R Notebook

This is an R Markdown Notebook. When you execute code within the notebook, the results appear beneath the code.

Try executing this chunk by clicking the *Run* button within the chunk or by placing your cursor inside it and pressing *Ctrl+Shift+Enter*.

```
setwd("C:/Users/Usuario/Desktop/UOC/2o semestre/Mineria_de_datos/Práctica/archivos")
datos_tienda<-read.csv("tienda.cvs", header=FALSE, fileEncoding='UTF-8')
datos_pais<-read.csv("pais.cvs", header=FALSE, fileEncoding='UTF-8')
datos_region<-read.csv("regiongeografica.cvs", header=FALSE, fileEncoding='UTF-8')
datos_cliente<-read.csv("cliente.cvs", header=FALSE, fileEncoding='UTF-8')
datos_producto<-read.csv("producto.cvs", header=FALSE, fileEncoding='UTF-8')
datos_familia<-read.csv("familia.cvs", header=FALSE, fileEncoding='UTF-8')
datos_subfamilia<-read.csv("subfamilia.cvs", header=FALSE, fileEncoding='UTF-8')
datos_seccion<-read.csv("seccion.cvs", header=FALSE, fileEncoding='UTF-8')
datos_pedido<-read.csv("pedido.cvs", header=FALSE, fileEncoding='UTF-8')
datos_proveedor<-read.csv("proveedor.cvs", header=FALSE, fileEncoding='UTF-8')
datos_promocion<-read.csv("promocion.cvs", header=FALSE, fileEncoding='UTF-8')
datos_lineas<-read.csv("lineasticket.cvs", header=FALSE, fileEncoding='UTF-8')
datos_cabecera<-read.csv("cabeceraticket.cvs", header=FALSE, fileEncoding='UTF-8')
# Comprobamos que hemos cargado bien los datos usando la funciÃ³n head()
head(datos_tienda)
```

```
##                V1                       V2  V3              V4
## 1       Barcelona         Castellets, 119  223 Centro comercial
## 2       Florencia               Venize, 56 275 Tienda de barrio
## 3 Fort Lauderdale     23, Vyn Ness Street  135 Centro comercial
## 4       Liverpool       23, Kingstown Road  80 Tienda de barrio
## 5       Londres I     78, Westland Street  114         Galería
## 6       Londres II 198, SouthCastle Street  195 Centro comercial
##              V5   V6
## 1         España XRTX
## 2         Italia XRTS
## 3 Estados Unidos BRTX
## 4   Reino Unido  BRXS
## 5   Reino Unido  BRTX
## 6   Reino Unido  BRXX
```

```
head(datos_pais)
```

```
##               V1      V2        V3           V4
## 1         Italia  301230  58384321   Sur Europa
## 2 Estados Unidos 9372610 266504935 Norteamérica
## 3         España  504750  39510740   Sur Europa
## 4       Francia   547030  58376462 Norte Europa
## 5       Alemania  356910  81549019 Norte Europa
## 6   Reino Unido   244820  58452516 Norte Europa
```

```
head(datos_region)
```

```
##               V1       V2
## 1   Norteamérica América
## 2 Latinoamérica  América
```

```
## 3   Norte Europa   Europa
## 4     Sur Europa   Europa
## 5       Oceanía  Oceanía
```

```
head(datos_cliente)
```

```
##         V1                     V2      V3       V4        V5
## 1 0000001R Roca Sacristán Narciso Hombre  19551220 Soltero/a
## 2 0065536F Fuentes Mohedano Rosa    Mujer 19420108 Casado/a
## 3 0065537P       Prat Salom Pedro Hombre  19400315 Casado/a
## 4 0000002J         Jones Nicholas Hombre  19110808 Soltero/a
## 5 0000003B       Burton Alexander Hombre  19420417 Casado/a
## 6 0065538S         Sales Deborah    Mujer 19410526 Casado/a
##                                       V6
## 1 Piazzale Suppercortemaggiore 4 , Milano
## 2               C/ Niza 73 08032 Barcelona
## 3       corso Vittorio Emanuele, 102 Roma
## 4     1 Place de la Sorbonne , 75003 Paris
## 5   46 Stockwell Place ,Liverpool L69 2DH
## 6               Leopoldstraße 44, München
##                                     V7 V8           V9          V10 V11
## 1 Economistas,Abogados & Admin.Empresas   0   Sur Europa       España   4
## 2             Ingenieros & Especialistas  1   Sur Europa       España  16
## 3   Doctores & Profesionales de la Salud  2   Sur Europa       España  14
## 4             Ingenieros & Especialistas  0 Norte Europa Reino Unido    2
## 5   Doctores & Profesionales de la Salud  2 Norte Europa Reino Unido   13
## 6 Economistas,Abogados & Admin.Empresas   1 Norte Europa Reino Unido    7
##   V12
## 1   7
## 2  13
## 3  10
## 4   9
## 5   9
## 6  11
```

```
head(datos_producto)
```

```
##      V1                   V2           V3   V4   V5               V6
## 1 001CH             Chesire  Reino Unido  3.30 4.69 Porción (250 g)
## 2 002CO             Cotswold Reino Unido  3.47 4.98 Porción (250 g)
## 3 003CL Crumbly Lancanshire  Reino Unido  3.93 5.59 Porción (250 g)
## 4 004DG   Double Gloucester  Reino Unido  3.48 4.98 Porción (250 g)
## 5 005HU             Huntsman Reino Unido  4.83 6.84 Porción (250 g)
## 6 006MB Mature Blue Stilton  Reino Unido  5.08 7.13 Porción (250 g)
##                   V7             V8  V9
## 1       Vaca Curado    Smith Farmer 101
## 2       Vaca Curado        Old Hill 101
## 3   Vaca Semicurado  The Farmhouse  101
## 4       Vaca Curado      Mr. Cooper 101
## 5 Vaca Pasta veteada     Thoncheese 101
## 6 Vaca Pasta veteada       Blue Cow 101
```

```
head(datos_familia)
```

```
##                       V1 V2     V3
## 1             D.O. Rioja    Vinos
```

```
## 2           D.O. Penedés    Vinos
## 3 D.O. Ribera del Duero     Vinos
## 4         D.O. Somontano    Vinos
## 5         D.O. Priorato     Vinos
## 6             D.O. Pfalz    Vinos
```

```
head(datos_subfamilia)
```

```
