVAJN"
## [161] "YLYRN" "AFCNG" "QKWKX" "PFNXW" "HDBHU" "VHPSN" "HDSYL" "QAAPO"
## [169] "WREAN" "VHOIE" "IPHWQ" "PDYPL" "TZIIY" "FZOLP" "OBBJT" "ANRHU"
## [177] "AIBKZ" "RKWEA" "JEFSW" "ZYBQF" "RPORY" "OEYJI" "EEDQS" "IYOPW"
## [185] "GBZBK" "TDLTQ" "PETCE" "PPQSM" "QGPJQ" "WMCUC" "TBYFV" "IKBWD"
## [193] "EPERH" "RQWCS" "WDOLG" "GZTJS" "JZQDA" "TQQGZ" "MUGOV" "IWBVL"
## [201] "RZBUG" "KGFLU" "HUXBN" "IRNMM" "CMFJB" "KNLTT" "URWPK" "GGCWH"
## [209] "NWRJT" "RZIRF" "DJONX" "GZZXA" "URJXD" "NBOHJ" "EERPJ" "LUKAC"
## [217] "HVJXG" "JAQNI" "SQSHB" "NNOJF" "KZTYE" "UYVYR" "WAPNJ" "AKDOY"
## [225] "LYDJO" "TSSQJ" "SVCTH" "FXDRG" "PXCED" "IGNHG" "SIXUQ" "EXQHE"
## [233] "VHVJE" "GVITY" "PXXSD" "VVMAS" "HDDON" "PXPDY" "BNBGM" "GENLX"
## [241] "VDUSC" "DXAQC" "QATWU" "BWJYY" "RVHTW" "NYWMB" "LNRJU" "QBWCR"
## [249] "PSPVL" "QKWBG" "CNYCJ" "KUNYV" "DFJWQ" "BKPXH" "PAPTI" "ULRJR"
## [257] "WCKFT" "OATQZ" "DHTMH" "MDNCE" "QAKHO" "VXDVS" "UPAFX" "LNWXT"
## [265] "VPXXE" "RVQLO" "WWCAA" "EOSJW" "JEEJB" "IDBDX" "JPYEE" "AGIEF"
## [273] "MWVCJ" "OVNSA" "NPOJQ" "CDGXN" "HHCNP" "HCHMH" "EVSDY" "LQUFC"
## [281] "HCJWJ" "IHASS" "QAIKB" "UZMWI" "LJNHY" "IAWKH" "VBTUI" "GBSWT"
## [289] "IZQZO" "LXFWW" "DPRTB" "XXUWB" "ULQZC" "UGNVJ" "TIZLP" "GQOMJ"
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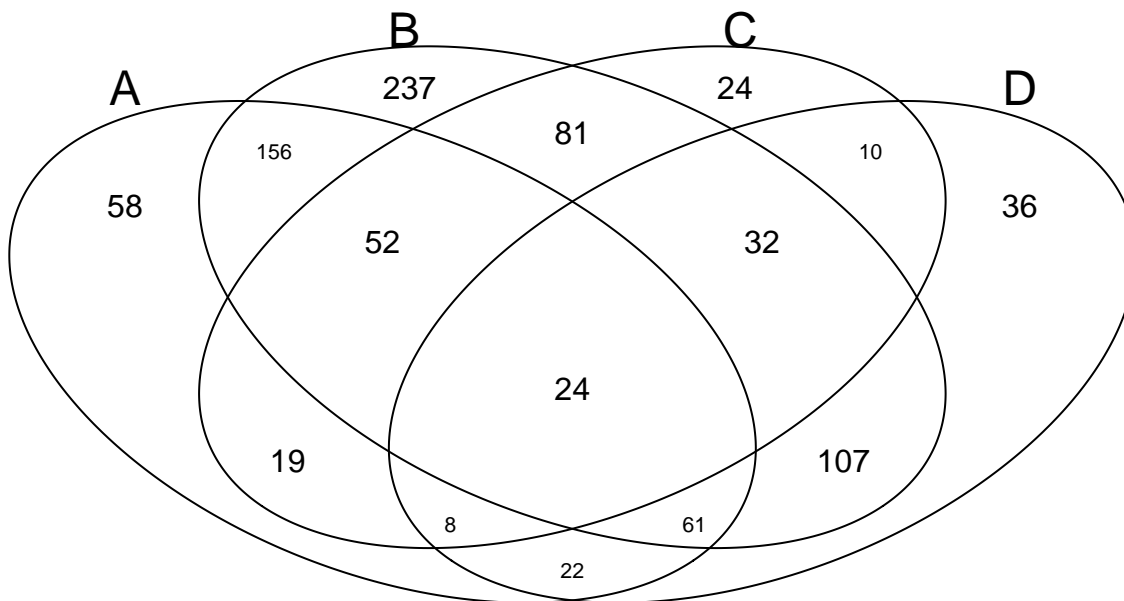
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## [297] "QDDXD" "OSECG" "MDRFK" "YCVCV"
```

