# 15FuncionesEstadisticasBasicas_cheatsheet.R

moka

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```
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# Fecha: 12.04.2023
# Objetivo:
# Referencia: Basado en R Programming Fundamentals, StanfordOnline XDFS112
```

```
require(ggplot2)
library(dplyr)
# Limpiar el espacio de trabajo
rm(list=ls())
```

```
# Configurar el directorio
```

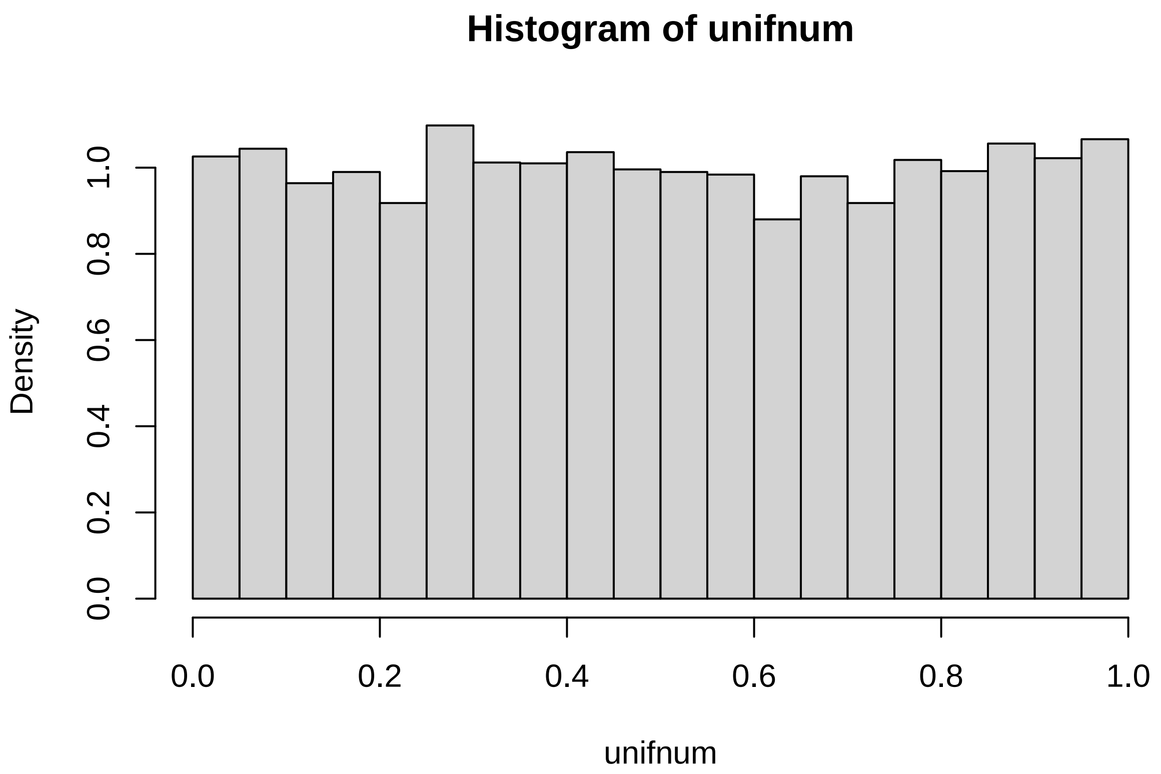
```
midirectorio<-setwd("~/Dropbox/0.POST-PHD/GOALS/2.CODE/R/Ecomienza/15FuncionesEstadisticasBasicas")
midirectorio
```

```
## [1] "/Users/moka/Dropbox/0.POST-PHD/GOALS/2.CODE/R/Ecomienza/15FuncionesEstadisticasBasicas"
```

```
# Establecer la semilla
set.seed(1)
```

```
# Generarara numeros aleatorios
```

```
? Distributions

# Distribucion uniforme
unifnum=runif(10000,0,1)
hist(unifnum,freq=F)
```



```
summary(unifnum)
```

```
##      Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
## 0.0001064 0.2525854 0.4957413 0.5001680 0.7568858 0.9999306
```

```
# Cambiar el intervalo a -10,10

# Para simulaciones es mejor utilizar  replicate(), apply(), tambien es mejor usar funciones que ya han
reps=10000
system.time(x1<-colSums(matrix(runif(100*5),nrow=5)))
```

```
##    user  system elapsed
##       0       0       0
```

```
system.time(x1<-apply(matrix(runif(100*5),ncol=5),2,sum))
```

```
##    user  system elapsed
##   0.000   0.000   0.001
```

```
system.time(x1<-lapply(1:reps,function(i){sum(runif(n=5))}))
```

```
##    user  system elapsed
##   0.013   0.001   0.013
```

```
system.time(x1<-sapply(1:reps,function(i){sum(runif(n=5))}))
```

```
##    user  system elapsed
##   0.014   0.001   0.014
```

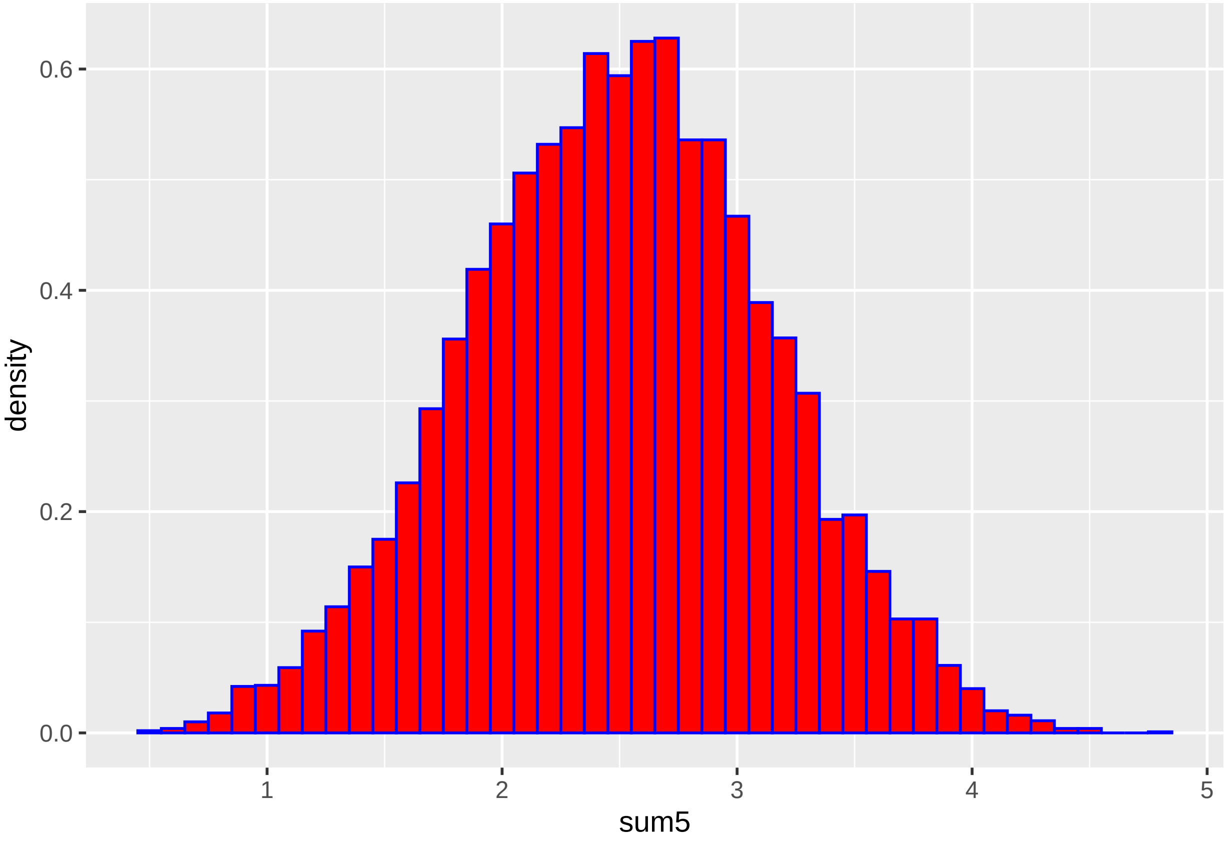
```
system.time(sum5<-replicate(reps,sum(runif(5))))
```

```
##    user  system elapsed
##   0.012   0.001   0.013
```

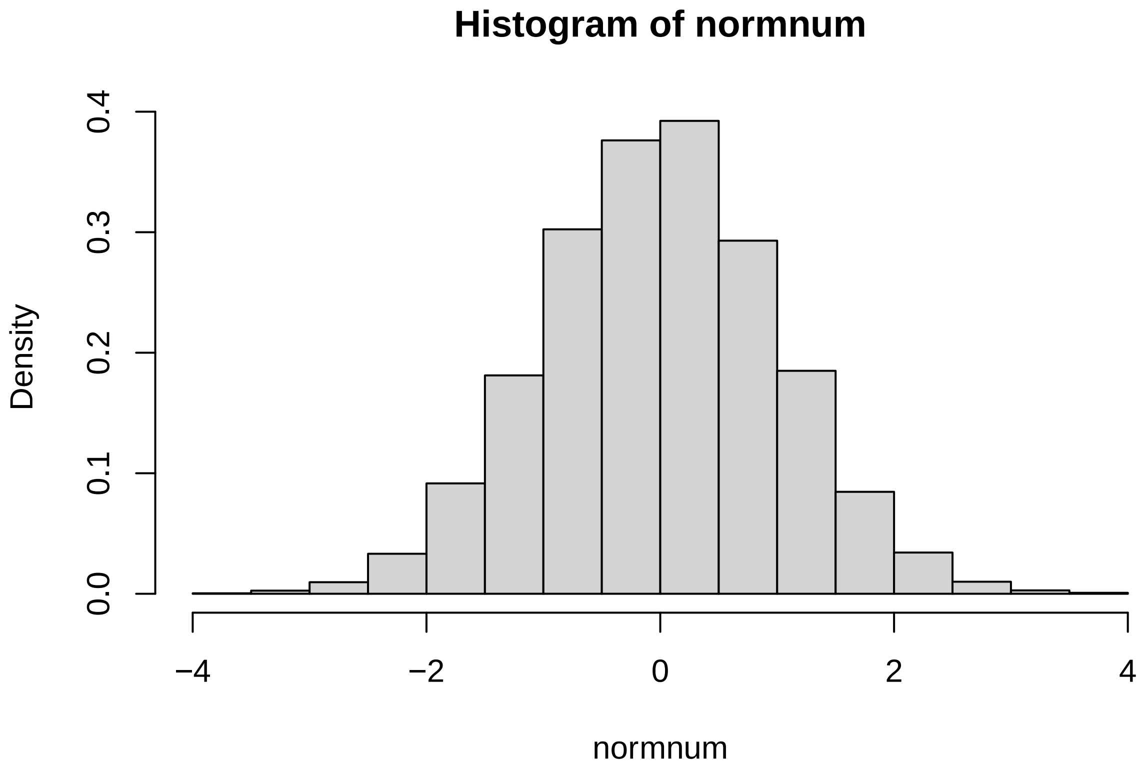
```
d5=data.frame(sum5)
summary(sum5) # Simetrica, media y mediana iguales.
```

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##  0.4766  2.0565  2.5073  2.4985  2.9341  4.7685
```

```
# Para usar ggplot2, primero hay que declarar dataframe y la variable
#luego el tupo de grafico.
ggplot(d5,aes(sum5))+geom_histogram(aes(y=..density..),binwidth=0.1,color="blue",fill="red")
```