##                    V1 V2          V3
## 1     D.O. Rioja-Tinto      D.O. Rioja
## 2   D.O. Rioja-Blanco       D.O. Rioja
## 3   D.O. Rioja-Rosado       D.O. Rioja
## 4   D.O. Penedés-Tinto    D.O. Penedés
## 5 D.O. Penedés-Blanco     D.O. Penedés
## 6 D.O. Penedés-Rosado     D.O. Penedés
```

```
head(datos_seccion)
```

```
##           V1 V2
## 1     Vinos  NA
## 2 Espumosos  NA
## 3   Licores  NA
## 4     Quesos NA
## 5   Postres  NA
```

```
head(datos_pedido)
```

```
##      V1          V2    V3    V4 V5       V6 V7       V8
## 1 82207   Florencia 137TR 16.00 12 20000801 12 20000821
## 2 70595       Milán 219SY 18.28 12 20000801 12 20000821
## 3 93196 Miami Beach 335GB  9.31 12 20000801 12 20000821
## 4 66160     París I 305CH 18.03 12 20000801 12 20000821
## 5 55187       Roma  266BP  4.79 12 20000801 12 20000821
## 6 35933 Manhattan I 166TR  5.08 12 20000801 12 20000821
```

```
head(datos_proveedor)
```

```
##    V1                                V2                  V3
## 1 101           The Farmhouse Company        Richard Addams
## 2 102 Cooperative de Produits Laitiers Jean François Duval
## 3 103               Compagnie Laitier    Florence Deveroix
## 4 104             Compagnie du Fromage     Jacques Decruel
## 5 105               The Holland House        Mark Vanderlok
## 6 106 Cooperativa Agricola il Poggiolo   Andrea Cavaglieri
##                                                 V4       V5 V6 V7 V8
## 1                    122 Brackenbury Rd.,London SW3 76589900 60 NA NA
## 2             34 Rue de Raspail , Brussels, Belgium  90090011 60 NA NA
## 3         96 Rue Vauvilliers  , 75003 Paris, France  79034678 60 NA NA
## 4 15 Boulevard Bonne Nouvelle , 76003 Paris, France  56341390 90 NA NA
## 5           Leidsekade 97 1017 PN Amsterdam, Holland 45562389 60 NA NA
## 6   SS 503 Km. 23- Fraz. Rossoio 20 - 50042 -Italia   7893467 90 NA NA
##        V9
## 1 Global
## 2 Global
## 3 Global
## 4 Global
## 5 Global
```

```
## 6 Global
```

```
head(datos_promocion)
```

```
##                          V1           V2 V3       V4       V5    V6 V7 V8
## 1            Semillon 5%  Descuento 5% NA 20000901 20000930 295GS NA NA
## 2     Merlot Introduction          3x2  NA 20001001 20001031 308ME NA NA
## 3         Mahon-Chardonnay     Cruzada  NA 20001001 20001031 077MA NA NA
## 4 Carquiñolis-GranReserva      Cruzada  NA 20001101 20001130 108CA NA NA
## 5     Chocolate-Champagne      Cruzada  NA 20001101 20001130 123CB NA NA
##            V9 V10 V11
## 1              NA  NA
## 2              NA  NA
## 3 Manhattan I  NA  NA
## 4   Barcelona  NA  NA
## 5   Londres I  NA  NA
```

```
head(datos_lineas)
```

```
##   V1        V2   V3     V4 V5     V6 V7    V8
## 1  1 RO0196608 Roma 123CB   1  3.990    13641
## 2  1 RO0196609 Roma 267BP   1  8.800    13642
## 3  2 RO0065539 Roma 079MA   1  4.975    13638
## 4  3 RO0065539 Roma 158TR   2 11.450    13638
## 5  4 RO0065539 Roma 283BC   2 29.950    13638
## 6  1 RO0131072 Roma 208ME   1 26.200    13639
```

```
head(datos_cabecera)
```

```
##          V1       V2       V3 V4                 V5 V6       V7 V8 V9
## 1 P20000000 París II 20000918 16 Tarjeta de Crédito     33.1875  3  0
## 2 P20000001 París II 20000908 17           Efectivo     61.9400  2  1
## 3 P20065536 París II 20000915 13 Tarjeta de Crédito     26.9175  2  0
## 4 P20065537 París II 20000915 14 Tarjeta de Crédito     22.9500  3  0
## 5 P20000002 París II 20000902 10             Cheque    106.8200  6  1
## 6 P20000003 París II 20001013 11             Cheque     49.1300  6  0
```

```
# Añadimos los nombres de los atributos de cada una de las tablas
colnames(datos_tienda)<-c("nombre", "direccion", "superficie", "formato", "pais", "tipo_zona")
colnames(datos_pais)<-c("nom_pais", "extension", "poblacion", "nom_region")
colnames(datos_region)<-c("nom_region", "continente")
colnames(datos_cliente)<-c("cod_cliente", "nom_cliente", "sexo", "fecha_nac", "estado_civil", "direccion
                           "profesion", "num_hijos", "region", "nacionalidad", "total_compras", "puntos_
colnames(datos_producto)<-c("cod_producto", "descripcion", "nom_pais", "coste", "precio_venta", "tipo_u
                            "nom_subfamilia", "marca", "cod_proveedor")
colnames(datos_familia)<-c("nom_familia", "descripcion", "nom_seccion")
colnames(datos_subfamilia)<-c("nom_subfamilia", "descripcion", "nom_familia")
colnames(datos_seccion)<-c("nom_seccion", "descripcion")
colnames(datos_pedido)<-c("cod_pedido", "nom_tienda", "cod_producto", "precio_compra", "cantidad_solici
                          "fecha_solicitud", "cantidad_entregada", "fecha_entrega")
colnames(datos_proveedor)<-c("cod_proveedor", "nom_proveedor", "pers_contacto", "direccion",
                             "telefono", "periodo_pago", "pago_pendiente", "tipo_proveedor", "alcance")
colnames(datos_promocion)<-c("nom_promo", "tipo_promo", "coste", "fecha_ini",
                             "fecha_fin", "cod_producto", "nom_familia", "nom_seccion", "nom_tienda", "
colnames(datos_lineas)<-c("cod_linea", "cod_venta", "nom_tienda", "cod_producto", "cantidad",
                          "precio_venta", "nom_promo", "cod_cabecera")
colnames(datos_cabecera)<-c("cod_venta", "nom_tienda", "fecha", "hora",
```

```
                            "forma_pago", "cod_cliente", "importe_tot", "tot_unid", "puntos_ticket")

# Hacemos una primera descripciÃ³n de los datos utilizando las funciones str() y summary()
str(datos_tienda)
```

