```r
rm(list=ls())

datos <- read.csv("G512-datos02.csv")
head(datos)
```

```
##     X entidad anio acceso_electrd acceso_combust_limpios
## 1 778    Fiji 2000       75.72492                  28.20
## 2 779    Fiji 2001       77.00068                  28.15
## 3 780    Fiji 2002       79.63000                  28.20
## 4 781    Fiji 2003       80.00000                  28.30
## 5 782    Fiji 2004       80.79184                  28.50
## 6 783    Fiji 2005       82.05135                  28.70
##   cap_instald_energ_renov finan_paises_desarr energ_renov electrd_fosiles
## 1                  133.85                  NA       50.06            0.18
## 2                  133.42                  NA       40.44            0.17
## 3                  133.24                  NA       48.98            0.21
## 4                  133.15                  NA       40.83            0.31
## 5                  140.77              310000       35.72            0.31
## 6                  140.22              260000       40.02            0.37
##   electrd_nuclear electrd_de_energ_renov electrd_de_f_bajas_carb
## 1               0                   0.44                70.96774
## 2               0                   0.50                74.62686
## 3               0                   0.50                70.42254
## 4               0                   0.41                56.94444
## 5               0                   0.44                58.66667
## 6               0                   0.42                53.16456
##   consumo_energ_prim nivel_intens_energ_prim emisiones_CO2 renovables
## 1          9308.956                    2.75           810         NA
## 2          9574.995                    2.97          1040         NA
## 3          8027.728                    2.69           880         NA
## 4          8717.398                    2.79          1050         NA
## 5         11433.929                    3.27          1470         NA
## 6          9695.102                    2.72          1290         NA
##   crecimiento_PIB PIB_per_cap densidad_pobl_Km2 superficie   latitud longitud
## 1      -1.6999984    2069.317                49      18274 -17.71337  178.065
## 2       2.0000001    2030.246                49      18274 -17.71337  178.065
## 3       3.1999991    2248.714                49      18274 -17.71337  178.065
## 4       0.9999993    2818.914                49      18274 -17.71337  178.065
## 5       5.2999997    3311.160                49      18274 -17.71337  178.065
## 6       0.7000004    3627.633                49      18274 -17.71337  178.065
```

Las Variables y Datos

```r
dim(datos)[1]
```

¿De cuántos datos consta tu base de datos?

```
## [1] 126
```

```r
dim(datos)[2]
```

¿Cuántas variables están involucradas?

```
## [1] 22
```

```r
unique(datos$entidad)
```

¿Qué países le toco analizar a tu equipo?

```
## [1] "Fiji"       "Australia"  "Samoa"      "Kazakhstan" "Bhutan"
## [6] "Sri Lanka"
```

```r
encabezados <- names(datos)
```

Identifica y agrupa las variables según su naturaleza (geográficas, fuentes de energía y económicas)

```r
tail(encabezados, 4)
```

¿Cuántas variables geográficas identificaron?

```
## [1] "densidad_pobl_Km2" "superficie"        "latitud"
## [4] "longitud"
```

```r
encabezados[4:16]
```

¿Cuántas variables de fuentes de energía identificaron?

```
##  [1] "acceso_electrd"          "acceso_combust_limpios"
##  [3] "cap_instald_energ_renov" "finan_paises_desarr"
##  [5] "energ_renov"             "electrd_fosiles"
##  [7] "electrd_nuclear"         "electrd_de_energ_renov"
##  [9] "electrd_de_f_bajas_carb" "consumo_energ_prim"
## [11] "nivel_intens_energ_prim" "emisiones_CO2"
## [13] "renovables"
```

```
encabezados[17:18]
```

¿Cuántas variables económicas identificaron?

```
## [1] "crecimiento_PIB" "PIB_per_cap"
```

Elección de las Variables con las que se Trabajará

¿Qué variables seleccionaron para trabajar? ¿Por qué?

```
australia <- datos[datos$entidad == "Australia", ]
summary(australia)
```

Entidad => Autralia

```
##        X         entidad               anio      acceso_electrd
##  Min.   :106   Length:21          Min.   :2000   Min.   :100
##  1st Qu.:111   Class :character   1st Qu.:2005   1st Qu.:100
##  Median :116   Mode  :character   Median :2010   Median :100
##  Mean   :116                      Mean   :2010   Mean   :100
##  3rd Qu.:121                      3rd Qu.:2015   3rd Qu.:100
##  Max.   :126                      Max.   :2020   Max.   :100
##
##  acceso_combust_limpios cap_instald_energ_renov finan_paises_desarr
##  Min.   :100            Min.   : NA             Min.   : NA
##  1st Qu.:100            1st Qu.: NA             1st Qu.: NA
##  Median :100            Median : NA             Median : NA
##  Mean   :100            Mean   :NaN             Mean   :NaN
##  3rd Qu.:100            3rd Qu.: NA             3rd Qu.: NA
##  Max.   :100            Max.   : NA             Max.   : NA
##                         NA's   :21              NA's   :21
##   energ_renov     electrd_fosiles electrd_nuclear electrd_de_energ_renov
##  Min.   : 6.680   Min.   :181.1   Min.   :0       Min.   :17.11
##  1st Qu.: 7.100   1st Qu.:195.9   1st Qu.:0       1st Qu.:18.50
##  Median : 8.345   Median :203.7   Median :0       Median :21.19
##  Mean   : 8.267   Mean   :202.0   Mean   :0       Mean   :28.88
##  3rd Qu.: 9.312   3rd Qu.:208.6   3rd Qu.:0       3rd Qu.:36.15
##  Max.   :10.130   Max.   :216.4   Max.   :0       Max.   :63.99
##  NA's   :1
##  electrd_de_f_bajas_carb consumo_energ_prim nivel_intens_energ_prim
##  Min.   : 7.804          Min.   :61826      Min.   :4.300
##  1st Qu.: 8.660          1st Qu.:66744      1st Qu.:4.753
##  Median : 9.636          Median :68524      Median :5.380
##  Mean   :12.286          Mean   :68244      Mean   :5.231
##  3rd Qu.:14.962          3rd Qu.:69714      3rd Qu.:5.598
##  Max.   :25.503          Max.   :72305      Max.   :6.160
##                                             NA's   :1
##  emisiones_CO2      renovables     crecimiento_PIB      PIB_per_cap
```

```
##  Min.   :339450   Min.   : 3.681   Min.   :-0.003837   Min.   :19527
##  1st Qu.:369020   1st Qu.: 3.989   1st Qu.: 2.172337   1st Qu.:34081
##  Median :382635   Median : 4.314   Median : 2.726893   Median :49882
##  Mean   :375538   Mean   : 5.542   Mean   : 2.775869   Mean   :45553
##  3rd Qu.:386995   3rd Qu.: 6.526   3rd Qu.: 3.577015   3rd Qu.:56707
##  Max.   :395290   Max.   :10.790   Max.   : 4.205447   Max.   :68157
##  NA's   :1
##  densidad_pobl_Km2   superficie         latitud          longitud
##  Min.   :3         Min.   :7741220   Min.   :-25.27   Min.   :133.8
##  1st Qu.:3         1st Qu.:7741220   1st Qu.:-25.27   1st Qu.:133.8
##  Median :3         Median :7741220   Median :-25.27   Median :133.8
##  Mean   :3         Mean   :7741220   Mean   :-25.27   Mean   :133.8
##  3rd Qu.:3         3rd Qu.:7741220   3rd Qu.:-25.27   3rd Qu.:133.8
##  Max.   :3         Max.   :7741220   Max.   :-25.27   Max.   :133.8
##
```

```
electrd_fosiles <- australia$electrd_fosiles
summary(electrd_fosiles)
```

Fuentes de energía => (electrd_fosiles, electrd_de_f_bajas_carb, electr_energ_renov)

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##   181.1   195.9   203.7   202.0   208.6   216.4
```

```
electrd_de_f_bajas_carb <- australia$electrd_de_f_bajas_carb
summary(electrd_de_f_bajas_carb)
```

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##   7.804   8.660   9.636  12.286  14.962  25.503
```

```
electr_energ_renov <- australia$electr_energ_renov
summary(electr_energ_renov)
```

```
## Length  Class   Mode
##      0   NULL   NULL
```

```
PIB_per_capita <- australia$PIB_per_capita
summary(PIB_per_capita)
```

Fuente economica => (PIB_per_capita)

```
## Length  Class   Mode
##      0   NULL   NULL
```

```r
densidad_pobl_km2 <- australia$densidad_pobl_km2
summary(densidad_pobl_km2)
```

Variable geográficas => (densidad_pobl_km2)

```
## Length  Class   Mode
##      0   NULL   NULL
```