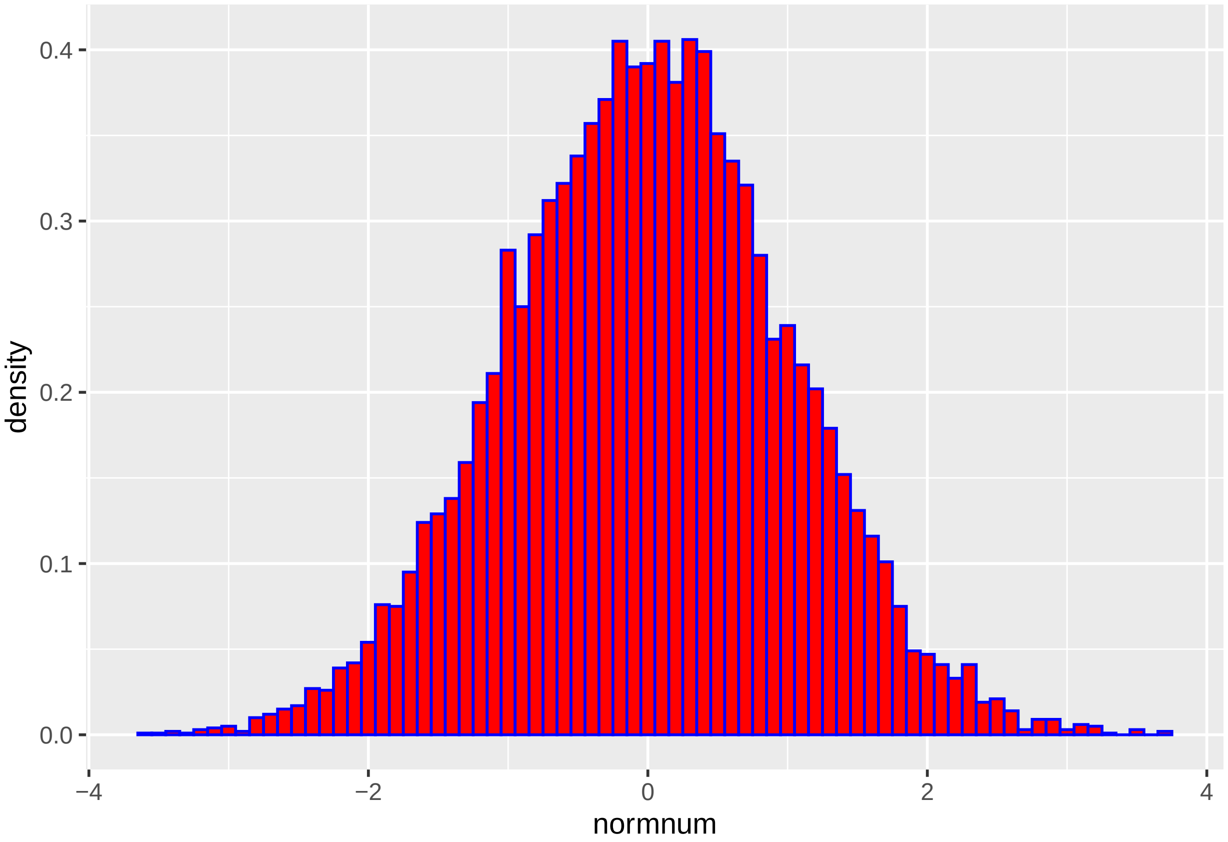
```
?geom_histogram


# Distribucion normal
normnum=rnorm(10000,0,1)
dn=data.frame(normnum)
hist(normnum,freq=F)
```



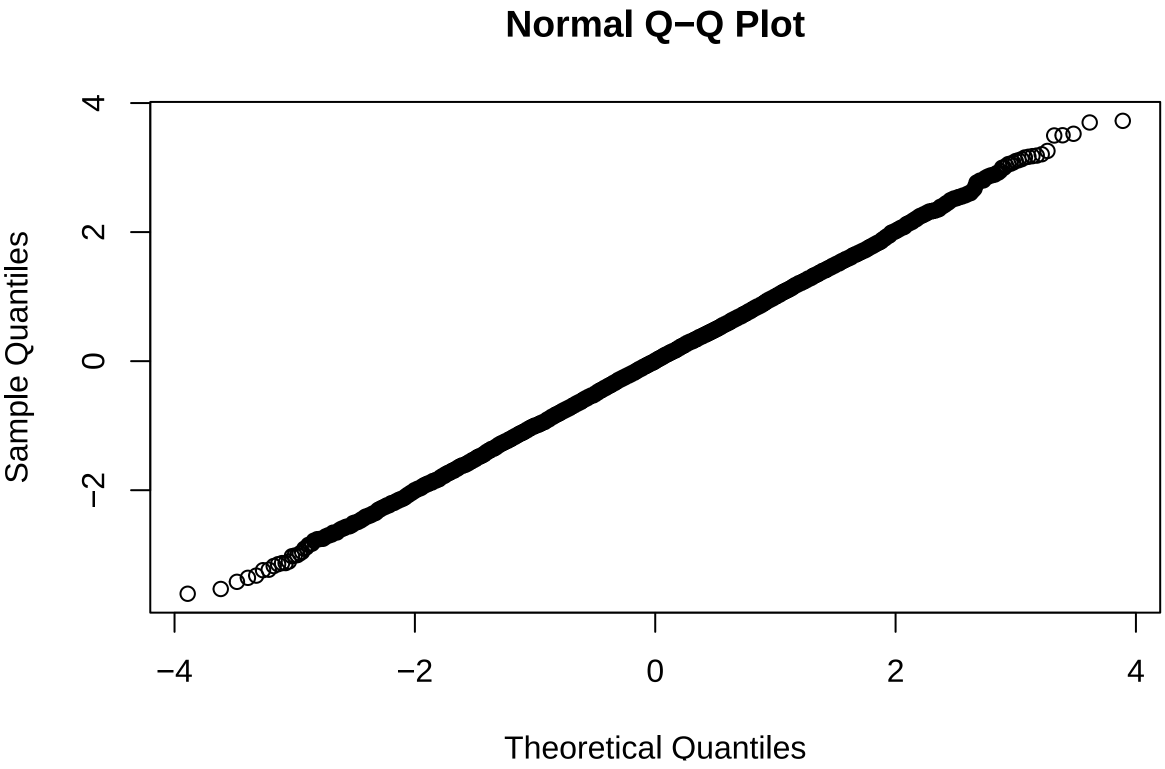
```
summary(normnum)
```

```
##      Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
## -3.604587 -0.680872  0.003936 -0.001864  0.663745  3.724271
```

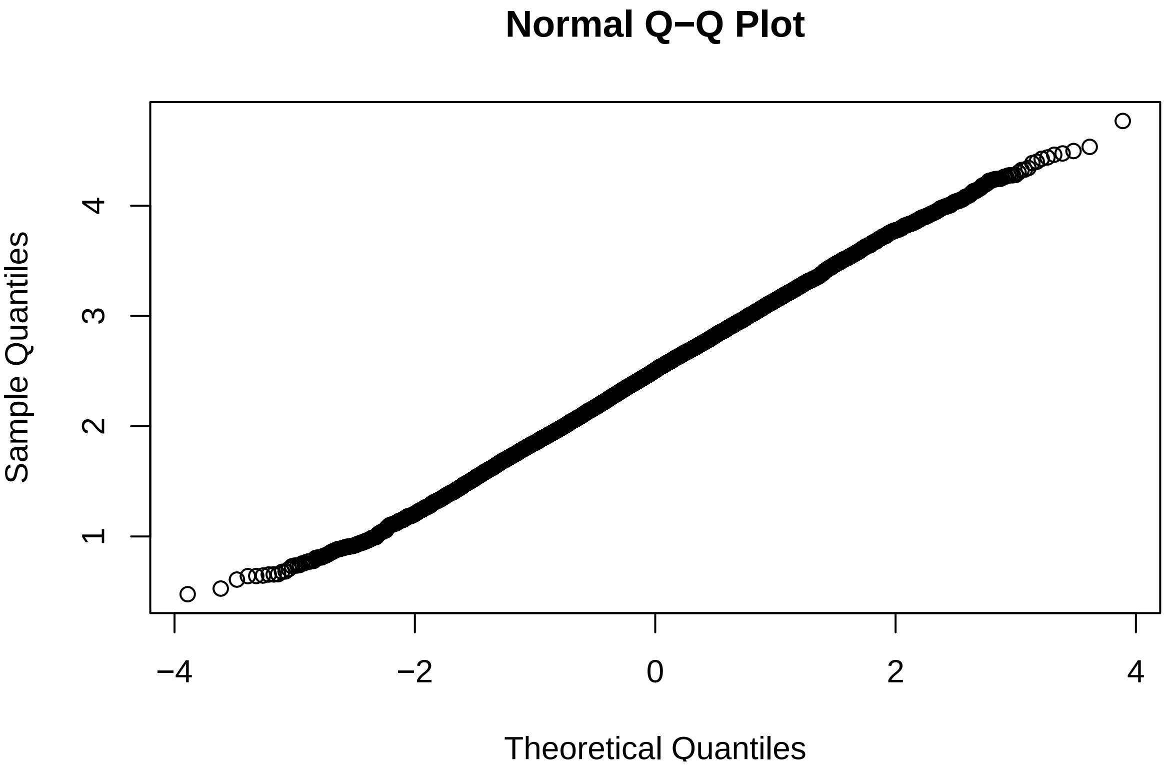
```
ggplot(dn,aes(normnum))+geom_histogram(aes(y=..density..),binwidth=0.1,color="blue",fill="red")
```