```
## 'data.frame':    15 obs. of  6 variables:
##  $ nombre    : Factor w/ 15 levels "Barcelona ","Florencia ",..: 1 2 3 4 5 6 7 8 9 10 ...
##  $ direccion : Factor w/ 15 levels "198, SouthCastle Street ",..: 10 14 3 2 8 1 12 4 6 5 ...
##  $ superficie: num  223 275 135 80 114 195 150 250 200 100 ...
##  $ formato   : Factor w/ 3 levels "Centro comercial",..: 1 3 1 3 2 1 2 2 3 1 ...
##  $ pais      : Factor w/ 6 levels "Alemania","España",..: 2 5 3 6 6 6 2 3 3 3 ...
##  $ tipo_zona : Factor w/ 8 levels "BRTX","BRXS",..: 7 6 1 2 1 3 4 8 5 4 ...
```

```
str(datos_pais)
```

```
## 'data.frame':    16 obs. of  4 variables:
##  $ nom_pais  : Factor w/ 16 levels "Alemania","Argentina ",..: 12 8 7 9 1 14 10 6 4 11 ...
##  $ extension : num  301230 9372610 504750 547030 356910 ...
##  $ poblacion : num  5.84e+07 2.67e+08 3.95e+07 5.84e+07 8.15e+07 ...
##  $ nom_region: Factor w/ 5 levels "Latinoamérica ",..: 5 3 5 2 2 2 2 2 2 2 ...
```

```
str(datos_region)
```

```
## 'data.frame':    5 obs. of  2 variables:
##  $ nom_region: Factor w/ 5 levels "Latinoamérica ",..: 3 1 2 5 4
##  $ continente: Factor w/ 3 levels "América ","Europa",..: 1 1 2 2 3
```

```
str(datos_cliente)
```

```
## 'data.frame':    4069 obs. of  12 variables:
##  $ cod_cliente  : Factor w/ 4069 levels "0000001R","0000002J",..: 1 64 65 2 3 66 67 128 129 192 ...
##  $ nom_cliente  : Factor w/ 3288 levels "Acadia","Acedo Gómez Agustín ",..: 2581 1031 2437 1491 474 1
##  $ sexo         : Factor w/ 3 levels "Empresa","Hombre ",..: 2 3 2 2 2 3 2 2 3 2 ...
##  $ fecha_nac    : int  19551220 19420108 19400315 19110808 19420417 19410526 19641108 19421027 19641
##  $ estado_civil : Factor w/ 5 levels "","Casado/a ",..: 4 2 2 4 2 2 4 2 2 3 ...
##  $ direccion    : Factor w/ 2544 levels "0 Castle Street ,Liverpool L69 3BX",..: 1974 1534 1648 27 93
##  $ profesion    : Factor w/ 10 levels "Alimentación",..: 6 9 5 9 5 6 9 5 6 6 ...
##  $ num_hijos    : int  0 1 2 0 2 1 0 0 3 0 ...
##  $ region       : Factor w/ 3 levels "Norte Europa",..: 3 3 3 1 1 1 1 2 2 1 ...
##  $ nacionalidad : Factor w/ 3 levels "España","Estados Unidos",..: 1 1 1 3 3 3 3 2 2 3 ...
##  $ total_compras: int  4 16 14 2 13 7 10 2 21 5 ...
##  $ puntos_cumul : int  7 13 10 9 9 11 12 6 15 9 ...
```

```
str(datos_producto)
```

```
## 'data.frame':    339 obs. of  9 variables:
##  $ cod_producto  : Factor w/ 339 levels "001CH","002CO",..: 1 2 3 4 5 6 7 8 9 10 ...
##  $ descripcion   : Factor w/ 248 levels "1989 Brut Champagne ",..: 64 72 78 84 112 133 170 134 185 24
##  $ nom_pais      : Factor w/ 15 levels "Alemania","Australia ",..: 13 13 13 13 13 13 13 13 13 13 ...
##  $ coste         : num  3.3 3.47 3.93 3.48 4.83 5.08 4.18 4.15 4.31 5.07 ...
##  $ precio_venta  : num  4.69 4.98 5.59 4.98 6.84 7.13 6.23 6.23 6.23 7.48 ...
##  $ tipo_unidad   : Factor w/ 5 levels "Botella ","Botella (1.5 l) ",..: 4 4 4 4 4 4 4 4 4 4 ...
##  $ nom_subfamilia: Factor w/ 74 levels "Bizcochos ","Bollería",..: 68 68 72 68 71 71 72 68 72 73 ...
##  $ marca         : Factor w/ 184 levels "Allimat-Deiss ",..: 151 125 158 123 167 12 165 184 41 12 ..
##  $ cod_proveedor : num  101 101 101 101 101 101 101 101 101 101 ...
```

```r
str(datos_familia)
```

```
## 'data.frame':    28 obs. of  3 variables:
##  $ nom_familia: Factor w/ 28 levels "Búfala","Cabra ",..: 20 14 19 21 16 15 18 17 12 6 ...
##  $ descripcion: Factor w/ 2 levels "","Tipo de leche ": 1 1 1 1 1 1 1 1 1 1 ...
##  $ nom_seccion: Factor w/ 5 levels "Espumosos ","Licores ",..: 5 5 5 5 5 5 5 5 5 5 ...
```

```r
str(datos_subfamilia)
```

```
## 'data.frame':    115 obs. of  3 variables:
##  $ nom_subfamilia: Factor w/ 115 levels "Bizcochos ","Bollería",..: 77 75 76 59 57 58 74 72 73 80 ..
##  $ descripcion   : Factor w/ 2 levels "","Textura del queso ": 1 1 1 1 1 1 1 1 1 1 ...
##  $ nom_familia   : Factor w/ 28 levels "Búfala","Cabra ",..: 20 20 20 14 14 14 19 19 19 21 ...
```

```r
str(datos_seccion)
```

```
## 'data.frame':    5 obs. of  2 variables:
##  $ nom_seccion: Factor w/ 5 levels "Espumosos ","Licores ",..: 5 1 2 4 3
##  $ descripcion: logi  NA NA NA NA NA
```

```r
str(datos_pedido)
```