```
venn(input)
```



```
# primero instalamos paquete "gplots" para poder visualizar los diagramas de Venn.
# creamos una fx "oneName" que crea un muestreo de 5 letras juntas entre "" .
# creamos un vector "geneNames" de 1000 combinaciones de oneName.
# creamos 4 grupos a partir de geneNames de diferente tamaños de forma aleatoria.
# creamos una lista con los 4 grupos , que seria el conjunto de datos.
# representamos el conjunto "input" a traves de diagramas de Venn , ejecutando la fx "venn".
# lo que vemos en la representacion de los diagramas de venn , es las intersecciones entre grupos y el
# si como ejemplo cojemos el Grupo A , vemos que tiene :
# 57 elementos no compartidos con ningun otro grupo
# y que comparte con el GroupB : 152 + 56 + 25 + 75 = 308 elementos.
```

```
# C. A partir de los datos siguientes:
```

```
x <- c(1,3,5,7,9)
```

```
y <- c(2, 4, 6, 8)
```

```
z <- matrix(runif(20, 1, 10), 5, 4)
```

```
order(x) # ordenamos los dos vectores x , y para poder repesentar graficamente un contour()
```

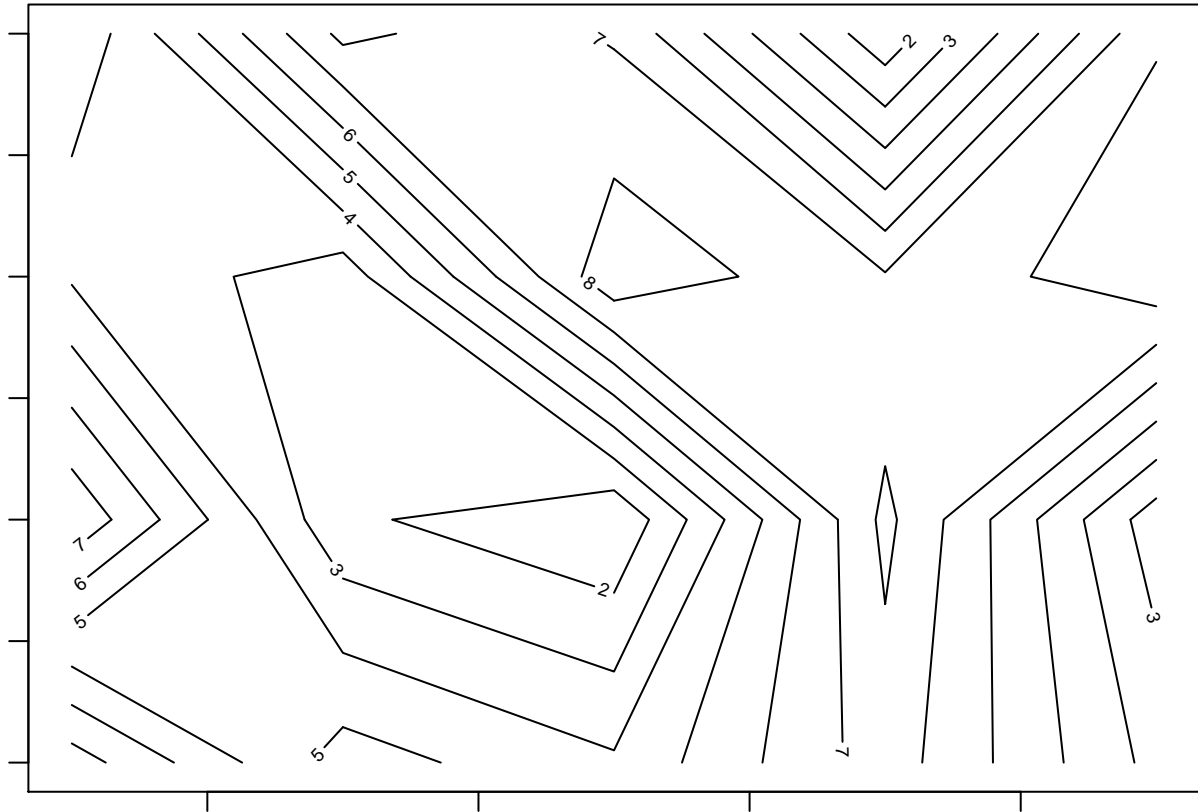
```
## [1] 1 2 3 4 5
```