Creación de una base de datos de trabajo del equipo

```r
# Instala y carga los paquetes necesarios
# install.packages("dplyr")
library(dplyr)
```

```
##
## Attaching package: 'dplyr'

## The following objects are masked from 'package:stats':
##
##     filter, lag

## The following objects are masked from 'package:base':
##
##     intersect, setdiff, setequal, union
```

```r
# Define los países por región
africa_del_sur <- c("Burundi", "Equatorial Guinea", "Eswatini", "Gabon", "Kenya", "Lesotho", "Madagascar
                    "Malawi", "Mauritius", "Mozambique", "Namibia", "Rwanda", "South Africa", "Uganda",
                    "Zambia", "Zimbabwe")

africa_del_norte <- c("Algeria", "Angola", "Benin", "Burkina Faso", "Cameroon", "Central African Republi
                      "Egypt", "Ethiopia", "Ghana", "Guinea", "Liberia", "Mali", "Mauritania", "Morocco
                      "Niger", "Nigeria", "Sao Tome and Principe", "Senegal", "Sierra Leone", "Sudan",
                      "Togo", "Tunisia")

america_del_sur <- c("Argentina", "Brazil", "Chile", "Colombia", "Ecuador", "Guyana", "Paraguay", "Peru
                     "Suriname", "Uruguay")

america_centro_norte <- c("Belize", "Costa Rica", "El Salvador", "Guatemala", "Honduras", "Nicaragua",
                          "Panama", "Canada", "United States", "Mexico")

caribe <- c("Cuba", "Dominican Republic", "Haiti", "Jamaica", "Trinidad and Tobago")

europa_occidental <- c("Austria", "Belgium", "Denmark", "Finland", "France", "Germany", "Iceland",
                       "Ireland", "Italy", "Luxembourg", "Netherlands", "Norway", "Portugal", "Spain",
                       "Sweden", "Switzerland", "United Kingdom")

europa_oriental <- c("Belarus", "Bulgaria", "Estonia", "Greece", "Hungary", "Latvia", "Lithuania",
```

```
                    "North Macedonia", "Poland", "Romania", "Slovenia", "Ukraine")

asia_occidental <- c("China", "Cambodia", "Indonesia", "Japan", "Malaysia", "Mongolia", "Myanmar",
                     "Philippines", "Thailand")

asia_central <- c("Afghanistan", "Bangladesh", "Bhutan", "India", "Kazakhstan", "Nepal", "Pakistan",
                  "Sri Lanka", "Tajikistan", "Uzbekistan")

oceania <- c("Australia", "Fiji", "New Zealand", "Papua New Guinea", "Samoa")

# Crear una nueva columna de región
datos1 <- datos %>%
  mutate(region = case_when(
    entidad %in% africa_del_sur ~ "Africa del Sur",
    entidad %in% africa_del_norte ~ "Africa del Norte",
    entidad %in% america_del_sur ~ "America del Sur",
    entidad %in% america_centro_norte ~ "America Centro-Norte",
    entidad %in% caribe ~ "Caribe",
    entidad %in% europa_occidental ~ "Europa Occidental",
    entidad %in% europa_oriental ~ "Europa Oriental",
    entidad %in% asia_occidental ~ "Asia Occidental",
    entidad %in% asia_central ~ "Asia Central",
    entidad %in% oceania ~ "Oceania",
    TRUE ~ "Otros"
  ))
str(datos1)
```

```
## 'data.frame':    126 obs. of  23 variables:
##  $ X                       : int  778 779 780 781 782 783 784 785 786 787 ...
##  $ entidad                 : chr  "Fiji" "Fiji" "Fiji" "Fiji" ...
##  $ anio                    : int  2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 ...
##  $ acceso_electrd          : num  75.7 77 79.6 80 80.8 ...
##  $ acceso_combust_limpios  : num  28.2 28.1 28.2 28.3 28.5 ...
##  $ cap_instald_energ_renov: num  134 133 133 133 141 ...
##  $ finan_paises_desarr     : num  NA NA NA NA 310000 ...
##  $ energ_renov             : num  50.1 40.4 49 40.8 35.7 ...
##  $ electrd_fosiles         : num  0.18 0.17 0.21 0.31 0.31 0.37 0.39 0.27 0.26 0.28 ...
##  $ electrd_nuclear         : int  0 0 0 0 0 0 0 0 0 0 ...
##  $ electrd_de_energ_renov  : num  0.44 0.5 0.5 0.41 0.44 0.42 0.45 0.6 0.62 0.58 ...
##  $ electrd_de_f_bajas_carb: num  71 74.6 70.4 56.9 58.7 ...
##  $ consumo_energ_prim      : num  9309 9575 8028 8717 11434 ...
##  $ nivel_intens_energ_prim: num  2.75 2.97 2.69 2.79 3.27 2.72 2.91 2.7 2.15 1.93 ...
##  $ emisiones_CO2           : num  810 1040 880 1050 1470 ...
##  $ renovables              : num  NA NA NA NA NA NA NA NA NA NA ...
##  $ crecimiento_PIB         : num  -1.7 2 3.2 1 5.3 ...
##  $ PIB_per_cap             : num  2069 2030 2249 2819 3311 ...
##  $ densidad_pobl_Km2       : int  49 49 49 49 49 49 49 49 49 49 ...
##  $ superficie              : int  18274 18274 18274 18274 18274 18274 18274 18274 18274 18274 ...
##  $ latitud                 : num  -17.7 -17.7 -17.7 -17.7 -17.7 ...
##  $ longitud                : num  178 178 178 178 178 ...
##  $ region                  : chr  "Oceania" "Oceania" "Oceania" "Oceania" ...
```

```r
datos1 = select(datos1, entidad, electrd_fosiles, electrd_de_f_bajas_carb, energ_renov, PIB_per_cap, den
datos1=datos1[-1]
datos1=na.omit(datos1)
# Guardar el subconjunto de datos en un archivo CSV
write.csv(datos1, "datosEq2.csv", row.names = FALSE)
```

Análisis Estadístico de los datos comparativo por región

```r
# Cargar la base de datos de trabajo
datosEq2 <- read.csv("datosEq2.csv")

R1 = subset(datosEq2, region == "Oceania")
R2 = subset(datosEq2, region == "Asia Central")

cat("Región 1: Oceania","\n")
```

Análisis Numérico (medidas resumen: centro, dispersión y posición)

```
## Región 1: Oceania
```

```r
summary(R1)
```

```
##  electrd_fosiles  electrd_de_f_bajas_carb  energ_renov      PIB_per_cap
##  Min.   :  0.05   Min.   : 7.804          Min.   : 6.680   Min.   : 1542
##  1st Qu.:  0.09   1st Qu.:14.939          1st Qu.: 9.318   1st Qu.: 3375
##  Median :  0.31   Median :45.455          Median :33.690   Median : 4291
##  Mean   : 67.71   Mean   :39.609          Mean   :29.162   Mean   :17559
##  3rd Qu.:196.07   3rd Qu.:58.417          3rd Qu.:40.977   3rd Qu.:31406
##  Max.   :216.42   Max.   :74.627          Max.   :59.690   Max.   :68157
##  densidad_pobl_Km2    region
##  Min.   : 3.00     Length:60
##  1st Qu.: 3.00     Class :character
##  Median :49.00     Mode  :character
##  Mean   :40.67
##  3rd Qu.:70.00
##  Max.   :70.00
```

```r
cat("Región 2: Asia Central","\n")
```

```
## Región 2: Asia Central
```

```r
summary(R2)
```

```
##  electrd_fosiles  electrd_de_f_bajas_carb  energ_renov     PIB_per_cap
##  Min.   : 0.000   Min.   :  8.347         Min.   : 1.15   Min.   :  718.2
##  1st Qu.: 0.000   1st Qu.: 12.505         1st Qu.: 2.12   1st Qu.: 1477.2
##  Median : 5.535   Median : 41.805         Median :60.45   Median : 2776.1
##  Mean   :26.146   Mean   : 51.249         Mean   :49.82   Mean   : 3959.5
```

```
##  3rd Qu.:59.182   3rd Qu.:100.000         3rd Qu.:86.58   3rd Qu.: 4063.7
##  Max.   :96.360   Max.   :100.000         Max.   :93.46   Max.   :13890.6
##  densidad_pobl_Km2    region
##  Min.   :  7.0     Length:60
##  1st Qu.:  7.0     Class :character
##  Median : 20.0     Mode  :character
##  Mean   :122.7
##  3rd Qu.:341.0
##  Max.   :341.0
```

```
cat("Región 1: Oceania","\n")
```

```
## Región 1: Oceania
```

```
apply(R1[,1:5], 2, sd)
```

```
##         electrd_fosiles electrd_de_f_bajas_carb             energ_renov
##                96.40994                22.76190                16.25952
##             PIB_per_cap       densidad_pobl_Km2
##             21785.96812                28.21628
```

```
cat("Región 2: Asia Central","\n")
```

```
## Región 2: Asia Central
```

```
apply(R2[,1:5], 2, sd)
```

```
##         electrd_fosiles electrd_de_f_bajas_carb             energ_renov
##                34.30846                37.40357                36.60060
##             PIB_per_cap       densidad_pobl_Km2
##              3483.58181               155.77980
```

```
cat("Región 1: Oceania","\n")
```

```
## Región 1: Oceania
```

```
Rm = function(x)((max(x)+min(x))/2)
apply(R1[,1:5], 2, Rm)
```

```
##         electrd_fosiles electrd_de_f_bajas_carb             energ_renov
##               108.23500                41.21562                33.18500
##             PIB_per_cap       densidad_pobl_Km2
##             34849.34733                36.50000
```