```
## 'data.frame':    8882 obs. of  8 variables:
##  $ cod_pedido         : num  82207 70595 93196 66160 55187 ...
##  $ nom_tienda         : Factor w/ 15 levels "Barcelona","Florencia",..: 2 11 10 13 15 8 6 10 5 15 ..
##  $ cod_producto       : Factor w/ 338 levels "001CH","002CO",..: 137 219 334 304 265 166 289 333 275
##  $ precio_compra      : num  16 18.28 9.31 18.03 4.79 ...
##  $ cantidad_solicitada: int  12 12 12 12 12 12 12 12 12 90 ...
##  $ fecha_solicitud    : int  20000801 20000801 20000801 20000801 20000801 20000801 20000801 20000801
##  $ cantidad_entregada : int  12 12 12 12 12 12 12 12 12 90 ...
##  $ fecha_entrega      : int  20000821 20000821 20000821 20000821 20000821 20000821 20000821 20000821
```

```r
str(datos_proveedor)
```

```
## 'data.frame':    48 obs. of  9 variables:
##  $ cod_proveedor : num  101 102 103 104 105 106 107 108 109 110 ...
##  $ nom_proveedor : Factor w/ 48 levels "Atlas Vineyard",..: 44 24 16 15 45 19 23 34 35 38 ...
##  $ pers_contacto : Factor w/ 48 levels "Andrea Cavaglieri ",..: 45 23 13 18 31 1 29 41 24 22 ...
##  $ direccion     : Factor w/ 48 levels "10 Avenue de Caroline , 93021 Bordeaux, France",..: 4 16 24 8
##  $ telefono      : num  76589900 90090011 79034678 56341390 45562389 ...
##  $ periodo_pago  : int  60 60 60 90 60 90 60 60 60 90 ...
##  $ pago_pendiente: logi  NA NA NA NA NA NA ...
##  $ tipo_proveedor: logi  NA NA NA NA NA NA ...
##  $ alcance       : Factor w/ 3 levels "Global ","Local",..: 1 1 1 1 1 1 1 1 3 1 ...
```

```r
str(datos_promocion)
```

```
## 'data.frame':    5 obs. of  11 variables:
##  $ nom_promo   : Factor w/ 5 levels "Carquiñolis-GranReserva ",..: 5 4 3 1 2
##  $ tipo_promo  : Factor w/ 3 levels "3x2 ","Cruzada ",..: 3 1 2 2 2
##  $ coste       : logi  NA NA NA NA NA
##  $ fecha_ini   : int  20000901 20001001 20001001 20001101 20001101
##  $ fecha_fin   : int  20000930 20001031 20001031 20001130 20001130
##  $ cod_producto: Factor w/ 5 levels "077MA","108CA",..: 4 5 1 2 3
##  $ nom_familia : logi  NA NA NA NA NA
##  $ nom_seccion : logi  NA NA NA NA NA
##  $ nom_tienda  : Factor w/ 4 levels "","Barcelona",..: 1 1 4 2 3
```

```
##  $ nom_region  : logi  NA NA NA NA NA
##  $ nom_pais    : logi  NA NA NA NA NA
```

```
str(datos_lineas)
```

```
## 'data.frame':    174671 obs. of  8 variables:
##  $ cod_linea   : int  1 1 2 3 4 1 2 1 1 1 ...
##  $ cod_venta   : Factor w/ 74327 levels "BA0000000","BA0000001",..: 69474 69475 69269 69269 69269 693
##  $ nom_tienda  : Factor w/ 15 levels "Barcelona ","Florencia ",..: 15 15 15 15 15 15 15 15 11 11 ...
##  $ cod_producto: Factor w/ 338 levels "001CH ","002CO ",..: 123 266 79 158 281 208 81 63 178 79 ...
##  $ cantidad    : int  1 1 1 2 2 1 1 2 1 1 ...
##  $ precio_venta: num  3.99 8.8 4.97 11.45 29.95 ...
##  $ nom_promo   : Factor w/ 6 levels "","Carquiñolis-GranReserva ",..: 1 1 1 1 1 1 1 1 1 1 ...
##  $ cod_cabecera: int  13641 13642 13638 13638 13638 13639 13639 13640 13645 13646 ...
```

```
str(datos_cabecera)
```