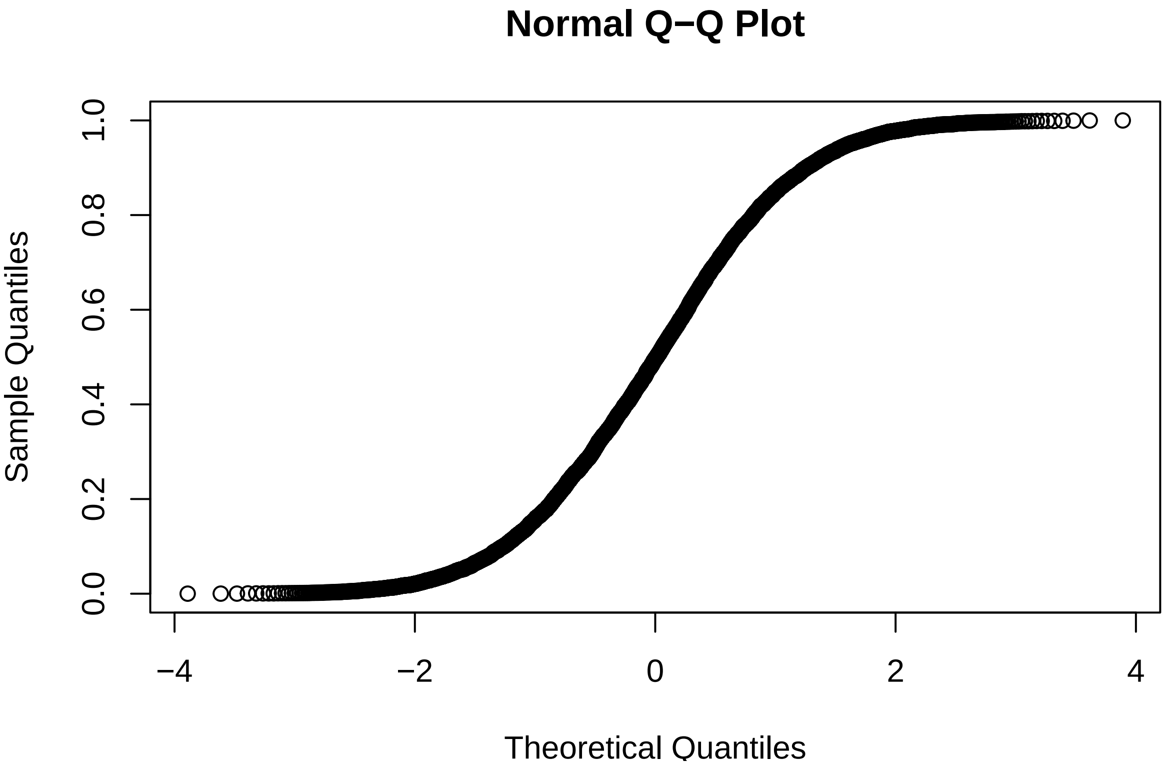
```
# Cambiar parametros a mu=1, sigma=10

# Comparar distribuciones:  Cuantil Cuantil plot (qqplot)
?qqnorm
qqnorm(normnum)
```


Normal Q−Q Plot

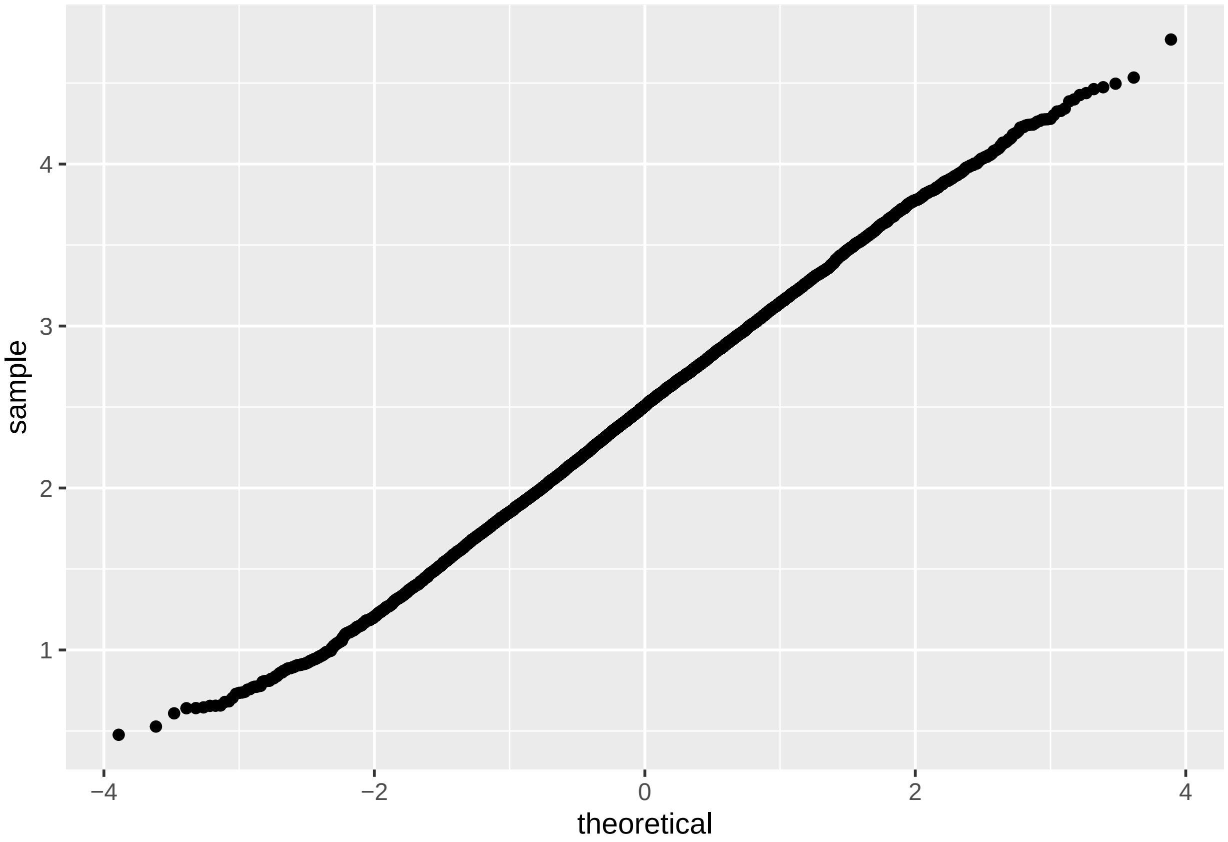
```
# Podemos ver que la linea tiene un efecto de borde en las colas, esto es normal y causado por la gener
# aleatoria. Lo que buscamos son desviaciones en el medio: si este es el caso los datos no son distribu
qqnorm(sum5)
```