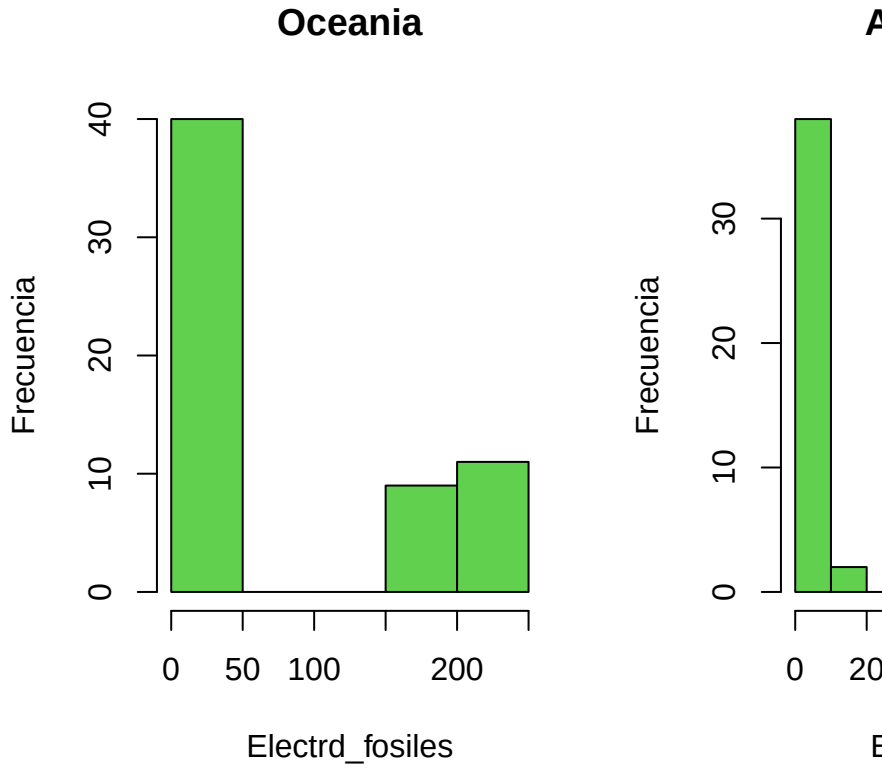
```
cat("Región 2: Asia Central","\n")
```

```
## Región 2: Asia Central
```

```
apply(R2[,1:5], 2, Rm)
```

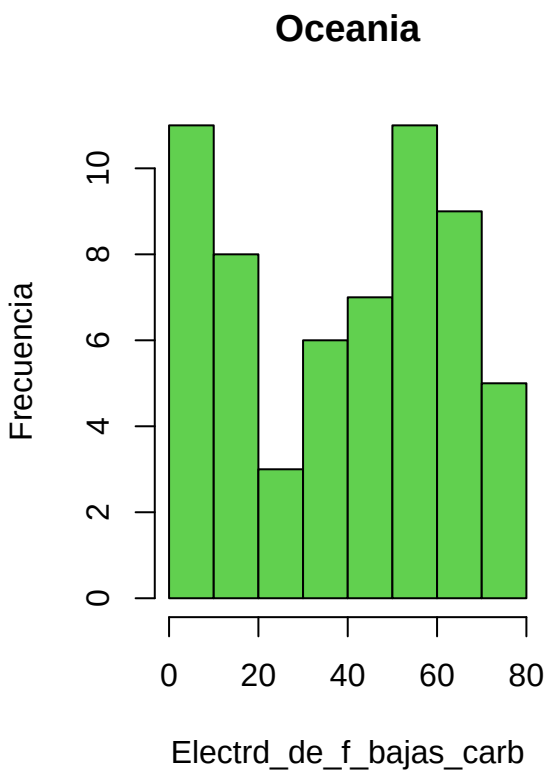
```
##         electrd_fosiles electrd_de_f_bajas_carb             energ_renov
##                48.18000                54.17342                47.30500
##             PIB_per_cap       densidad_pobl_Km2
##              7304.41365               174.00000
```

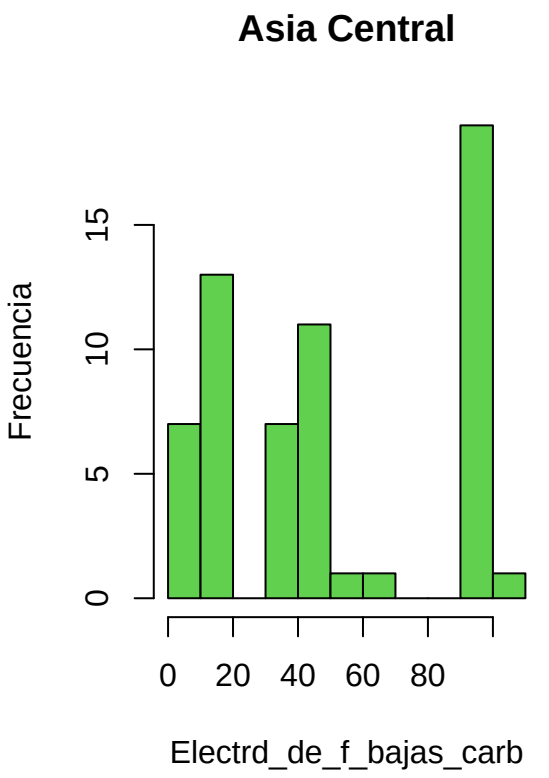
```
par(mfrow=c(1,2))
hist(R1$electrd_fosiles, col = 3, main = "Oceania", xlab = "Electrd_fosiles", ylab = "Frecuencia")
hist(R2$electrd_fosiles, col = 3, main = "Asia Central", xlab = "Electrd_fosiles", ylab = "Frecuencia")
```



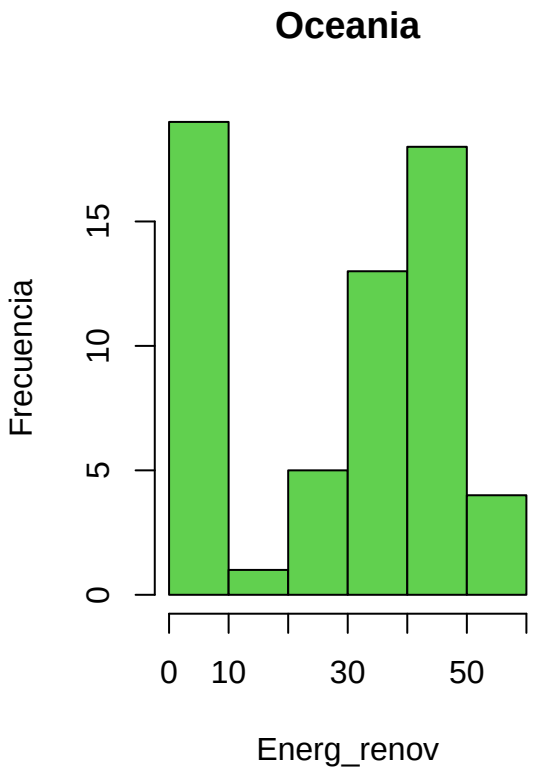
Análisis Gráfico (histogramas y boxplots)

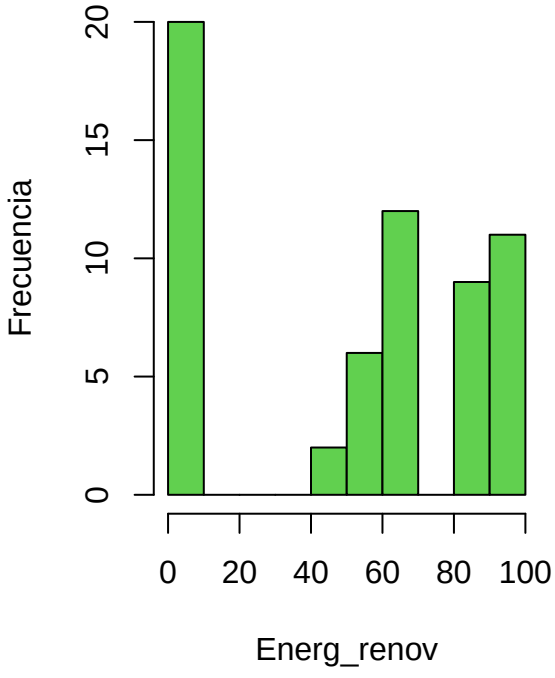
```
hist(R1$electrd_de_f_bajas_carb, col = 3, main = "Oceania", xlab = "Electrd_de_f_bajas_carb", ylab = "F
hist(R2$electrd_de_f_bajas_carb, col = 3, main = "Asia Central", xlab = "Electrd_de_f_bajas_carb", ylab
```