```
## 'data.frame':    74327 obs. of  9 variables:
##  $ cod_venta    : Factor w/ 74327 levels "BA0000000","BA0000001",..: 67000 67001 67064 67065 67002 67
##  $ nom_tienda   : Factor w/ 15 levels "Barcelona ","Florencia ",..: 14 14 14 14 14 14 14 14 14 14 ..
##  $ fecha        : int  20000918 20000908 20000915 20000915 20000902 20001013 20001009 20001014 20001
##  $ hora         : int  16 17 13 14 10 11 21 9 12 18 ...
##  $ forma_pago   : Factor w/ 6 levels "Cheque","Cheque de Turista ",..: 5 3 5 5 1 1 1 5 3 1 ...
##  $ cod_cliente  : Factor w/ 3924 levels "","0000001R ",..: 1 1 1 1 1 1 1 1 1 1 ...
##  $ importe_tot  : num  33.2 61.9 26.9 22.9 106.8 ...
##  $ tot_unid     : int  3 2 2 3 6 6 7 8 2 2 ...
##  $ puntos_ticket: int  0 1 0 0 1 0 1 1 0 0 ...
```

```
summary(datos_tienda)
```

```
##               nombre                     direccion   superficie
##  Barcelona       :1   198, SouthCastle Street :1   Min.   : 75.0
##  Florencia       :1   23, Kingstown Road      :1   1st Qu.:107.0
##  Fort Lauderdale :1   23, Vyn Ness Street     :1   Median :170.0
##  Liverpool       :1   55, 22nd Street         :1   Mean   :163.8
##  Londres I       :1   560, Collins Av         :1   3rd Qu.:207.5
##  Londres II      :1   67, 51st Street         :1   Max.   :275.0
##  (Other)         :9   (Other)                 :9
##              formato              pais     tipo_zona
##  Centro comercial:4   Alemania      :1   BRXX   :3
##  Galería         :5   España        :2   BXTX   :3
##  Tienda de barrio:6   Estados Unidos:4   BRTX   :2
##                       Francia       :2   XRTX   :2
##                       Italia        :3   XRXX   :2
##                       Reino Unido   :3   BRXS   :1
##                                          (Other):2
```

```
summary(datos_pais)
```

```
##        nom_pais    extension         poblacion                 nom_region
##  Alemania  : 1   Min.   :  30510   Min.   :  3562164   Latinoamérica :1
##  Argentina : 1   1st Qu.:  63478   1st Qu.:  9722349   Norte Europa  :9
##  Australia : 1   Median : 403437   Median : 31708936   Norteamérica  :3
##  Bélgica   : 1   Mean   :2150139   Mean   : 49418835   Oceanía       :1
##  Canadá    : 1   3rd Qu.:2171135   3rd Qu.: 58401370   Sur Europa    :2
##  Dinamarca : 1   Max.   :9976140   Max.   :266504935
##  (Other)   :10
```

```r
summary(datos_region)
```

```
##           nom_region    continente
##  Latinoamérica :1    América :2
##  Norte Europa  :1    Europa  :2
##  Norteamérica  :1    Oceanía :1
##  Oceanía       :1
##  Sur Europa    :1
```

```r
summary(datos_cliente)
```

```
##    cod_cliente           nom_cliente        sexo        fecha_nac
##  0000001R:   1   Hut Pizzeria  :   6   Empresa: 805   Min.   :19100204
##  0000002J:   1   Norma         :   6   Hombre :2076   1st Qu.:19390225
##  0000003B:   1   Payne Henry   :   6   Mujer  :1188   Median :19511109
##  0000004N:   1   Brigham Ernest:   5                  Mean   :19516993
##  0000005E:   1   Noma          :   5                  3rd Qu.:19670811
##  0000006C:   1   Tanner        :   5                  Max.   :19791231
##  (Other) :4063   (Other)       :4036
##         estado_civil                                      direccion
##                : 805   116 Sussex Gardens ,London EC1          :   7
##  Casado/a      :1318   15 Bury St, St James'S ,London NW1      :   7
##  Divorciado/a : 651   Corso Buenos Aires 3 , Milano           :   7
##  Soltero/a     :1219   Piazzale Suppercortemaggiore 4 , Milano :   7
##  Viudo/a       :  76   Via Ludovico Ariosto 22 , Milano        :   7
##                        Viale Lombardia 55 , Milano             :   7
##                        (Other)                                 :4027
##                                    profesion     num_hijos
##  Economistas,Abogados & Admin.Empresas :707   Min.   :0.0000
##  Gerentes & Directivos                 :703   1st Qu.:0.0000
##  Doctores & Profesionales de la Salud  :663   Median :0.0000
##  Ingenieros & Especialistas            :507   Mean   :0.9684
##  Architectos,Decoradores & Humanistas  :485   3rd Qu.:2.0000
##  Catering                              :339   Max.   :4.0000
##  (Other)                               :665   NA's   :805
##           region             nacionalidad  total_compras
##  Norte Europa:1821   España        :1349   Min.   : 0.000
##  Norteamérica: 899   Estados Unidos: 899   1st Qu.: 5.000
##  Sur Europa  :1349   Reino Unido   :1821   Median : 8.000
##                                            Mean   : 8.729
##                                            3rd Qu.:12.000
##                                            Max.   :48.000
##
##   puntos_cumul
##  Min.   :  5.00
##  1st Qu.:  7.00
##  Median :  9.00
##  Mean   : 11.54
##  3rd Qu.: 12.00
##  Max.   :105.00
##
```

```r
summary(datos_producto)
```

```
##   cod_producto           descripcion            nom_pais
```

```
##  001CH  :  1   Tinto Reserva 95: 17   España        :113
##  002CO  :  1   Tinto Reserva 94: 12   Francia       : 68
##  003CL  :  1   Chardonnay 98   :  9   Estados Unidos: 51
##  004DG  :  1   Merlot 97       :  7   Italia        : 25
##  005HU  :  1   Chardonnay 97   :  6   Reino Unido   : 25
##  006MB  :  1   Tinto Crianza 96:  6   Australia     : 15
##  (Other):333   (Other)         :282   (Other)       : 42
##      coste          precio_venta              tipo_unidad
##  Min.   :  1.40   Min.   :  2.000   Botella         :205
##  1st Qu.:  4.18   1st Qu.:  6.305   Botella (1.5 l) :  1
##  Median :  6.15   Median :  9.980   Caja            : 24
##  Mean   : 11.10   Mean   : 18.991   Porción (250 g) :103
##  3rd Qu.: 11.10   3rd Qu.: 19.950   Unidad          :  6
##  Max.   :558.58   Max.   :899.000
##
##                       nom_subfamilia                  marca
##  D.O. Rioja-Tinto            : 40    West Vineyards      : 13
##  D.O. Napa-Blanco            : 34    Château d'Or        : 10
##  Vaca Semicurado             : 26    Golden Valley       : 10
##  Vaca Curado                 : 16    Bodegas de Aragón   :  8
##  D.O. Champagne-Brut         : 14    Conde Duque Alvarez :  8
##  D.O. Ribera del Duero-Tinto : 12    Golden Vineyards    :  8
##  (Other)                     :197    (Other)             :282
##  cod_proveedor
##  Min.   :101.0
##  1st Qu.:110.0
##  Median :304.0
##  Mean   :240.3
##  3rd Qu.:315.0
##  Max.   :329.0
##
```

```
summary(datos_familia)
```

```
##               nom_familia         descripcion     nom_seccion
##  Búfala              : 1                :23   Espumosos : 2
##  Cabra               : 1   Tipo de leche : 5   Licores   : 1
##  D.O. Alsace         : 1                       Postres   : 2
##  D.O. Barossa Valley : 1                       Quesos    : 5
##  D.O. Beaujolais     : 1                       Vinos     :18
##  D.O. Bordeaux       : 1
##  (Other)             :22
```

```
summary(datos_subfamilia)
```

```
##              nom_subfamilia             descripcion     nom_familia
##  Bizcochos           :  1                      :80   Búfala    : 7
##  Bollería            :  1    Textura del queso :35   Cabra     : 7
##  Búfala Añejo        :  1                            D.O. Cava : 7
##  Búfala Curado       :  1                            Mixto     : 7
##  Búfala Fresco       :  1                            Oveja     : 7
##  Búfala Pasta blanda :  1                            Vaca      : 7
##  (Other)             :109                            (Other)   :73
```

```
summary(datos_seccion)
```

```
##      nom_seccion descripcion
##  Espumosos :1    Mode:logical
##  Licores   :1    NA's:5
##  Postres   :1
##  Quesos    :1
##  Vinos     :1
```

```
summary(datos_pedido)