Normal Q−Q Plot

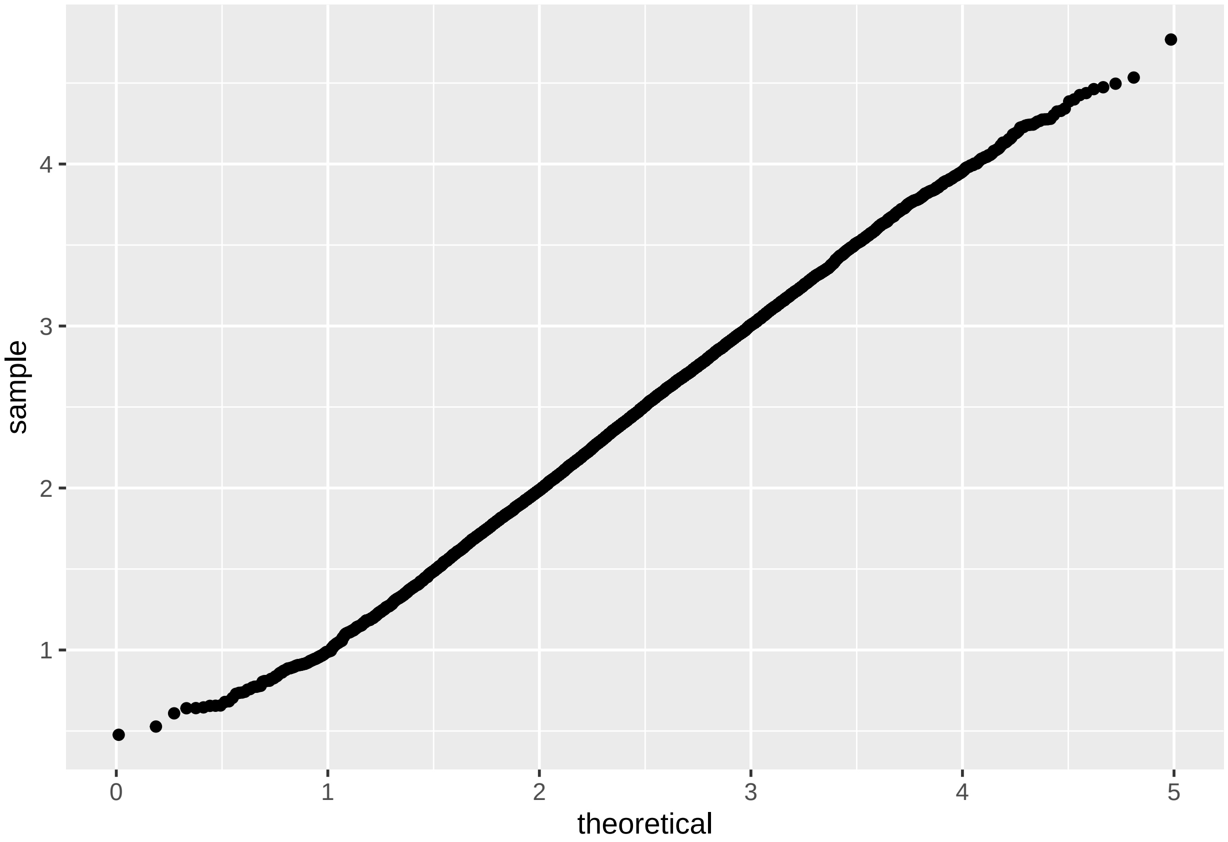
```
qqnorm(unifnum)
```



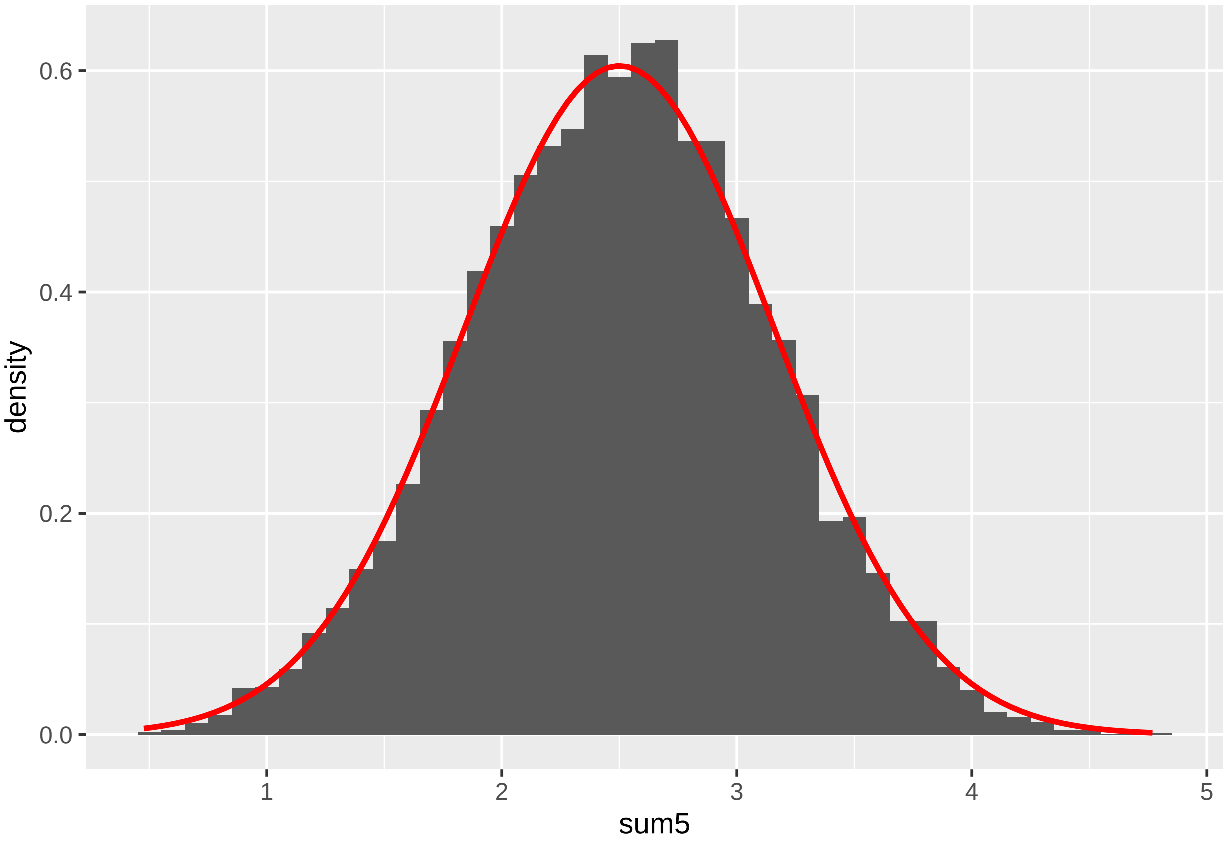
```
ggplot(data.frame(sum5),aes(sample=sum5))+geom_point(stat="qq")
```



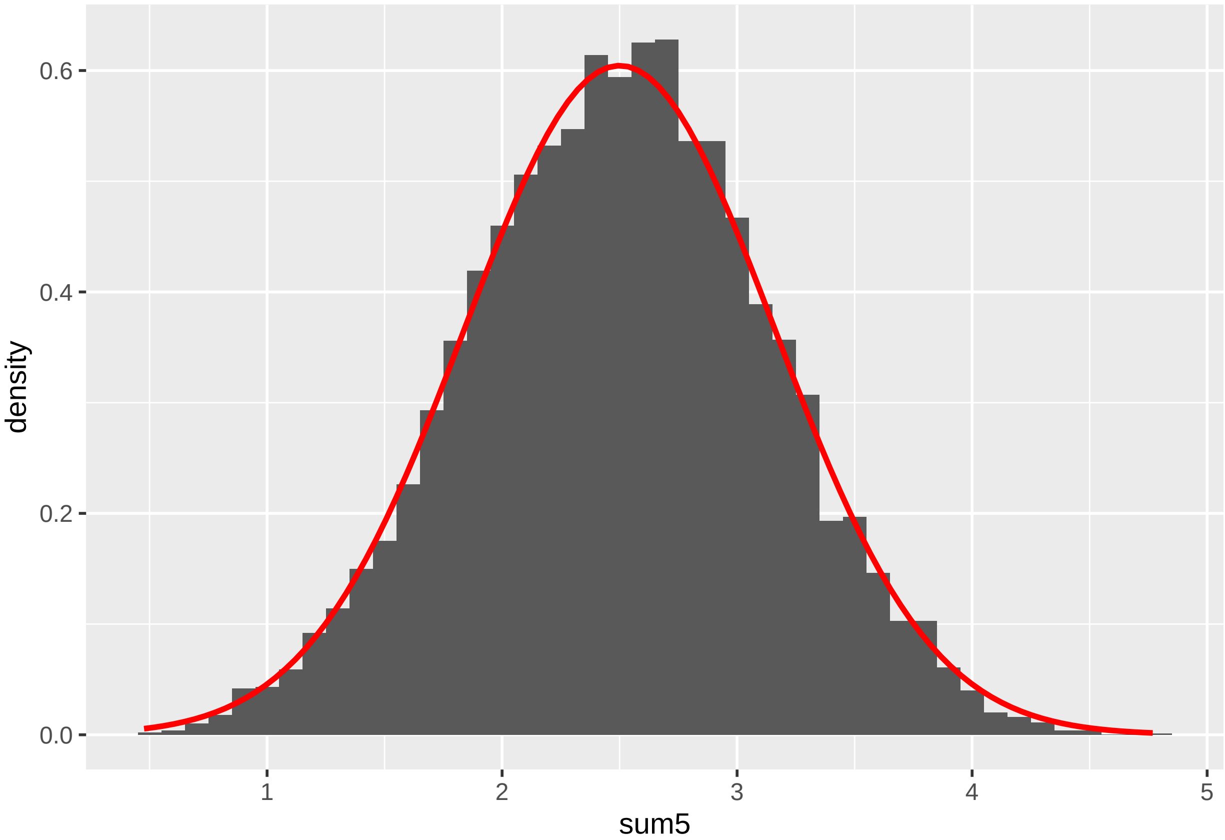
```
# En este caso la distribucion teorica esta centrada en 0  pero la distribucion muestral en 2.5
# Se puede corregir de la siguiente manera.
ggplot(data.frame(sum5),aes(sample=sum5))+stat_qq(distribution=qnorm,dparams=list(mean(sum5),sd(sum5)))
```



```
# Histograms con la funcion de densidad de probailidad de la normal
ggplot(data.frame(sum5),aes(x=sum5))+geom_histogram(aes(y=..density..),binwidth=0.1)+stat_function(fun=
```



```
ggplot(data.frame(unifnum),aes(x=sum5))+geom_histogram(aes(y=..density..),binwidth=0.1)+stat_function(fu
```



```
# Testeo
?htest
```

```
## No documentation for 'htest' in specified packages and libraries:
## you could try '??htest'
```

```
?t.test
# Ejemplo
?sleep
head(sleep)
```

```
##   extra group ID
## 1   0.7     1  1
## 2  -1.6     1  2
## 3  -0.2     1  3
## 4  -1.2     1  4
## 5  -0.1     1  5
## 6   3.4     1  6
```