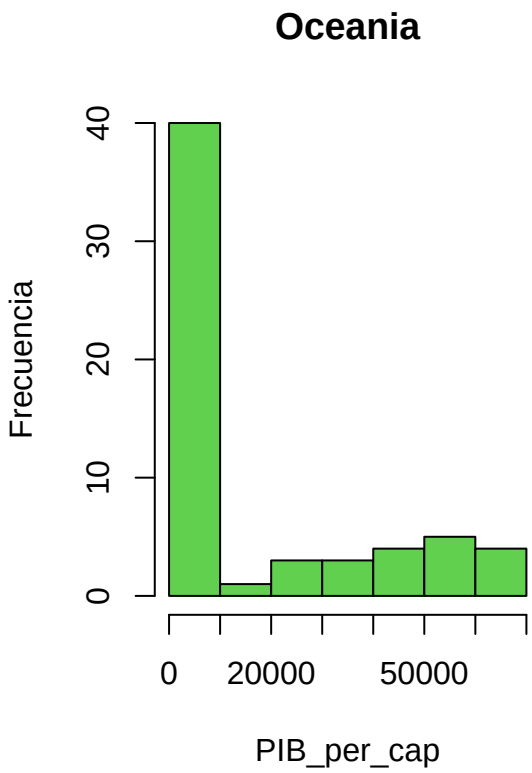


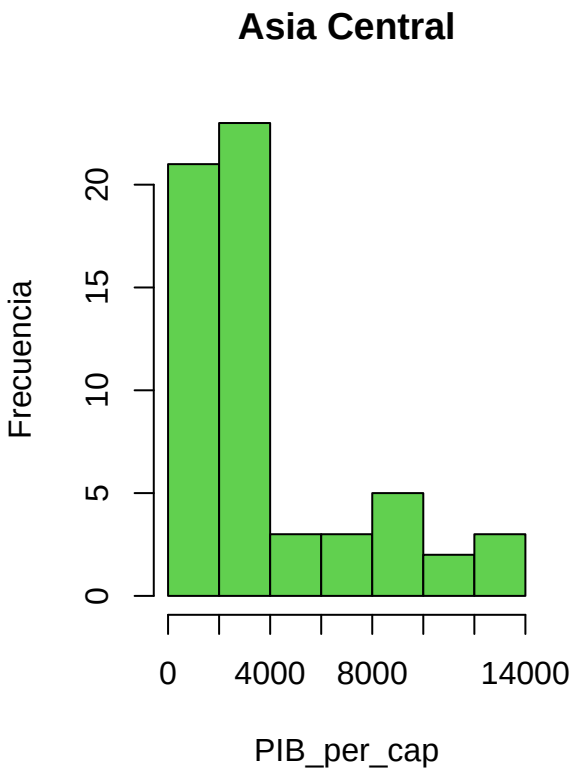

```r
hist(R1$energ_renov, col = 3, main = "Oceania", xlab = "Energ_renov", ylab = "Frecuencia")
hist(R2$energ_renov, col = 3, main = "Asia Central", xlab = "Energ_renov", ylab = "Frecuencia")
```



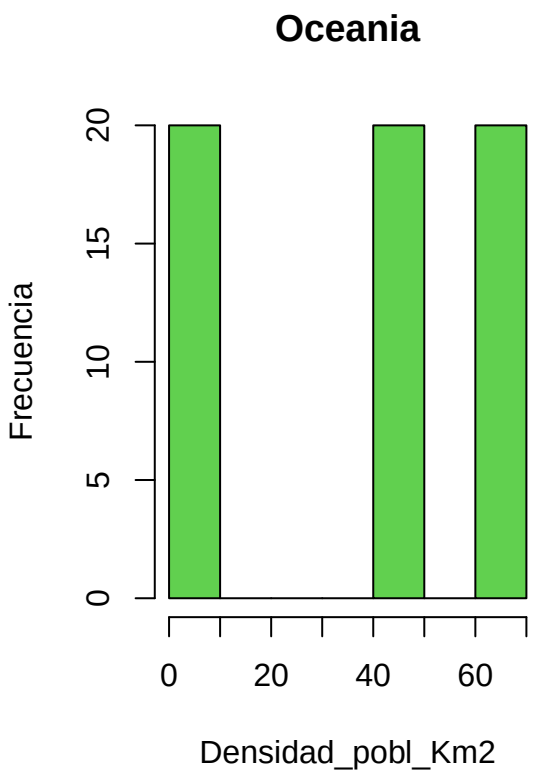


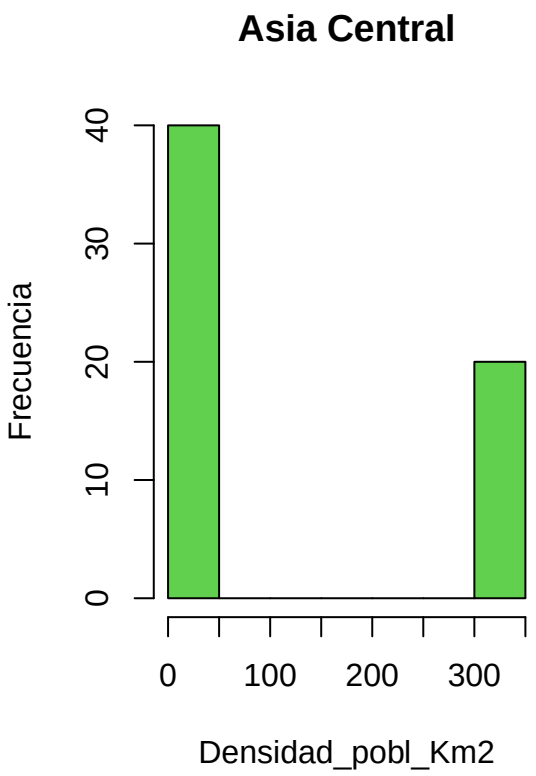
```r
hist(R1$PIB_per_cap, col = 3, main = "Oceania", xlab = "PIB_per_cap", ylab = "Frecuencia")
hist(R2$PIB_per_cap, col = 3, main = "Asia Central", xlab = "PIB_per_cap", ylab = "Frecuencia")
```



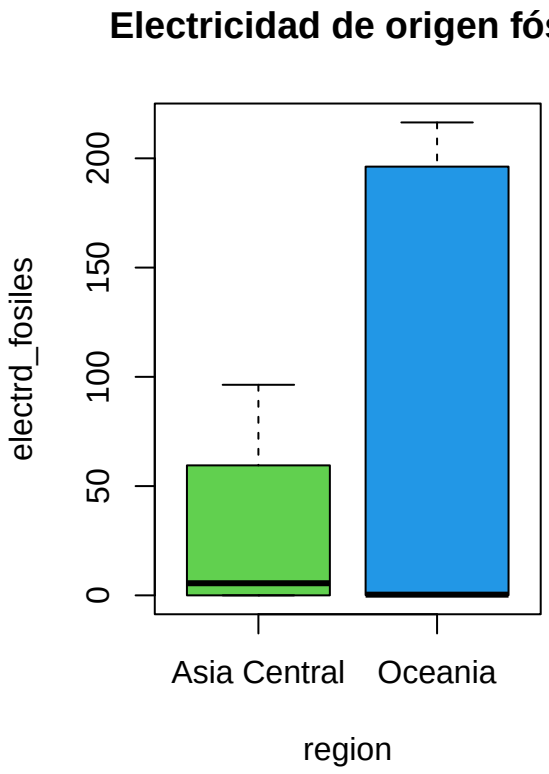


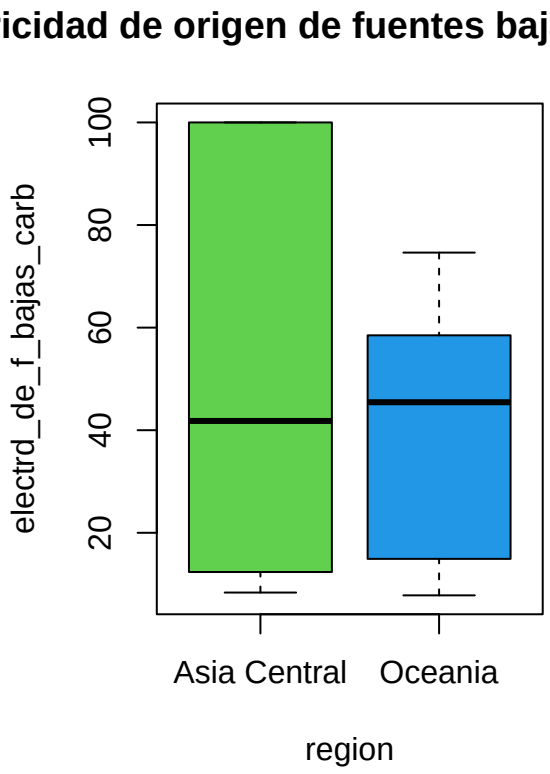

```r
hist(R1$densidad_pobl_Km2, col = 3, main = "Oceania", xlab = "Densidad_pobl_Km2", ylab = "Frecuencia")
hist(R2$densidad_pobl_Km2, col = 3, main = "Asia Central", xlab = "Densidad_pobl_Km2", ylab = "Frecuenc
```