```

```
##    cod_pedido          nom_tienda    cod_producto  precio_compra
##  Min.   :    4   Londres I  : 708   022CA  :  60   Min.   :  1.400
##  1st Qu.:25867   Manhattan I: 660   023CH  :  60   1st Qu.:  3.930
##  Median :50868   París I    : 653   040ED  :  60   Median :  5.250
##  Mean   :50512   Londres II : 633   060PR  :  60   Mean   :  8.199
##  3rd Qu.:75395   Miami Beach: 610   079MA  :  60   3rd Qu.:  8.480
##  Max.   :99994   Munich     : 599   088SG  :  60   Max.   :558.580
##                  (Other)    :5019   (Other):8522
##  cantidad_solicitada fecha_solicitud cantidad_entregada fecha_entrega
##  Min.   :  10.00     Min.   :2e+07   Min.   :   0.00    Min.   :1.9e+07
##  1st Qu.:  10.00     1st Qu.:2e+07   1st Qu.:  10.00    1st Qu.:2.0e+07
##  Median :  12.00     Median :2e+07   Median :  12.00    Median :2.0e+07
##  Mean   :  26.13     Mean   :2e+07   Mean   :  26.08    Mean   :2.0e+07
##  3rd Qu.:  24.00     3rd Qu.:2e+07   3rd Qu.:  24.00    3rd Qu.:2.0e+07
##  Max.   :1752.00     Max.   :2e+07   Max.   :1752.00    Max.   :2.0e+07
##
```

```
summary(datos_proveedor)
```

```
##  cod_proveedor                      nom_proveedor            pers_contacto
##  Min.   :101.0   Atlas Vineyard            : 1    Andrea Cavaglieri : 1
##  1st Qu.:112.8   Australian Cellars Company: 1    Andrew Schnell    : 1
##  Median :305.5   Australian Cow Company    : 1    Begoña Iribarren  : 1
##  Mean   :240.9   Bavarese Inc.             : 1    Benjamin Lynn     : 1
##  3rd Qu.:317.2   Bebidas Selección         : 1    Bettina Rassmann  : 1
##  Max.   :329.0   Bodegas de Aragón         : 1    Carles Vilaseca   : 1
##                  (Other)                   :42    (Other)           :42
##                                          direccion     telefono
##  10 Avenue de Caroline , 93021 Bordeaux, France: 1   Min.   :  3346678
##  119 Rue Volney , 75498 Paris, France          : 1   1st Qu.:  7868732
##  12 American Dr, St Pauls NSW 2111 Australia   : 1   Median : 56852902
##  122 Brackenbury Rd.,London SW3                : 1   Mean   :279829589
##  122Griffin Rd  Fort Lauderdale, FL 33041, USA : 1   3rd Qu.:912349696
##  123 Boulevard Raspail , 75003 Poissy, France  : 1   Max.   :969048832
##  (Other)                                       :42
##   periodo_pago   pago_pendiente tipo_proveedor      alcance
##  Min.   :15.00   Mode:logical   Mode:logical   Global   :46
##  1st Qu.:30.00   NA's:48        NA's:48        Local    : 1
##  Median :60.00                                 Regional : 1
##  Mean   :56.56
##  3rd Qu.:90.00
##  Max.   :90.00
##
```

```
summary(datos_promocion)
```

```
##                    nom_promo        tipo_promo  coste
```

```
##  Carquiñolis-GranReserva :1   3x2         :1    Mode:logical
##  Chocolate-Champagne     :1   Cruzada     :3    NA's:5
##  Mahon-Chardonnay        :1   Descuento 5%:1
##  Merlot Introduction     :1
##  Semillon 5%             :1
##
##    fecha_ini       fecha_fin     cod_producto nom_familia
##  Min.   :2e+07   Min.   :2e+07   077MA:1      Mode:logical
##  1st Qu.:2e+07   1st Qu.:2e+07   108CA:1      NA's:5
##  Median :2e+07   Median :2e+07   123CB:1
##  Mean   :2e+07   Mean   :2e+07   295GS:1
##  3rd Qu.:2e+07   3rd Qu.:2e+07   308ME:1
##  Max.   :2e+07   Max.   :2e+07
##  nom_seccion          nom_tienda nom_region     nom_pais
##  Mode:logical              :2    Mode:logical   Mode:logical
##  NA's:5          Barcelona  :1    NA's:5         NA's:5
##                  Londres I  :1
##                  Manhattan I:1
##
##
```

```
summary(datos_lineas)
```

```
##    cod_linea          cod_venta             nom_tienda     cod_producto
##  Min.   : 1.000   M15505039:    15   Londres I   :29803   022CA  :  6409
##  1st Qu.: 1.000   M12031696:    14   Manhattan I :23642   125CT  :  6158
##  Median : 2.000   L13801129:    13   Londres II  :15367   122TI  :  5448
##  Mean   : 2.135   M12883623:    13   Milán       :14618   262BO  :  5060
##  3rd Qu.: 3.000   M13407976:    13   Munich      :13207   145TG  :  4922
##  Max.   :15.000   MB1048604:    13   París I     :12806   283BC  :  4752
##                   (Other)  :174590   (Other)     :65228   (Other):141922
##     cantidad      precio_venta                         nom_promo
##  Min.   :1.000   Min.   :  0.000                          :172922
##  1st Qu.:1.000   1st Qu.:  5.725   Carquiñolis-GranReserva :     3
##  Median :1.000   Median :  9.588   Chocolate-Champagne     :   117
##  Mean   :1.329   Mean   : 14.454   Mahon-Chardonnay        :   109
##  3rd Qu.:1.000   3rd Qu.: 19.380   Merlot Introduction     :   876
##  Max.   :7.000   Max.   :899.000   Semillon 5%             :   644
##
##   cod_cabecera
##  Min.   :13527
##  1st Qu.:32332
##  Median :50578
##  Mean   :50679
##  3rd Qu.:69085
##  Max.   :87853
##
```

```
summary(datos_cabecera)
```

```
##      cod_venta            nom_tienda        fecha            hora
##  BA0000000:    1   Londres I   :10652   Min.   :2e+07   Min.   : 9.00
##  BA0000001:    1   Manhattan I : 8984   1st Qu.:2e+07   1st Qu.:13.00
##  BA0000002:    1   Londres II  : 6995   Median :2e+07   Median :18.00
##  BA0000003:    1   Milán       : 6701   Mean   :2e+07   Mean   :17.06
```

```
##  BA0000004:    1   Munich      : 5882   3rd Qu.:2e+07   3rd Qu.:21.00
##  BA0000005:    1   París I     : 5586   Max.   :2e+07   Max.   :22.00
##  (Other)  :74321   (Other)     :29527
##              forma_pago       cod_cliente     importe_tot
##  Cheque            :21820            :38810   Min.   :   2.00
##  Cheque de Turista :  433   2097157G :   48   1st Qu.:  13.79
##  Efectivo          :15200   3145777T :   48   Median :  29.95
##  Otra Tarjeta      : 1701   2293787M :   41   Mean   :  45.23
##  Tarjeta de Crédito:24779   1900549R :   40   3rd Qu.:  54.00
##  Tarjeta Débito    :10394   3670041C :   39   Max.   :2303.74
##                             (Other)  :35301
##     tot_unid      puntos_ticket
##  Min.   : 1.000   Min.   : 0.0000
##  1st Qu.: 1.000   1st Qu.: 0.0000
##  Median : 2.000   Median : 0.0000
##  Mean   : 3.119   Mean   : 0.3423
##  3rd Qu.: 4.000   3rd Qu.: 1.0000
##  Max.   :41.000   Max.   :23.0000
##
```

```
# Desglosamos por profesión de cliente
sort(table(datos_cliente$profesion), decreasing= T)
```

```
##
## Economistas,Abogados & Admin.Empresas
##                                   707
##                 Gerentes & Directivos
##                                   703
##   Doctores & Profesionales de la Salud
##                                   663
##             Ingenieros & Especialistas
##                                   507
##   Architectos,Decoradores & Humanistas
##                                   485
##                              Catering
##                                   339
##                           Alimentación
##                                   271
##                           Ama de Casa
##                                   199
##                             Servicios
##                                   193
##                                  Food
##                                     2
```

```
# Desglosamos por pais del producto
sort(table(datos_producto$nom_pais), decreasing= T)
```

```
##
##         España       Francia  Estados Unidos         Italia   Reino Unido
##            113             68             51             25            25
##     Australia        Holanda        Bélgica       Alemania       Irlanda
##             15              8              7              6             5
##         Suiza          Chile          Suecia         Canadá     Dinamarca
##              5              4              3              2             2
```