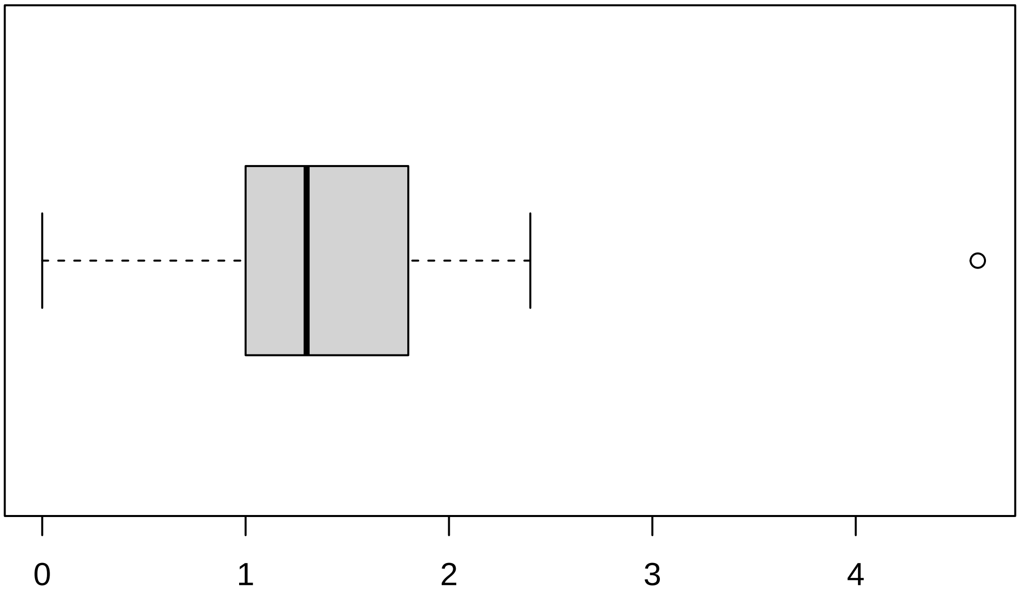
```
attach(sleep)
```

```
## The following objects are masked from sleep (pos = 4):
##
##     extra, group, ID

## The following objects are masked from sleep (pos = 6):
##
##     extra, group, ID

## The following objects are masked from sleep (pos = 8):
```

```
##
##     extra, group, ID
## The following objects are masked from sleep (pos = 10):
##
##     extra, group, ID
## The following objects are masked from sleep (pos = 12):
##
##     extra, group, ID
## The following objects are masked from sleep (pos = 14):
##
##     extra, group, ID
## The following objects are masked from sleep (pos = 16):
##
##     extra, group, ID
## The following objects are masked from sleep (pos = 18):
##
##     extra, group, ID
## The following objects are masked from sleep (pos = 20):
##
##     extra, group, ID
## The following objects are masked from sleep (pos = 22):
##
##     extra, group, ID
## The following objects are masked from sleep (pos = 24):
##
##     extra, group, ID
## The following objects are masked from sleep (pos = 26):
##
##     extra, group, ID
## The following objects are masked from sleep (pos = 28):
##
##     extra, group, ID
## The following objects are masked from sleep (pos = 30):
##
##     extra, group, ID
## The following objects are masked from sleep (pos = 32):
##
##     extra, group, ID
## The following objects are masked from sleep (pos = 34):
##
##     extra, group, ID
## The following objects are masked from sleep (pos = 36):
##
##     extra, group, ID
## The following objects are masked from sleep (pos = 38):
##
```

```
##     extra, group, ID

## The following objects are masked from sleep (pos = 40):
##
##     extra, group, ID

## The following objects are masked from sleep (pos = 42):
##
##     extra, group, ID

## The following objects are masked from sleep (pos = 44):
##
##     extra, group, ID

## The following objects are masked from sleep (pos = 46):
##
##     extra, group, ID

## The following objects are masked from sleep (pos = 48):
##
##     extra, group, ID

## The following objects are masked from sleep (pos = 50):
##
##     extra, group, ID

## The following objects are masked from sleep (pos = 52):
##
##     extra, group, ID

## The following objects are masked from sleep (pos = 54):
##
##     extra, group, ID

## The following objects are masked from sleep (pos = 56):
##
##     extra, group, ID

## The following objects are masked from sleep (pos = 58):
##
##     extra, group, ID

## The following objects are masked from sleep (pos = 60):
##
##     extra, group, ID

## The following objects are masked from sleep (pos = 62):
##
##     extra, group, ID

## The following objects are masked from sleep (pos = 65):
##
##     extra, group, ID
```

```r
# Crear variables
difsleep=extra[group==2]-extra[group==1]
boxplot(difsleep,horizontal = T)
```



```
result.t=t.test(difsleep)
# Rechazamos la Ho, a NS of 5%, 10%, 1%.
# Problemsa: numero de observaciones bajo porlo que no podemos
# testear los supuestos del test.
# t-test (normalidad, homoscedasticidad)
class(t.test)
```

```
## [1] "function"
```

```
?t.test # ver argumentos y resultados de la funcion
result.t
```

```
##
##  One Sample t-test
##
## data:  difsleep
## t = 4.0621, df = 9, p-value = 0.002833
## alternative hypothesis: true mean is not equal to 0
## 95 percent confidence interval:
##  0.7001142 2.4598858
## sample estimates:
## mean of x
##      1.58
```

```
class(result.t) # Clase disenada para  test de hipotesis.
```

```
## [1] "htest"
```

```
# Podemos ver que el resultados es una lista, entonces podemos acceder los valores que necesitamos usan
result.t$p.value
```

```
## [1] 0.00283289
```

```
str(result.t)
```

```
## List of 10
##  $ statistic  : Named num 4.06
##   ..- attr(*, "names")= chr "t"
##  $ parameter  : Named num 9
##   ..- attr(*, "names")= chr "df"
##  $ p.value    : num 0.00283
##  $ conf.int   : num [1:2] 0.7 2.46
##   ..- attr(*, "conf.level")= num 0.95
##  $ estimate   : Named num 1.58
##   ..- attr(*, "names")= chr "mean of x"
##  $ null.value : Named num 0
##   ..- attr(*, "names")= chr "mean"
##  $ stderr     : num 0.389
##  $ alternative: chr "two.sided"
##  $ method     : chr "One Sample t-test"
##  $ data.name  : chr "difsleep"
##  - attr(*, "class")= chr "htest"
```

```
t.test(extra~group,paired=TRUE)
```

```
##
##  Paired t-test
##
## data:  extra by group
## t = -4.0621, df = 9, p-value = 0.002833
## alternative hypothesis: true mean difference is not equal to 0
## 95 percent confidence interval:
##  -2.4598858 -0.7001142
## sample estimates:
## mean difference
##           -1.58
```

```
 #Obtenemos un estadistico t que es negativo porque se toma la diferencia entre G1 y G2 mientras que R
t.test(extra~group,paired=FALSE) # Aqui no tomamos en cuenta que son los mismos estudiantes y por lo ta
```

```
##
##  Welch Two Sample t-test
##
## data:  extra by group
## t = -1.8608, df = 17.776, p-value = 0.07939
## alternative hypothesis: true difference in means between group 1 and group 2 is not equal to 0
## 95 percent confidence interval:
##  -3.3654832  0.2054832
## sample estimates:
## mean in group 1 mean in group 2
##            0.75            2.33
```

```
# Tener los mismos estudiantes aumenta el poder
# Hay que tener en cuenta el diseno de experimento

#  Testear grupos multiples
load("~/Dropbox/0.POST-PHD/GOALS/2.CODE/R/Ecomienza/datos/procesados/birthn.Rdata")
birthn[1:6,]
```

```
##   year month date_of_month day_of_week births
## 1 2000     1             1           6   9083
## 2 2000     1             2           7   8006
## 3 2000     1             3           1  11363
## 4 2000     1             4           2  13032
## 5 2000     1             5           3  12558
## 6 2000     1             6           4  12466
```

```
# Agrupar datos por dia
library(dplyr)
sumsperday<-birthn%>% group_by(day_of_week) %>% summarise(sum=sum(births)) %>% arrange()
sumsperday
```

```
## # A tibble: 7 x 2
##   day_of_week      sum
##         <int>    <int>
## 1           1  9316001
## 2           2 10274874
## 3           3 10109130
## 4           4 10045436
## 5           5  9850199
## 6           6  6704495
## 7           7  5886889
```

```
# Testear si hay la misma probailidad de nacimiento en cada dia.
# Supuestos:independencia entre dias y nacimientos
res=chisq.test(sumsperday[,2])
str(res)
```

```
## List of 9
##  $ statistic: Named num 2210468
##   ..- attr(*, "names")= chr "X-squared"
##  $ parameter: Named num 6
##   ..- attr(*, "names")= chr "df"
##  $ p.value  : num 0
##  $ method   : chr "Chi-squared test for given probabilities"
##  $ data.name: chr "sumsperday[, 2]"
##  $ observed : int [1:7] 9316001 10274874 10109130 10045436 9850199 6704495 5886889
##  $ expected : num [1:7] 8883861 8883861 8883861 8883861 8883861 ...
##  $ residuals: num [1:7] 145 467 411 390 324 ...
##  $ stdres   : num [1:7] 157 504 444 421 350 ...
##  - attr(*, "class")= chr "htest"
```

```
# Regresion
#install.packages("HistData")
library(HistData)
?Galton
head(Galton)
```

```
##   parent child
## 1   70.5  61.7
## 2   68.5  61.7
## 3   65.5  61.7
## 4   64.5  61.7
## 5   64.0  61.7
## 6   67.5  62.2
```

```
attach(Galton)
```

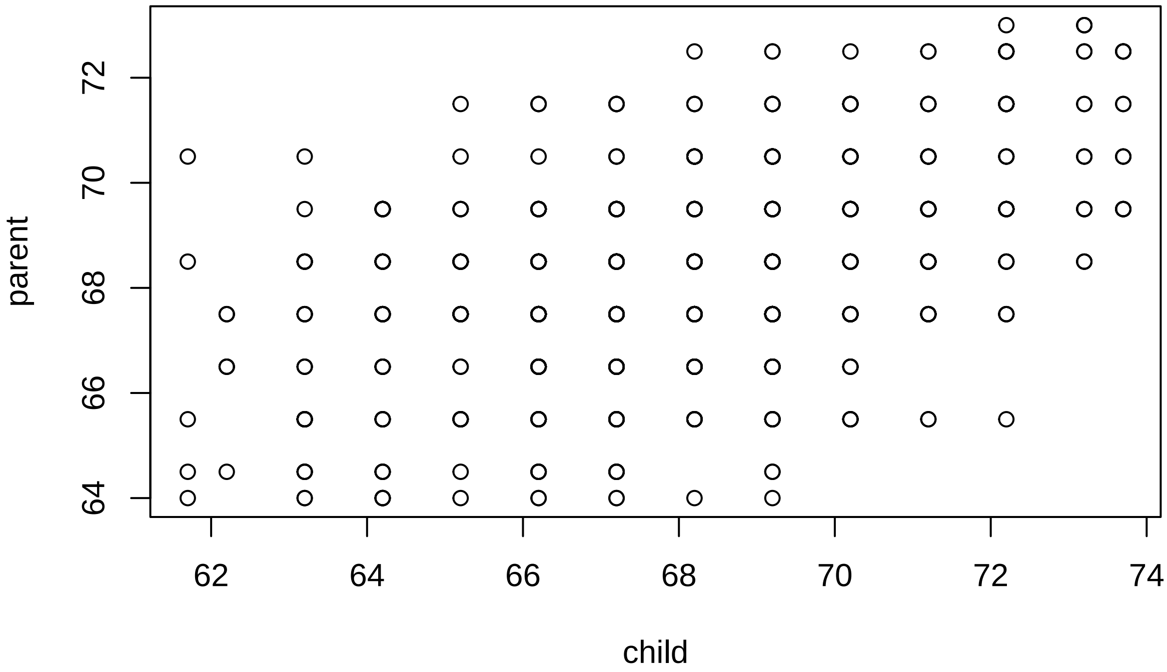
```
## The following objects are masked from Galton (pos = 4):
##
##     child, parent
```

```
## The following objects are masked from Galton (pos = 6):
```