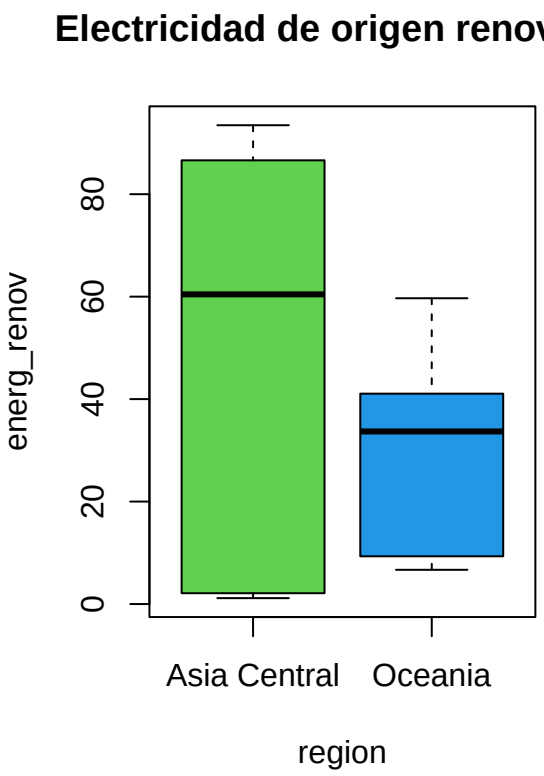


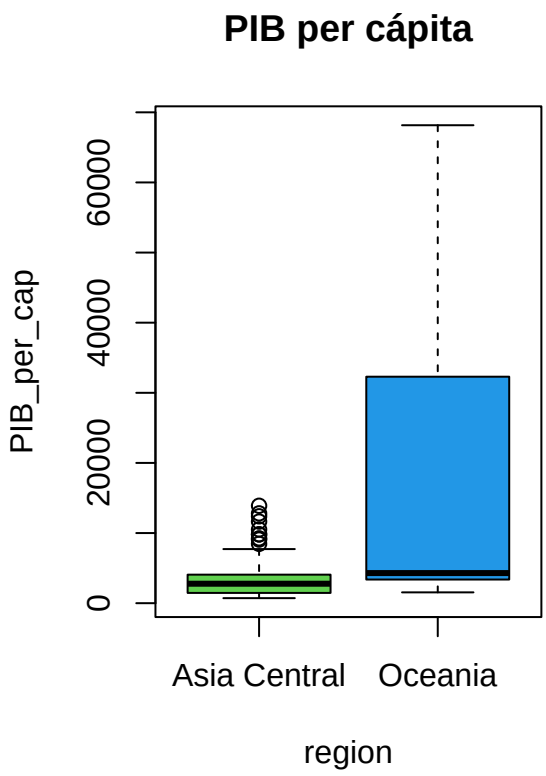

```
par(mfrow=c(1,2))
boxplot(electrd_fosiles ~ region, data = datos1, col=3:4, main = "Electricidad de origen fósil")
boxplot(electrd_de_f_bajas_carb ~ region, data = datos1, col=3:4, main = "Electricidad de origen de fuer
```



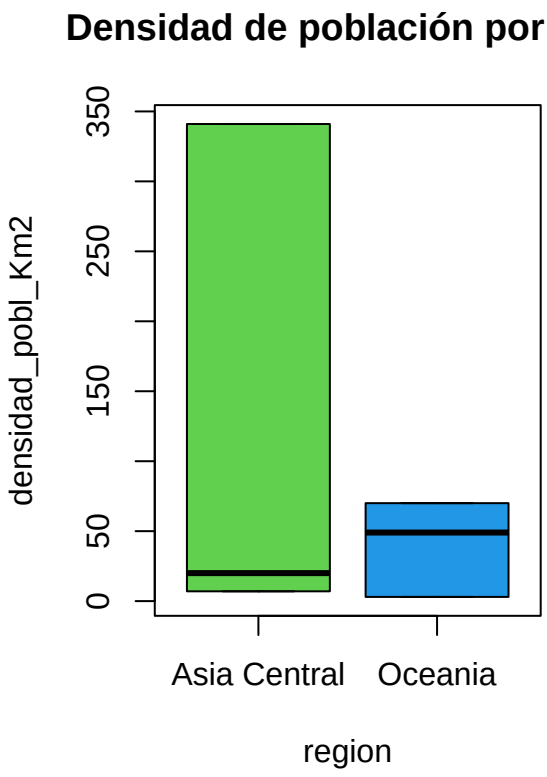


```r
boxplot(energ_renov ~ region, data = datos1, col=3:4, main = "Electricidad de origen renovable")
boxplot(PIB_per_cap ~ region, data = datos1, col=3:4, main = "PIB per cápita")
```






```r
boxplot(densidad_pobl_Km2 ~ region, data = datos1, col=3:4, main = "Densidad de población por km2")
```



Análisis de Relación

```
correl <- cor(R1[,1:5])
round(correl, 3)
```

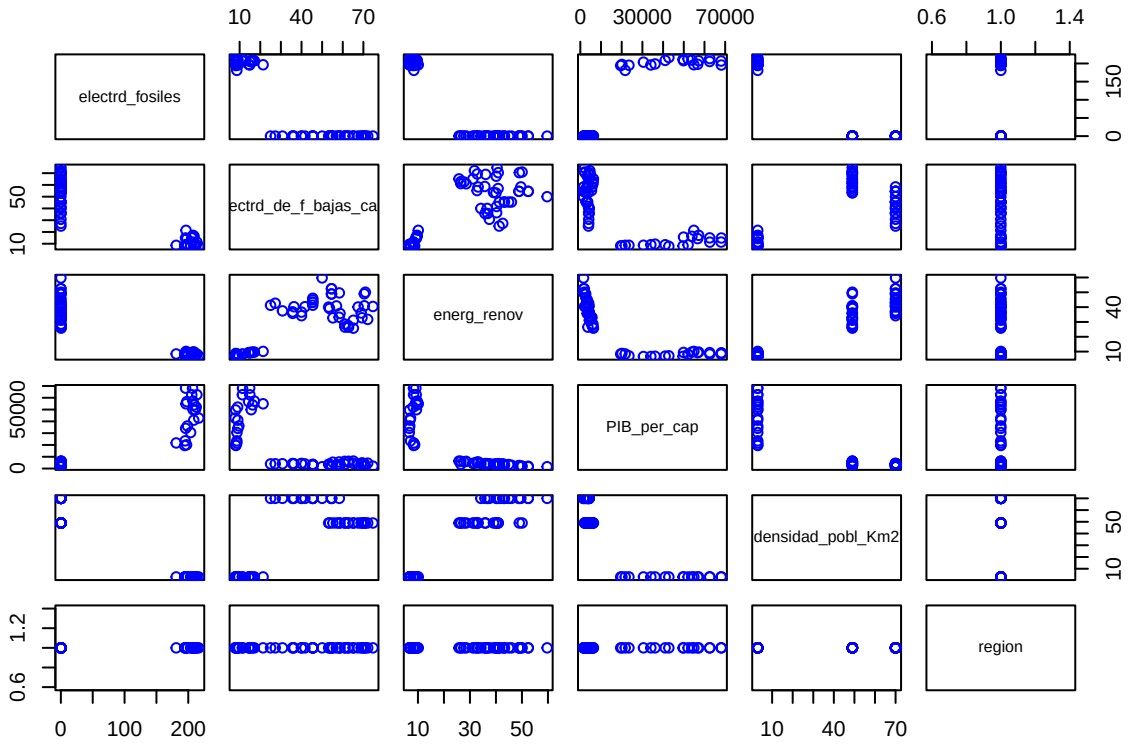
Calcula el coeficiente de correlación para todas las variables / Gráfico de dispersión

```
##                         electrd_fosiles electrd_de_f_bajas_carb energ_renov
## electrd_fosiles                   1.000                  -0.875      -0.916
## electrd_de_f_bajas_carb          -0.875                   1.000       0.777
## energ_renov                      -0.916                   0.777       1.000
## PIB_per_cap                       0.916                  -0.768      -0.839
## densidad_pobl_Km2                -0.951                   0.720       0.937
##                         PIB_per_cap densidad_pobl_Km2
## electrd_fosiles               0.916            -0.951
## electrd_de_f_bajas_carb      -0.768             0.720
## energ_renov                  -0.839             0.937
## PIB_per_cap                   1.000            -0.868
## densidad_pobl_Km2            -0.868             1.000
```