```r
# Por qué hay valores nulos en "precio_venta" de datos_lineas? cuales son?
x<-datos_lineas[(datos_lineas$precio_venta==0),]
nrow(x)
```

```
## [1] 229
```

```r
# Transformación de datos

# Añadimos una nueva variable llamada "tipo_cliente" en la tabla "datos_cliente"
# contendrá la informació de si el cliente es "particular" o "empresa"
library(dplyr)
```

```
## Warning: package 'dplyr' was built under R version 3.4.4
```

```
##
## 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
datos_cliente<-datos_cliente %>%
  mutate(tipo_cliente = ifelse(sexo == "Empresa", "Empresa", NA))
```

```
## Warning: package 'bindrcpp' was built under R version 3.4.4
```

```r
head(datos_cliente,20)
```

```
##    cod_cliente              nom_cliente    sexo fecha_nac  estado_civil
## 1     0000001R   Roca Sacristán Narciso Hombre   19551220     Soltero/a
## 2     0065536F   Fuentes Mohedano Rosa    Mujer  19420108     Casado/a
## 3     0065537P         Prat Salom Pedro Hombre   19400315     Casado/a
## 4     0000002J           Jones Nicholas Hombre   19110808     Soltero/a
## 5     0000003B         Burton Alexander Hombre   19420417     Casado/a
## 6     0065538S           Sales Deborah    Mujer  19410526     Casado/a
## 7     0065539C             Cruise Tony  Hombre   19641108     Soltero/a
## 8     0131072C             Coleman Tony Hombre   19421027     Casado/a
## 9     0131073S             Shaver Jane    Mujer  19641114     Casado/a
## 10    0196608M             Mills Thomas Hombre   19390923 Divorciado/a
## 11    0196609S           Shepherd Emily   Mujer  19650828     Casado/a
## 12    0131074N                    Nika Empresa  19690209
## 13    0131075E             Embury Lewis Hombre   19711204     Casado/a
## 14    0196610G             Gadd Deborah   Mujer  19410514     Casado/a
## 15    0196611P           Porter Gerald  Hombre   19450331     Casado/a
## 16    0000004N                  Nirupa Empresa  19390404
## 17    0000005E                  Embers Empresa  19650909
## 18    0065540A Avellaneda Alcázar Pilar   Mujer  19430723     Casado/a
## 19    0065541H         Holmes Jennifer    Mujer  19631115     Casado/a
## 20    0000006C             Calder Jhon  Hombre   19380322     Soltero/a
##                                 direccion
## 1  Piazzale Suppercortemaggiore 4 , Milano
## 2                C/ Niza 73 08032 Barcelona
## 3         corso Vittorio Emanuele, 102 Roma
## 4      1 Place de la Sorbonne , 75003 Paris
```

```
## 5    46 Stockwell Place ,Liverpool L69 2DH
## 6                Leopoldstraße 44, München
## 7      2 Renfleld Street ,Liverpool L69 7HY
## 8        67 Eldridge St  New York, NY 10006
## 9      432 Lafayette St  New York, NY 10006
## 10     68 Avenue de Villiers , 75015 Paris
## 11           Senefelderstrasse 12, München
## 12         28 E 12th St  New York, NY 10004
## 13   125 E 23rd St Fl 1  New York, NY 10015
## 14             2 Bellevue Road ,London SW1
## 15     22 Elizabeth St  New York, NY 10013
## 16                 via Montebello, 109 Roma
## 17                     via Sicilia, 24 Roma
## 18       Corso Di Porta Romana 68 , Milano
## 19         482 E 6th St  New York, NY 10011
## 20       2630 NE 203rd St  Miami, FL 33028
##                                profesion num_hijos       region
## 1  Economistas,Abogados & Admin.Empresas          0   Sur Europa
## 2              Ingenieros & Especialistas         1   Sur Europa
## 3    Doctores & Profesionales de la Salud         2   Sur Europa
## 4              Ingenieros & Especialistas         0 Norte Europa
## 5    Doctores & Profesionales de la Salud         2 Norte Europa
## 6  Economistas,Abogados & Admin.Empresas          1 Norte Europa
## 7              Ingenieros & Especialistas         0 Norte Europa
## 8    Doctores & Profesionales de la Salud         0 Norteamérica
## 9  Economistas,Abogados & Admin.Empresas          3 Norteamérica
## 10 Economistas,Abogados & Admin.Empresas          0 Norte Europa
## 11                 Gerentes & Directivos          3 Norte Europa
## 12                              Catering        NA Norteamérica
## 13             Ingenieros & Especialistas         2 Norteamérica
## 14 Economistas,Abogados & Admin.Empresas          2 Norte Europa
## 15   Architectos,Decoradores & Humanistas         2 Norteamérica
## 16                              Catering        NA   Sur Europa
## 17                             Servicios        NA   Sur Europa
## 18             Ingenieros & Especialistas         1   Sur Europa
## 19 Economistas,Abogados & Admin.Empresas          3 Norteamérica
## 20             Ingenieros & Especialistas         0 Norteamérica
##      nacionalidad total_compras puntos_cumul tipo_cliente
## 1          España             4            7         <NA>
## 2          España            16           13         <NA>
## 3          España            14           10         <NA>
## 4    Reino Unido              2            9         <NA>
## 5    Reino Unido             13            9         <NA>
## 6    Reino Unido              7           11         <NA>
## 7    Reino Unido             10           12         <NA>
## 8  Estados Unidos             2            6         <NA>
## 9  Estados Unidos            21           15         <NA>
## 10   Reino Unido              5            9         <NA>
## 11   Reino Unido             11            8         <NA>
## 12 Estados Unidos            10           14      Empresa
## 13 Estados Unidos             3            9         <NA>
## 14   Reino Unido              6            8         <NA>
## 15 Estados Unidos             2           10         <NA>
## 16         España             6           18      Empresa
```

```
## 17         España             7           10      Empresa
## 18         España             3            8         <NA>
## 19 Estados Unidos             3            9         <NA>
## 20 Estados Unidos             5            6         <NA>
```