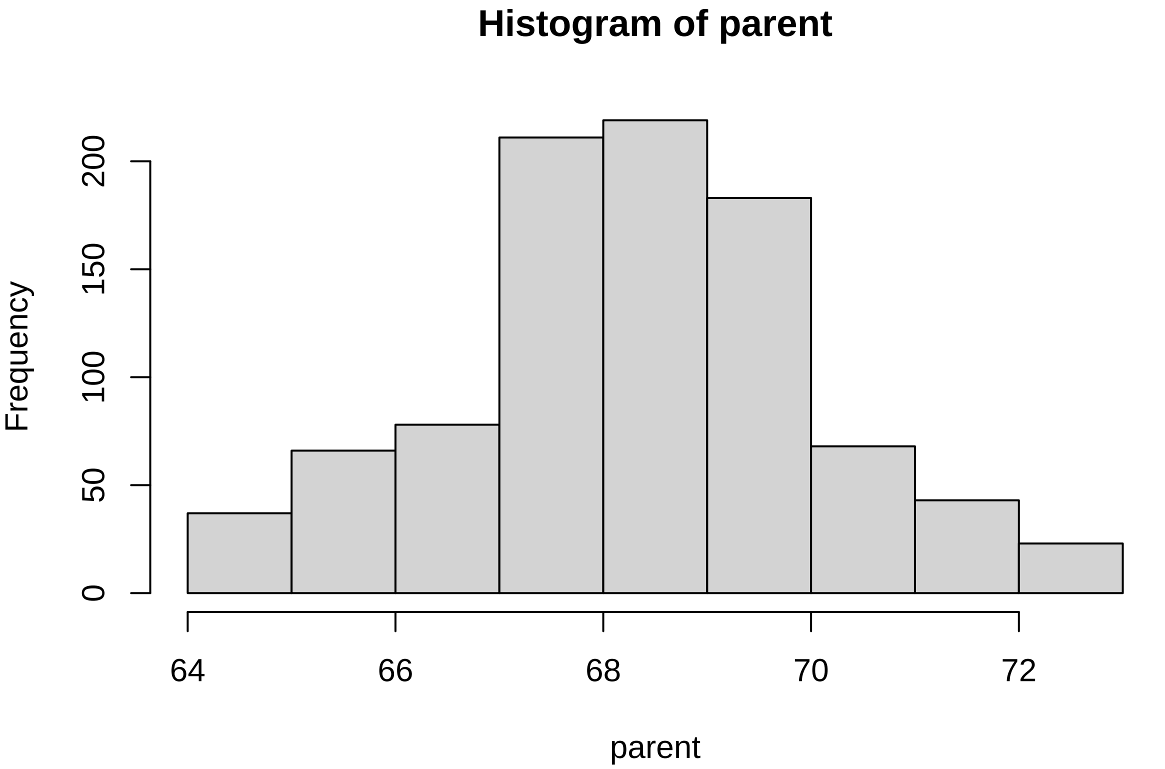
```
##
##     child, parent
## The following objects are masked from Galton (pos = 8):
##
##     child, parent
## The following objects are masked from Galton (pos = 10):
##
##     child, parent
## The following objects are masked from Galton (pos = 12):
##
##     child, parent
## The following objects are masked from Galton (pos = 14):
##
##     child, parent
## The following objects are masked from Galton (pos = 16):
##
##     child, parent
## The following objects are masked from Galton (pos = 18):
##
##     child, parent
## The following objects are masked from Galton (pos = 20):
##
##     child, parent
## The following objects are masked from Galton (pos = 22):
##
##     child, parent
## The following objects are masked from Galton (pos = 24):
##
##     child, parent
## The following objects are masked from Galton (pos = 26):
##
##     child, parent
## The following objects are masked from Galton (pos = 28):
##
##     child, parent
## The following objects are masked from Galton (pos = 30):
##
##     child, parent
## The following objects are masked from Galton (pos = 32):
##
##     child, parent
## The following objects are masked from Galton (pos = 34):
##
##     child, parent
## The following objects are masked from Galton (pos = 36):
##
```

```
##     child, parent
## The following objects are masked from Galton (pos = 38):
##
##     child, parent
## The following objects are masked from Galton (pos = 40):
##
##     child, parent
## The following objects are masked from Galton (pos = 42):
##
##     child, parent
## The following objects are masked from Galton (pos = 44):
##
##     child, parent
## The following objects are masked from Galton (pos = 46):
##
##     child, parent
## The following objects are masked from Galton (pos = 48):
##
##     child, parent
## The following objects are masked from Galton (pos = 50):
##
##     child, parent
## The following objects are masked from Galton (pos = 52):
##
##     child, parent
## The following objects are masked from Galton (pos = 54):
##
##     child, parent
## The following objects are masked from Galton (pos = 56):
##
##     child, parent
## The following objects are masked from Galton (pos = 58):
##
##     child, parent
## The following objects are masked from Galton (pos = 60):
##
##     child, parent
## The following objects are masked from Galton (pos = 62):
##
##     child, parent
## The following objects are masked from Galton (pos = 64):
##
##     child, parent
```

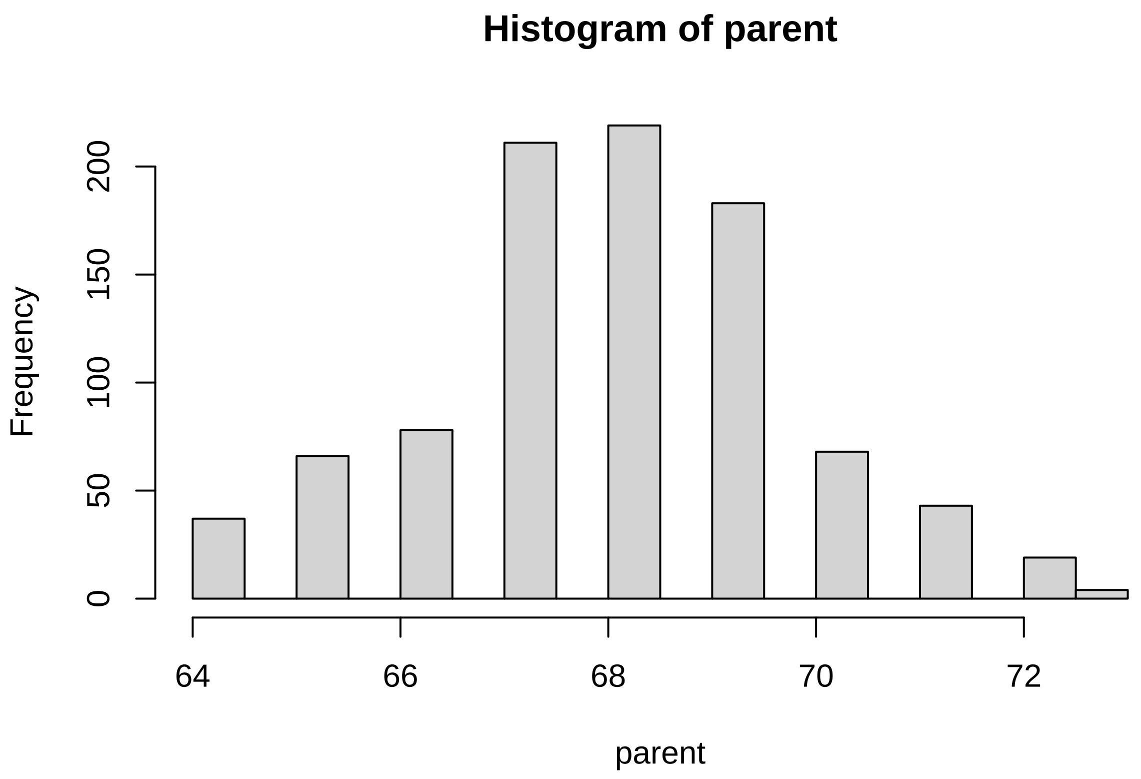
```
plot(child,parent)
```



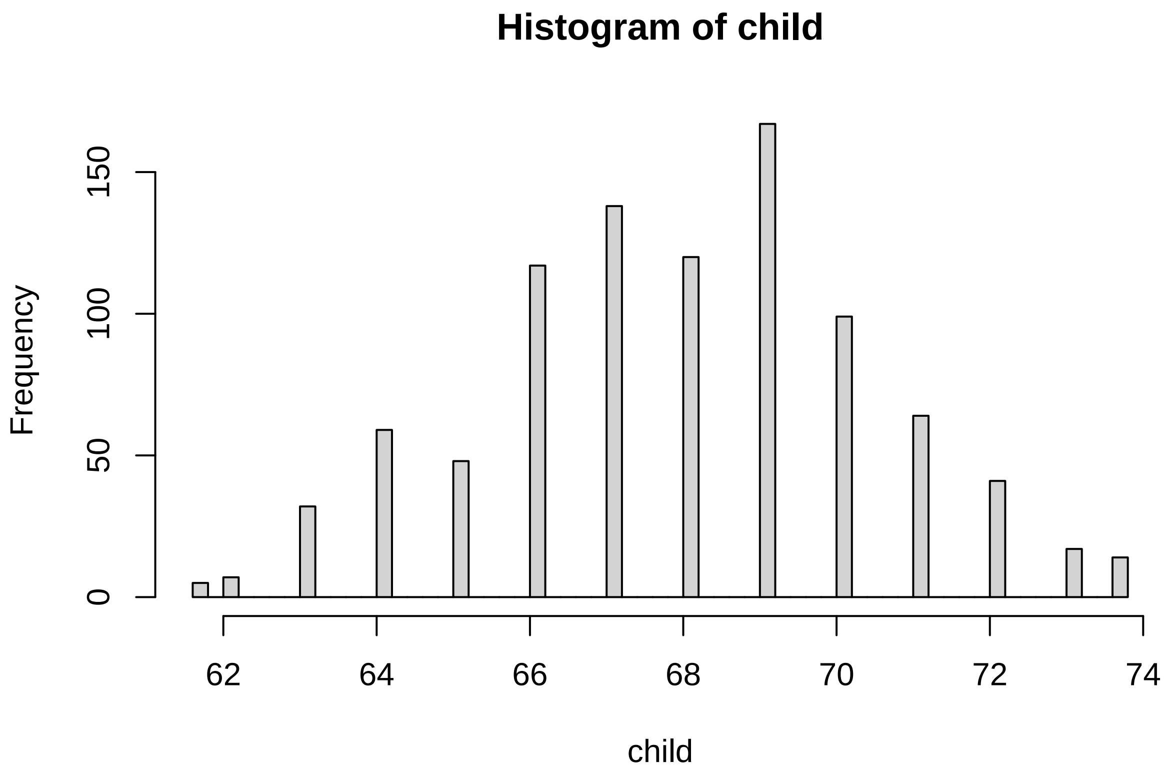
```
# Los datos no se han obtenido de manera continua, lo que conduce a una perdida de precision.

hist(parent)
```