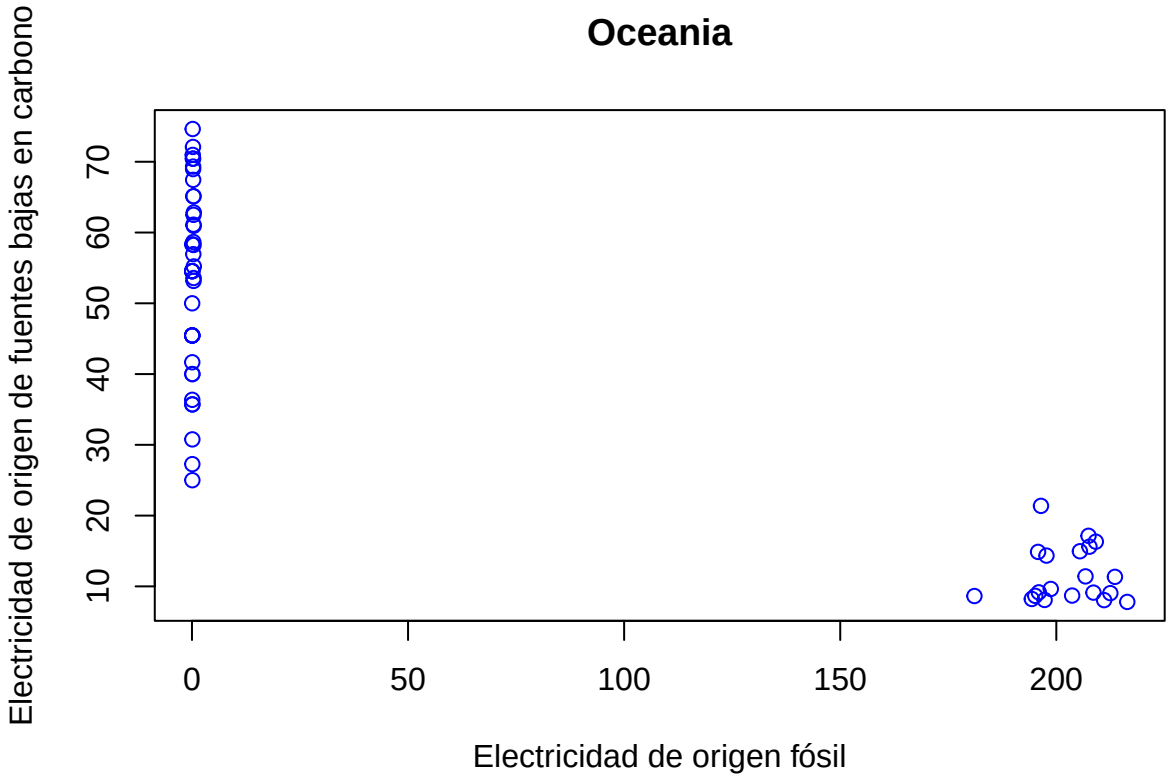
```
correl <- cor(R2[,1:5])
round(correl, 3)
```

```
##                         electrd_fosiles electrd_de_f_bajas_carb energ_renov
## electrd_fosiles                   1.000                  -0.792      -0.927
## electrd_de_f_bajas_carb          -0.792                   1.000       0.935
## energ_renov                      -0.927                   0.935       1.000
## PIB_per_cap                       0.839                  -0.593      -0.698
## densidad_pobl_Km2                -0.447                  -0.129       0.206
##                         PIB_per_cap densidad_pobl_Km2
## electrd_fosiles               0.839            -0.447
## electrd_de_f_bajas_carb      -0.593            -0.129
## energ_renov                  -0.698             0.206
## PIB_per_cap                   1.000            -0.325
## densidad_pobl_Km2            -0.325             1.000
```