```
order(y)
```

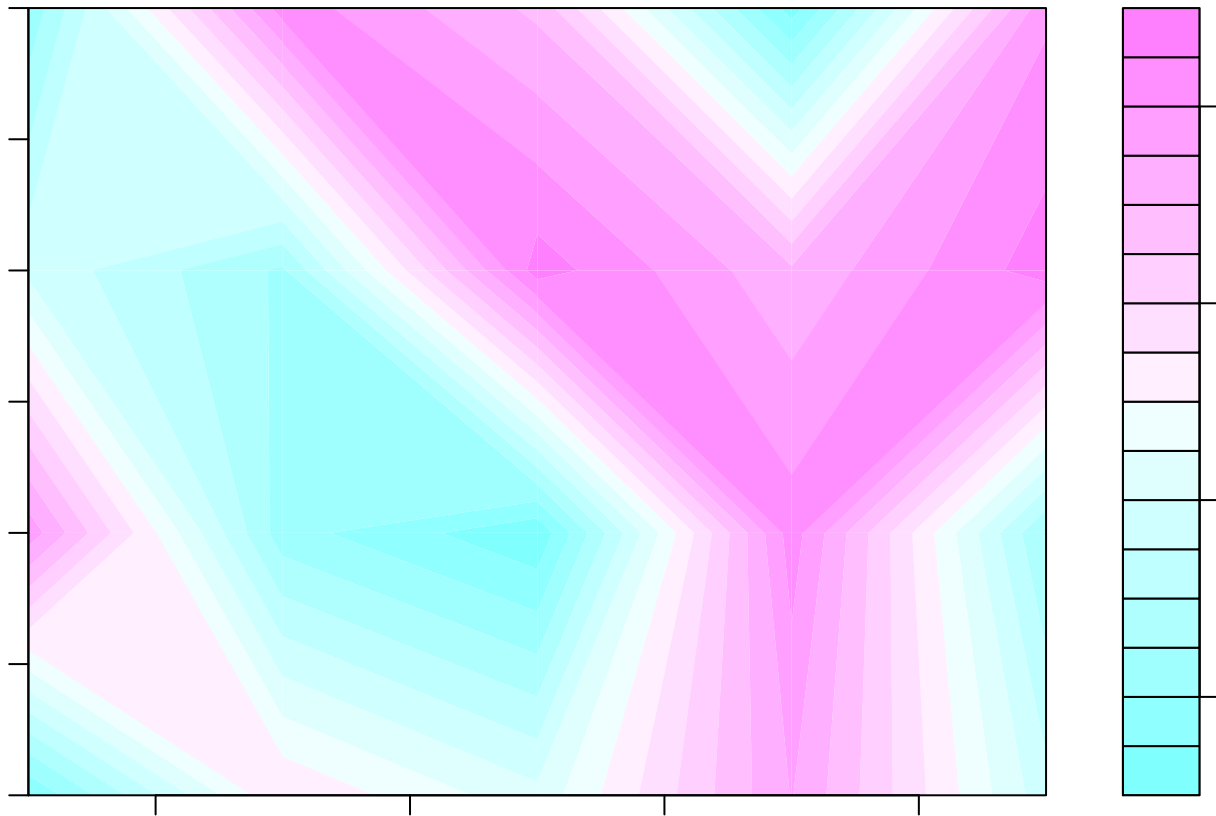
```
## [1] 1 2 3 4
```

```
# library(ggplots2) # me da error por este paquete no es disponible para la version 3.4.2 .
```

```
contour(x,y,z) # se representa sin poder hacer mucha modificaciones en los argumentos .
```



```
filled.contour(x,y,z)
```



```
# la funcion "contour" representa graficamente las isolneas de la matriz "z" respecto a lo vectores "x"  
# las isolneas representan valores constantes de z respecto a x,y.
```

```
# Sección 5
```

```
# heatmap es herramienta pra analizar y representar graficamente los datos de una matriz dando a cada v  
# los heatmaps tienen muchas aplicaciones , desde mapas del tiempo , visitas a paginas web , marketing  
# son muy usados en ciencias naturales , especialmente en biologia molecular .  
# en biologia molecular se usa para visualizar genes y interpretar sus expresiones.  
# tambien para identificar los genes que comunmente regulados , o relacionados con alguna patologia.
```

```
# B. Ejecuta el siguiente código para jugar con una aplicación.
```

```
# he instalado este paquete , porque me daba error instalar ggplot2 .  
library(shiny) # los siguientes pasos me daba error ,  
# " Error in library(heatmaply) : there is no package called 'heatmaply'"  
library(heatmaply)  
library(shinyHeatmaply)  
runApp(system.file("shinyapp", package = "shinyHeatmaply"))
```