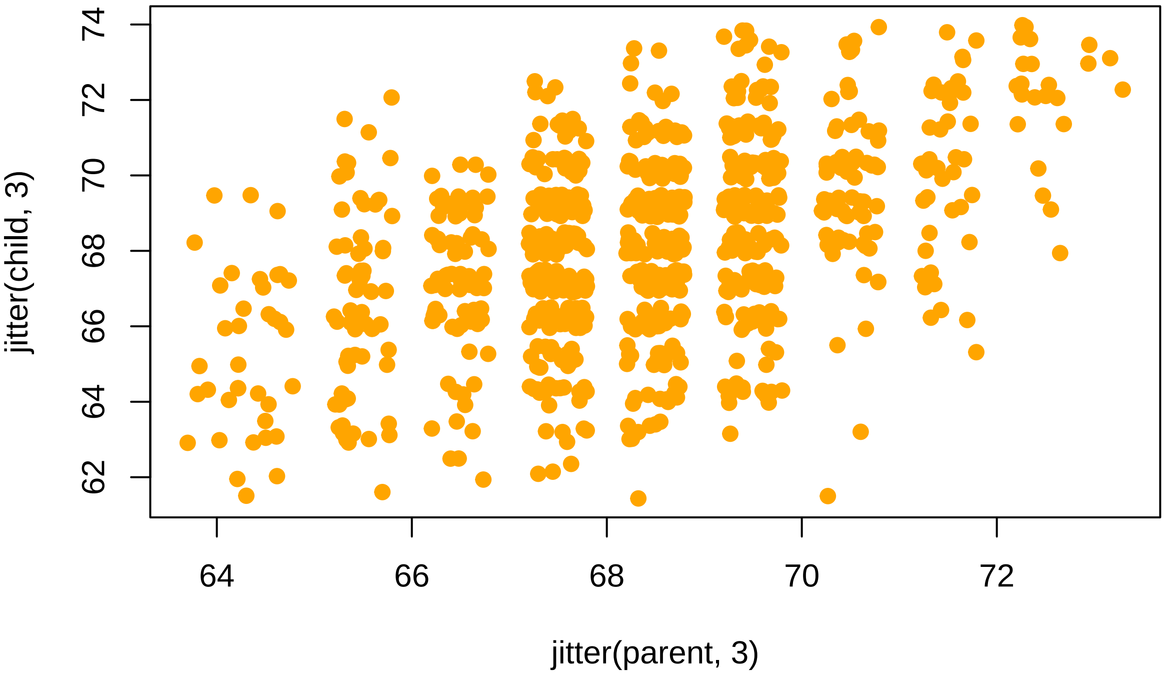
```
# Al aumentar la anchura de clase, se ve el problema
hist(parent,20)
```



```
hist(child,60)
```



```
# Vamos a corregir utilizando la funcion jitter
plot(jitter(parent,3),jitter(child,3),pch=19,col="orange")
```



```
# Ahora observamos elipsoides que se deben a la distribucion normal en ambas direcciones.

cor(parent,child)
```

```
## [1] 0.4587624
```

```
# Correlacion importante
# Hay un componente genetico
linearreg<-lm(child~parent)
summary(linearreg)
```

```
##
## Call:
## lm(formula = child ~ parent)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -7.8050 -1.3661  0.0487  1.6339  5.9264
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept) 23.94153    2.81088   8.517   <2e-16 ***
## parent       0.64629    0.04114  15.711   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 2.239 on 926 degrees of freedom
## Multiple R-squared:  0.2105, Adjusted R-squared:  0.2096
## F-statistic: 246.8 on 1 and 926 DF,  p-value: < 2.2e-16
```

```
class(linearreg)
```

```
## [1] "lm"
```

```
?lm
names(linearreg)
```

```
##  [1] "coefficients"  "residuals"     "effects"       "rank"          "fitted.values" "assign"
##  [7] "qr"            "df.residual"   "xlevels"       "call"          "terms"         "model"
```

```
linearreg$residuals
```

```
##           1           2           3           4           5           6           7           8
## -7.80501621 -6.51243505 -4.57356330 -3.92727272 -3.60412743 -5.36614446 -5.36614446 -5.36614446
##           9          10          11          12          13          14          15          16
## -4.71985388 -4.71985388 -4.71985388 -3.42727272 -6.30501621 -5.65872563 -5.01243505 -5.01243505
##          17          18          19          20          21          22          23          24
## -5.01243505 -5.01243505 -5.01243505 -5.01243505 -5.01243505 -4.36614446 -4.36614446 -4.36614446
##          25          26          27          28          29          30          31          32
## -4.36614446 -4.36614446 -3.71985388 -3.71985388 -3.71985388 -3.07356330 -3.07356330 -3.07356330
##          33          34          35          36          37          38          39          40
## -3.07356330 -3.07356330 -3.07356330 -3.07356330 -3.07356330 -3.07356330 -2.42727272 -2.42727272
##          41          42          43          44          45          46          47          48
## -2.42727272 -2.42727272 -2.10412743 -2.10412743 -4.65872563 -4.65872563 -4.65872563 -4.65872563
##          49          50          51          52          53          54          55          56
## -4.65872563 -4.65872563 -4.65872563 -4.65872563 -4.65872563 -4.65872563 -4.65872563 -4.65872563
##          57          58          59          60          61          62          63          64
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##          65          66          67          68          69          70          71          72
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##          73          74          75          76          77          78          79          80
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##          81          82          83          84          85          86          87          88
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##          89          90          91          92          93          94          95          96
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## -1.42727272 -1.42727272 -1.42727272 -1.10412743 -1.10412743 -1.10412743 -1.10412743 -4.95130679
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##         129         130         131         132         133         134         135         136
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##         137         138         139         140         141         142         143         144
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##         145         146         147         148         149         150         151         152
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## -3.95130679 -3.95130679 -3.30501621 -2.65872563 -2.65872563 -2.65872563 -2.65872563 -2.65872563
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##         169         170         171         172         173         174         175         176
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##         177         178         179         180         181         182         183         184
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##         185         186         187         188         189         190         191         192
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##         193         194         195         196         197         198         199         200
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##         201         202         203         204         205         206         207         208
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## -1.36614446 -0.71985388 -0.71985388 -0.71985388 -0.71985388 -0.71985388 -0.71985388 -0.71985388
##         241         242         243         244         245         246         247         248
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##         249         250         251         252         253         254         255         256
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##         297         298         299         300         301         302         303         304
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##         305         306         307         308         309         310         311         312
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##         321         322         323         324         325         326         327         328
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##         417         418         419         420         421         422         423         424
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##         617         618         619         620         621         622         623         624
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##        833        834        835        836        837        838        839        840 
## 2.98756495 2.98756495 2.98756495 2.98756495 2.98756495 2.98756495 2.98756495 2.98756495 
##        841        842        843        844        845        846        847        848 
## 2.98756495 2.98756495 2.98756495 3.63385554 3.63385554 3.63385554 3.63385554 3.63385554 
##        849        850        851        852        853        854        855        856 
## 3.63385554 3.63385554 3.63385554 3.63385554 3.63385554 3.63385554 4.92643670 4.92643670 
##        857        858        859        860        861        862        863        864 
## 1.07925733 1.40240263 1.40240263 1.40240263 1.40240263 1.40240263 1.40240263 1.40240263 
##        865        866        867        868        869        870        871        872 
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##        881        882        883        884        885        886        887        888 
## 3.34127437 3.34127437 3.34127437 3.34127437 3.34127437 3.34127437 3.34127437 3.34127437 
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## 3.98756495 3.98756495 3.98756495 3.98756495 4.63385554 4.63385554 4.63385554 4.63385554 
##        897        898        899        900        901        902        903        904 
## 5.92643670 2.07925733 2.07925733 2.07925733 2.40240263 2.40240263 3.04869321 3.04869321 
##        905        906        907        908        909        910        911        912 
## 3.69498379 3.69498379 3.69498379 4.34127437 4.34127437 4.34127437 4.34127437 4.98756495 
##        913        914        915        916        917        918        919        920 
## 4.98756495 4.98756495 2.90240263 2.90240263 2.90240263 2.90240263 3.54869321 3.54869321 
##        921        922        923        924        925        926        927        928 
## 4.19498379 4.19498379 4.19498379 4.84127437 4.84127437 4.84127437 4.84127437 4.84127437
```
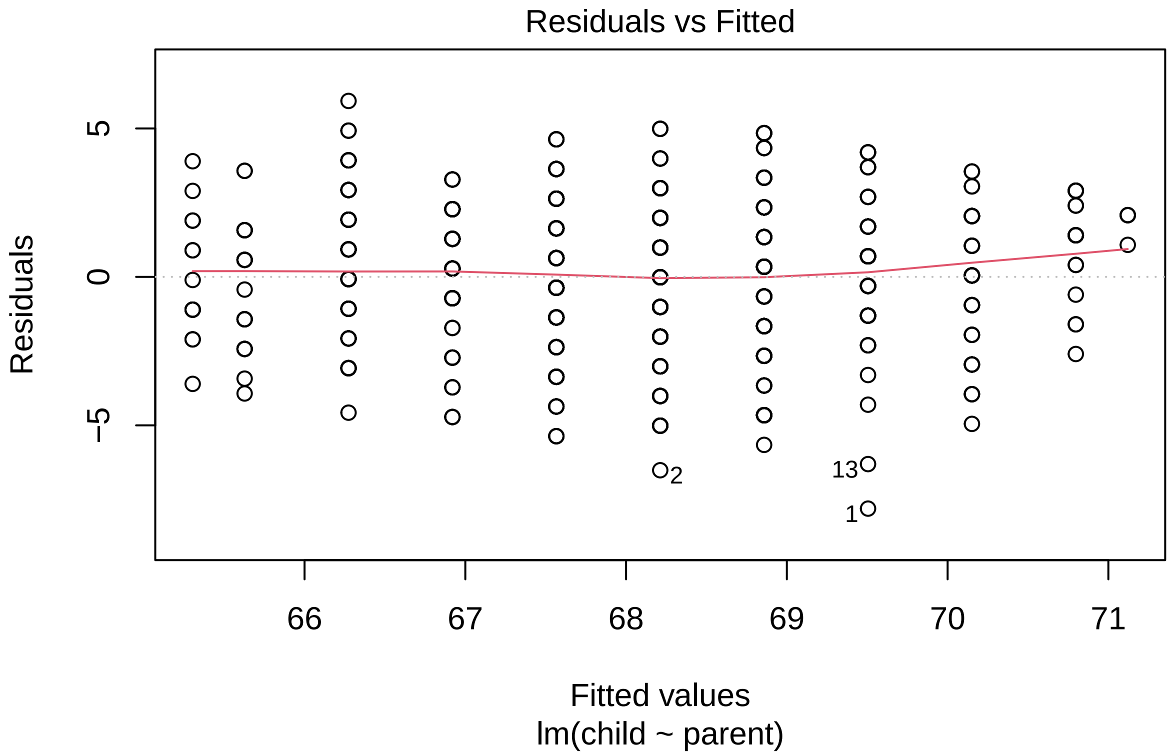
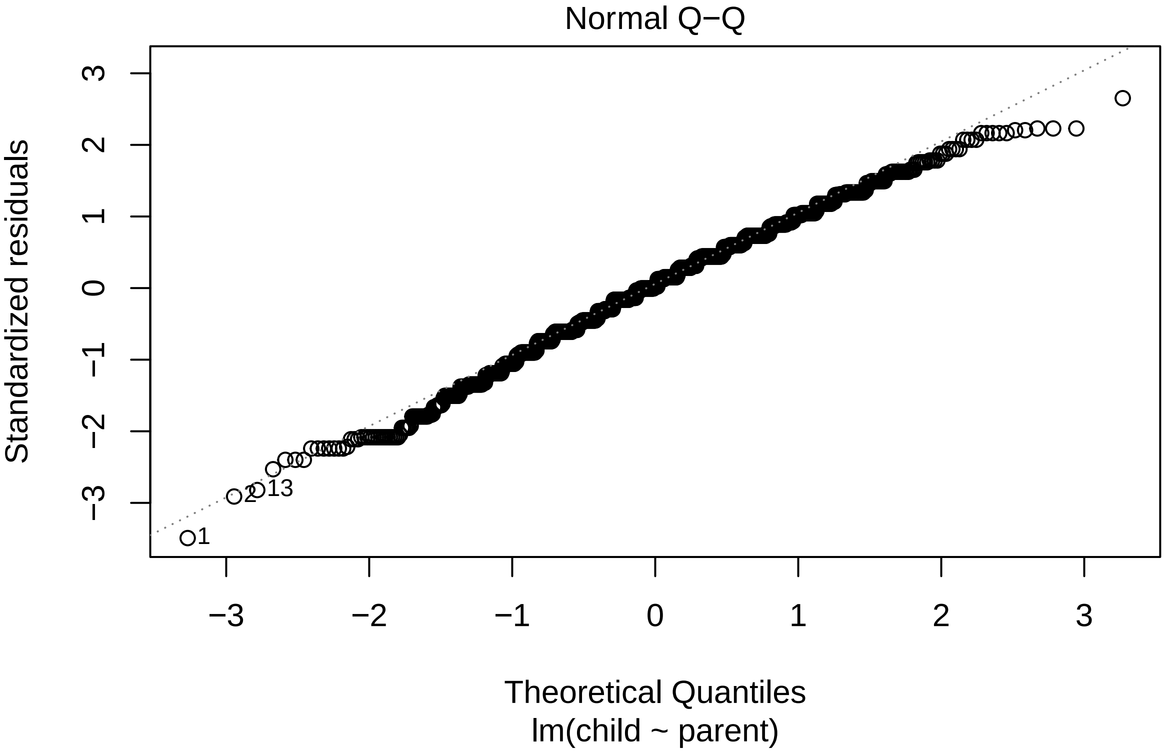
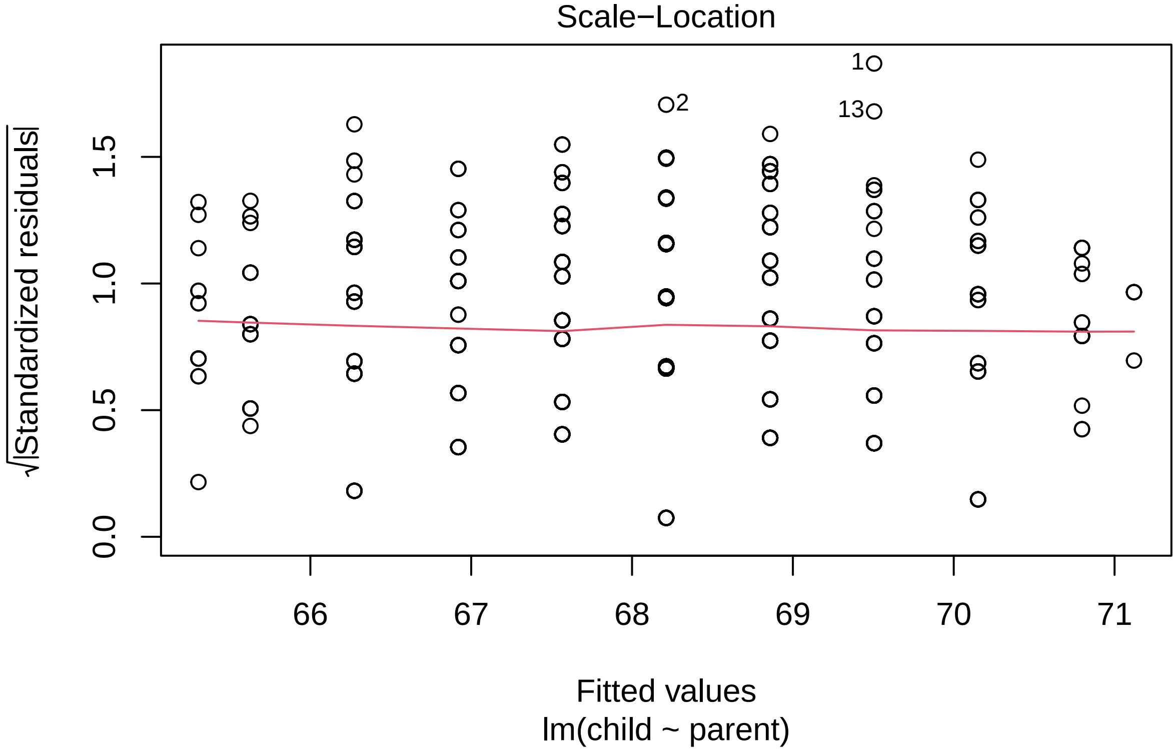
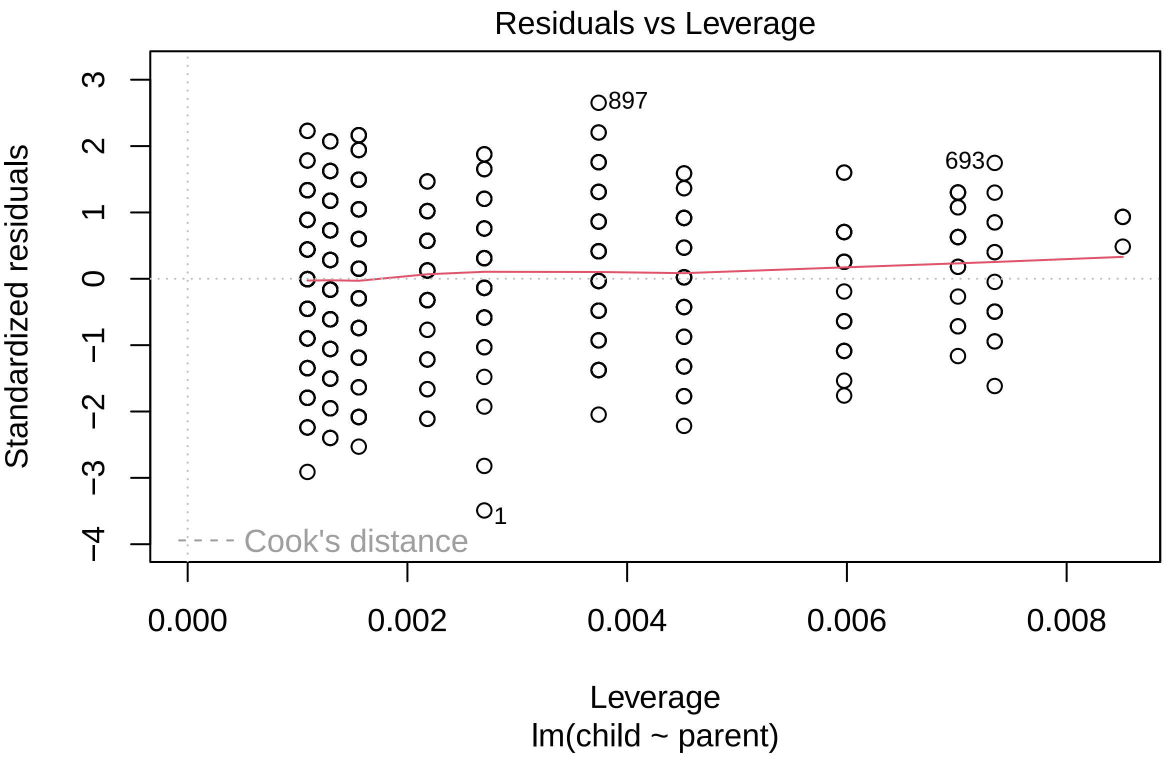

```
plot(linearreg)
```