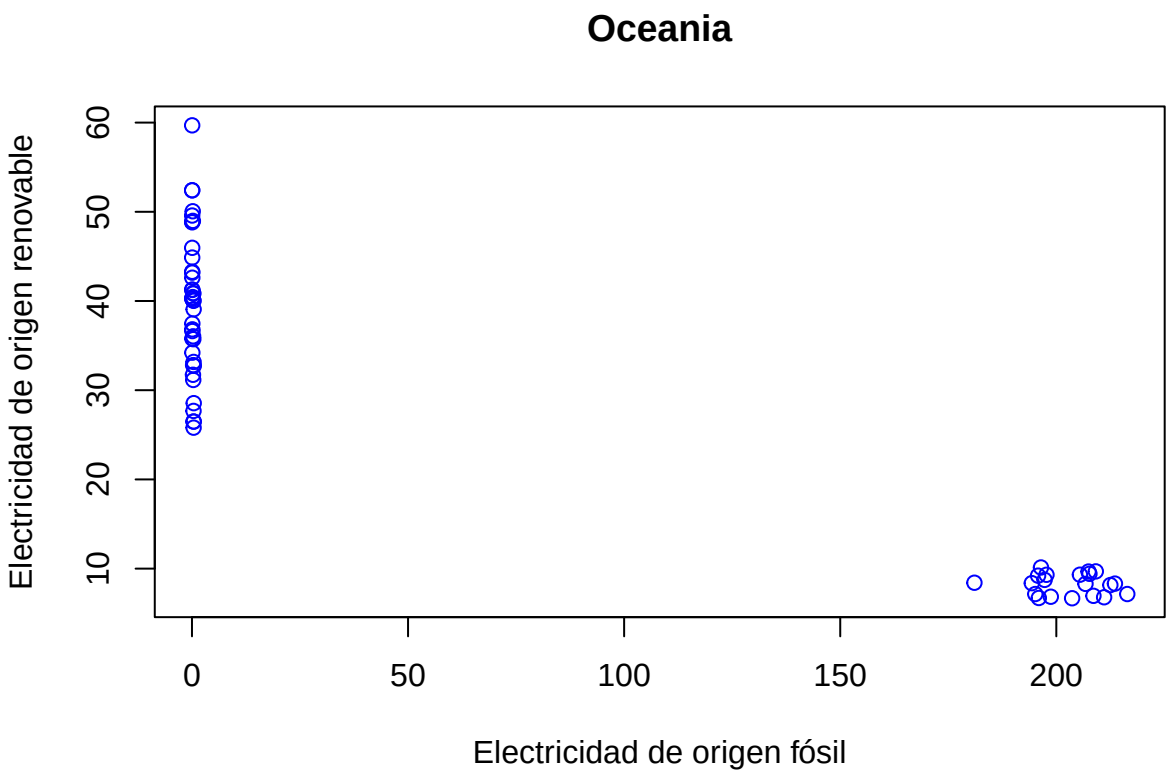
```
plot(R1, col = "blue")
```



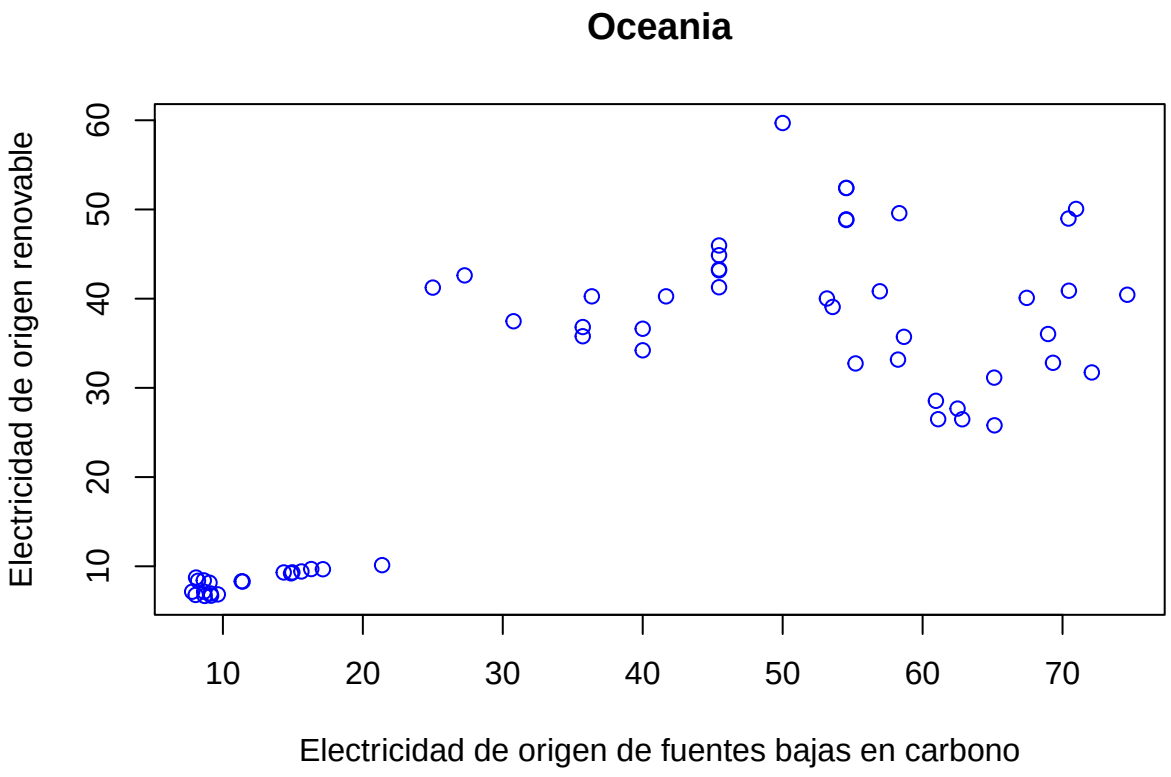

```
plot(R1$electrd_fosiles, R1$electrd_de_f_bajas_carb, col = "blue", main = "Oceania", xlab = "Electricida
```



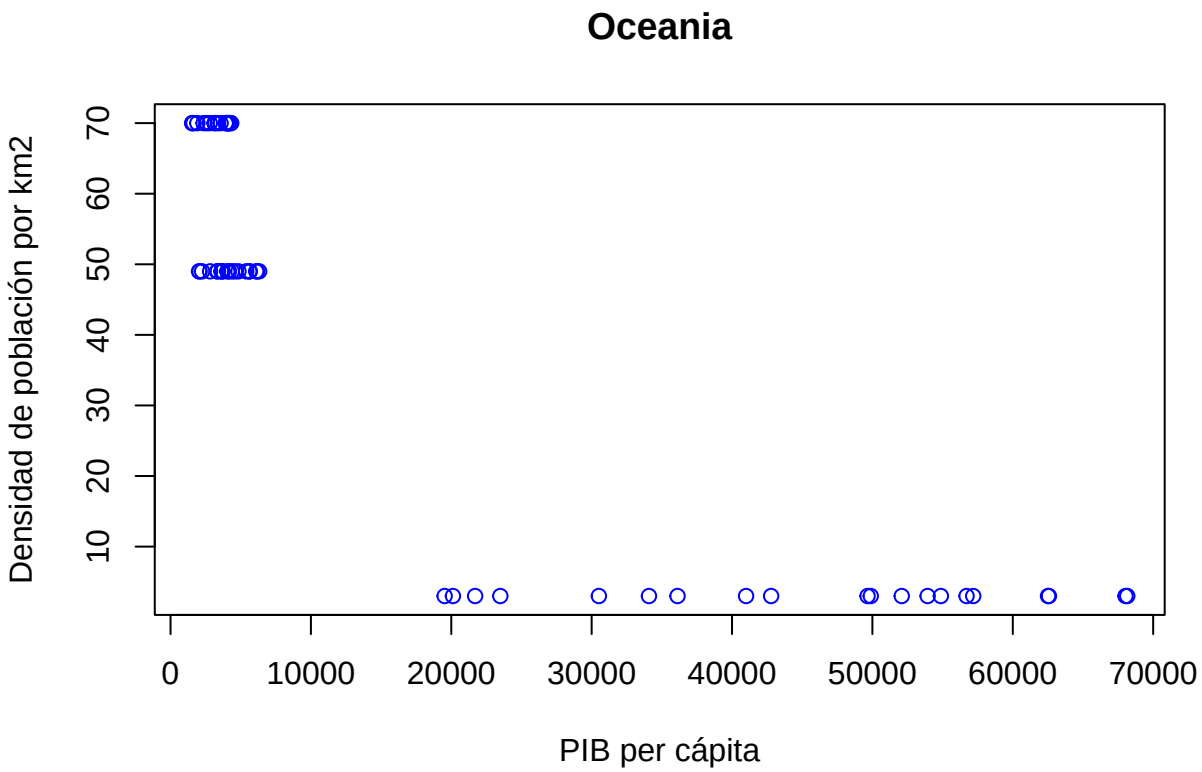

```
plot(R1$electrd_fosiles, R1$energ_renov, col = "blue", main = "Oceania", xlab = "Electricidad de origen
```



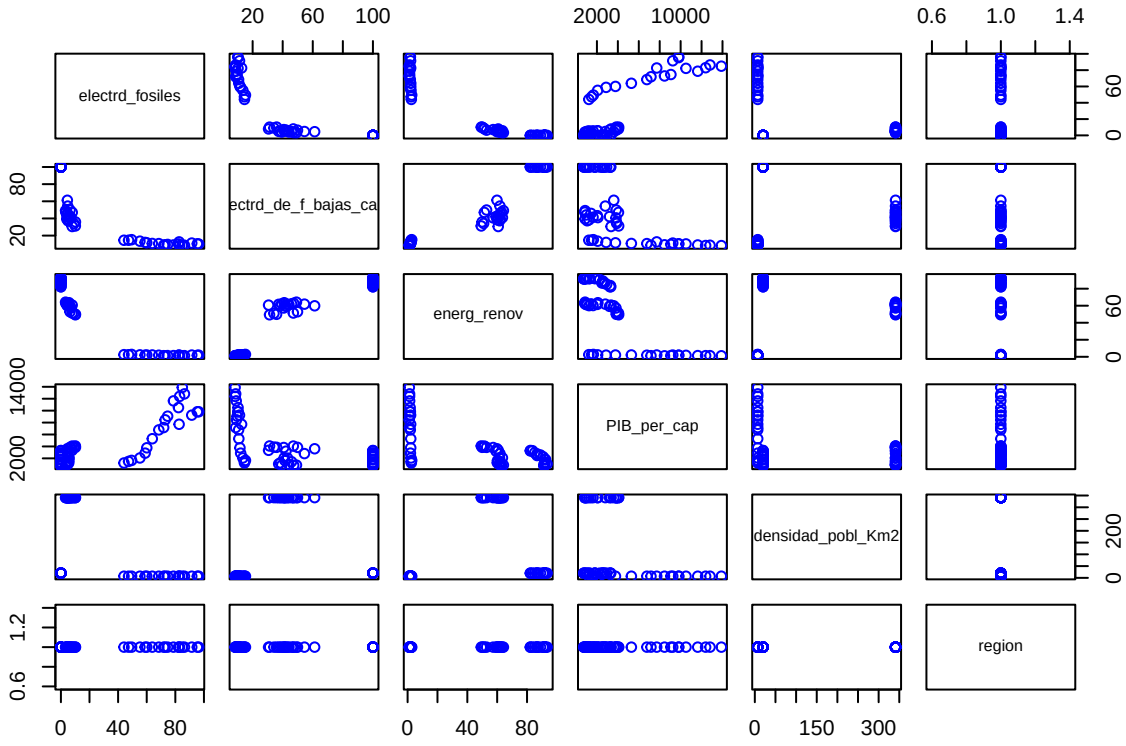

```
plot(R1$electrd_de_f_bajas_carb, R1$energ_renov, col = "blue", main = "Oceania", xlab = "Electricidad d
```



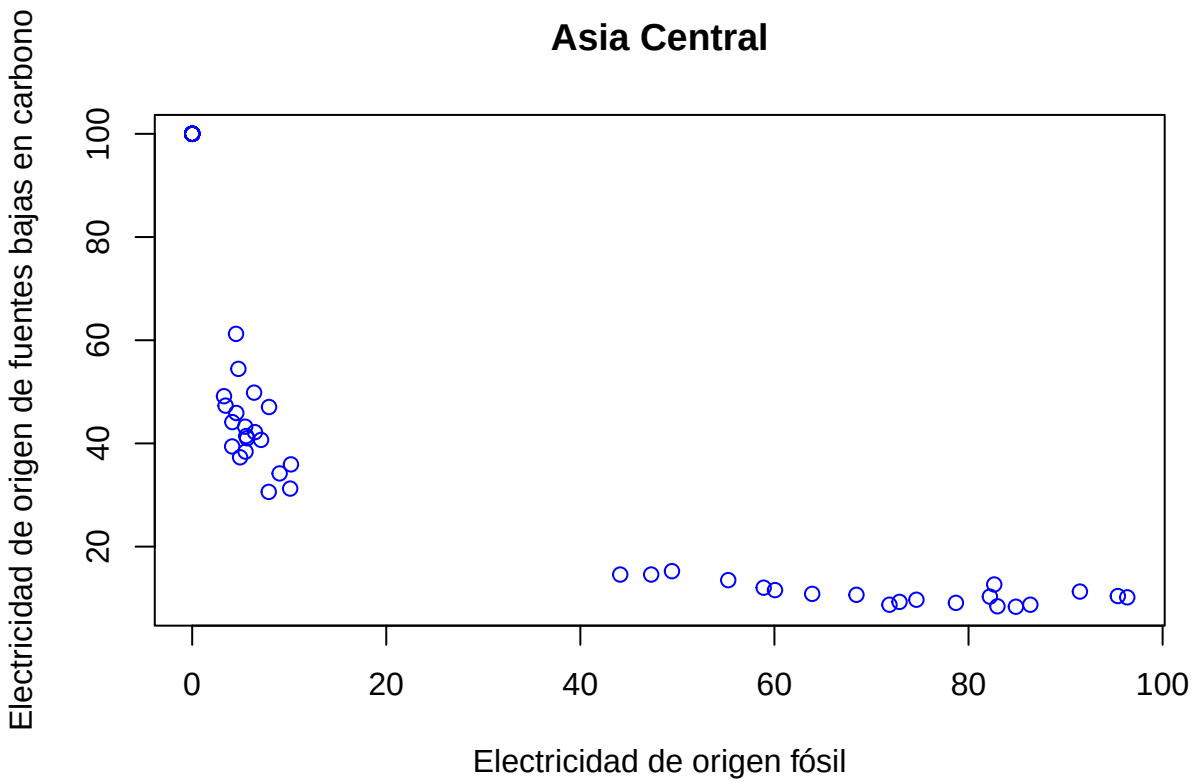
```r
plot(R1$PIB_per_cap, R1$densidad_pobl_Km2, col = "blue", main = "Oceania", xlab = "PIB per cápita", ylab
```



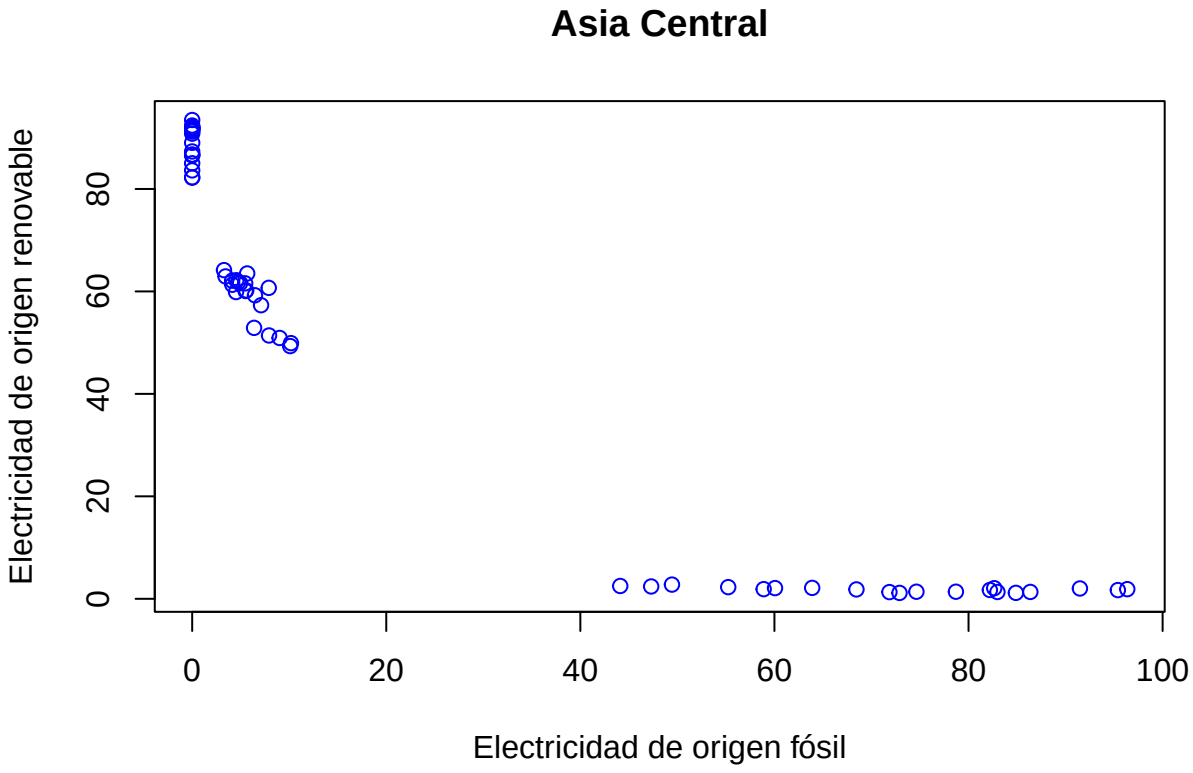

```r
plot(R2, col = "blue")
```



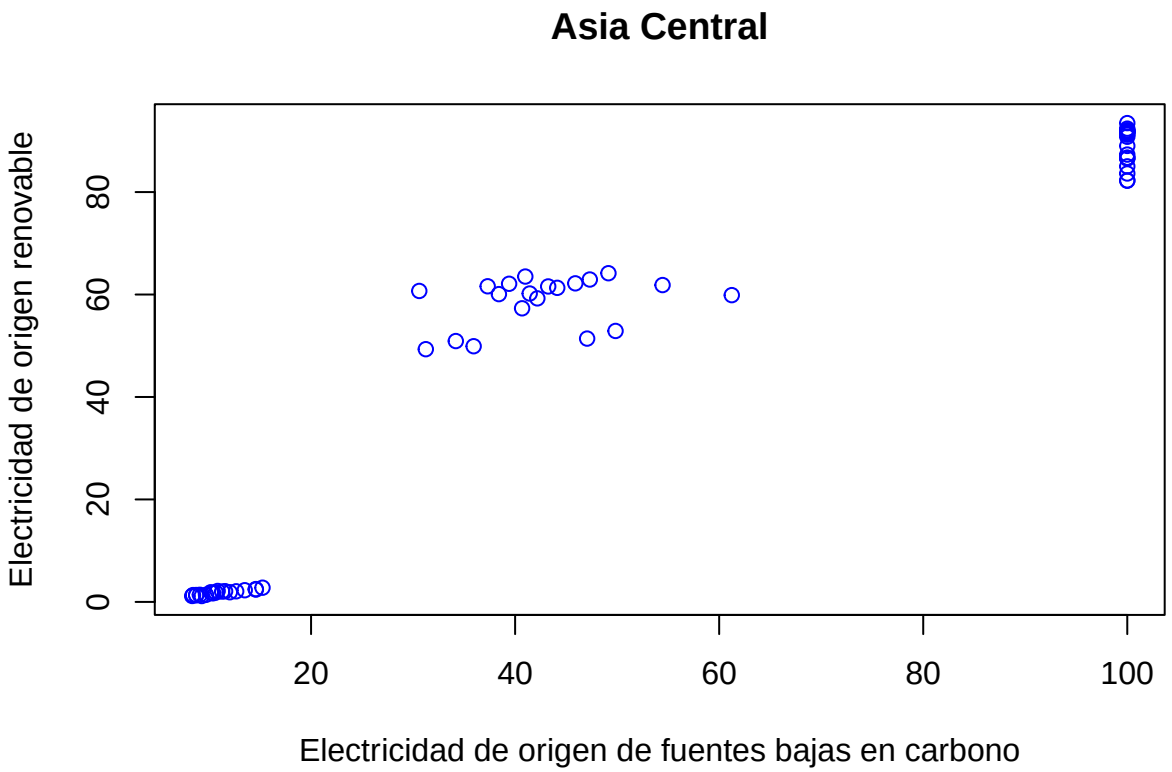
```r
plot(R2$electrd_fosiles, R2$electrd_de_f_bajas_carb, col = "blue", main = "Asia Central", xlab = "Electr
```




```r
plot(R2$electrd_fosiles, R2$energ_renov, col = "blue", main = "Asia Central", xlab = "Electricidad de or
```



```r
plot(R2$electrd_de_f_bajas_carb, R2$energ_renov, col = "blue", main = "Asia Central", xlab = "Electrici
```




```r
plot(R2$PIB_per_cap, R2$densidad_pobl_Km2, col = "blue", main = "Asia Central", xlab = "PIB per cápita"
```