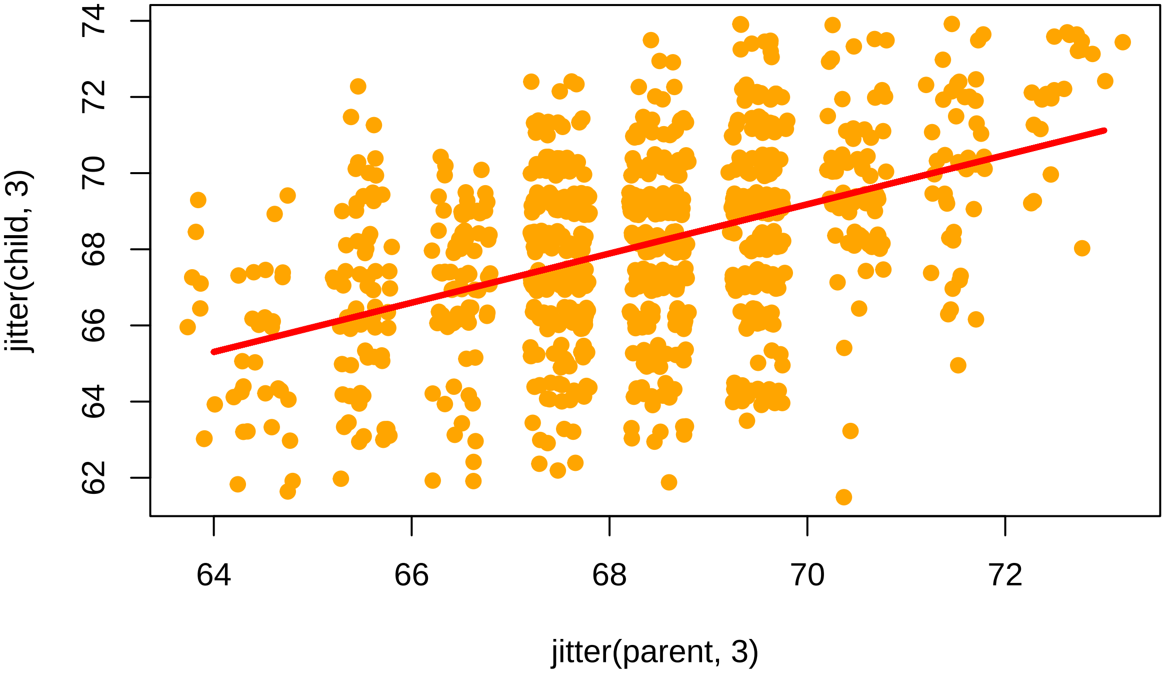



Normal Q−Q
Standardized residuals
3
2
1
0
−1
−2
−3
1
2
13
−3
−2
−1
0
1
2
3
Theoretical Quantiles
lm(child ~ parent)


Scale−Location
√|Standardized residuals|
1.5
1.0
0.5
0.0
1
13
2
66
67
68
69
70
71
Fitted values
lm(child ~ parent)



```
plot(jitter(parent,3),jitter(child,3),pch=19,col="orange")
#lines(parent,linearreg$fitted.values,col="red",lwd=3)
lines(parent,linearreg$fitted,col="red",lwd=3)
```


jitter(child, 3)
jitter(parent, 3)