```
# Ahora eliminamos el valor "Empresa" de la columna
datos_cliente$sexo[datos_cliente$sexo == "Empresa"]<-NA
head(datos_cliente,20)
```

```
##    cod_cliente              nom_cliente    sexo fecha_nac  estado_civil
## 1     0000001R   Roca Sacristán Narciso Hombre   19551220     Soltero/a
## 2     0065536F   Fuentes Mohedano Rosa    Mujer  19420108     Casado/a
## 3     0065537P         Prat Salom Pedro Hombre   19400315     Casado/a
## 4     0000002J           Jones Nicholas Hombre   19110808     Soltero/a
## 5     0000003B         Burton Alexander Hombre   19420417     Casado/a
## 6     0065538S           Sales Deborah    Mujer  19410526     Casado/a
## 7     0065539C             Cruise Tony  Hombre   19641108     Soltero/a
## 8     0131072C             Coleman Tony Hombre   19421027     Casado/a
## 9     0131073S             Shaver Jane    Mujer  19641114     Casado/a
## 10    0196608M             Mills Thomas Hombre   19390923 Divorciado/a
## 11    0196609S           Shepherd Emily   Mujer  19650828     Casado/a
## 12    0131074N                    Nika    <NA>  19690209
## 13    0131075E             Embury Lewis Hombre   19711204     Casado/a
## 14    0196610G             Gadd Deborah   Mujer  19410514     Casado/a
## 15    0196611P           Porter Gerald  Hombre   19450331     Casado/a
## 16    0000004N                  Nirupa    <NA>  19390404
## 17    0000005E                  Embers    <NA>  19650909
## 18    0065540A Avellaneda Alcázar Pilar   Mujer  19430723     Casado/a
## 19    0065541H         Holmes Jennifer    Mujer  19631115     Casado/a
## 20    0000006C             Calder Jhon  Hombre   19380322     Soltero/a
##                               direccion
## 1  Piazzale Suppercortemaggiore 4 , Milano
## 2               C/ Niza 73 08032 Barcelona
## 3        corso Vittorio Emanuele, 102 Roma
## 4      1 Place de la Sorbonne , 75003 Paris
## 5    46 Stockwell Place ,Liverpool L69 2DH
## 6               Leopoldstraße 44, München
## 7      2 Renfleld Street ,Liverpool L69 7HY
## 8        67 Eldridge St  New York, NY 10006
## 9      432 Lafayette St  New York, NY 10006
## 10     68 Avenue de Villiers , 75015 Paris
## 11          Senefelderstrasse 12, München
## 12         28 E 12th St  New York, NY 10004
## 13   125 E 23rd St Fl 1  New York, NY 10015
## 14            2 Bellevue Road ,London SW1
## 15     22 Elizabeth St  New York, NY 10013
## 16                via Montebello, 109 Roma
## 17                    via Sicilia, 24 Roma
## 18       Corso Di Porta Romana 68 , Milano
## 19         482 E 6th St  New York, NY 10011
## 20       2630 NE 203rd St  Miami, FL 33028
##                                profesion num_hijos       region
## 1  Economistas,Abogados & Admin.Empresas          0   Sur Europa
## 2              Ingenieros & Especialistas         1   Sur Europa
## 3    Doctores & Profesionales de la Salud         2   Sur Europa
```

```
## 4              Ingenieros & Especialistas         0 Norte Europa
## 5    Doctores & Profesionales de la Salud         2 Norte Europa
## 6  Economistas,Abogados & Admin.Empresas          1 Norte Europa
## 7              Ingenieros & Especialistas         0 Norte Europa
## 8    Doctores & Profesionales de la Salud         0 Norteamérica
## 9  Economistas,Abogados & Admin.Empresas          3 Norteamérica
## 10 Economistas,Abogados & Admin.Empresas          0 Norte Europa
## 11                Gerentes & Directivos          3 Norte Europa
## 12                               Catering        NA Norteamérica
## 13             Ingenieros & Especialistas         2 Norteamérica
## 14 Economistas,Abogados & Admin.Empresas          2 Norte Europa
## 15   Architectos,Decoradores & Humanistas         2 Norteamérica
## 16                               Catering        NA   Sur Europa
## 17                              Servicios        NA   Sur Europa
## 18             Ingenieros & Especialistas         1   Sur Europa
## 19 Economistas,Abogados & Admin.Empresas          3 Norteamérica
## 20             Ingenieros & Especialistas         0 Norteamérica
##      nacionalidad total_compras puntos_cumul tipo_cliente
## 1          España             4           7         <NA>
## 2          España            16          13         <NA>
## 3          España            14          10         <NA>
## 4    Reino Unido              2           9         <NA>
## 5    Reino Unido             13           9         <NA>
## 6    Reino Unido              7          11         <NA>
## 7    Reino Unido             10          12         <NA>
## 8  Estados Unidos             2           6         <NA>
## 9  Estados Unidos            21          15         <NA>
## 10   Reino Unido              5           9         <NA>
## 11   Reino Unido             11           8         <NA>
## 12 Estados Unidos            10          14      Empresa
## 13 Estados Unidos             3           9         <NA>
## 14   Reino Unido              6           8         <NA>
## 15 Estados Unidos             2          10         <NA>
## 16         España             6          18      Empresa
## 17         España             7          10      Empresa
## 18         España             3           8         <NA>
## 19 Estados Unidos             3           9         <NA>
## 20 Estados Unidos             5           6         <NA>
```

```
# Sustituimos "NA" por "Particular" en la columna "tipo_cliente"
datos_cliente$tipo_cliente[is.na(datos_cliente$tipo_cliente)]<-"Particular"
head(datos_cliente,20)
```

```
##    cod_cliente              nom_cliente    sexo fecha_nac  estado_civil
## 1     0000001R   Roca Sacristán Narciso Hombre   19551220     Soltero/a
## 2     0065536F   Fuentes Mohedano Rosa    Mujer  19420108     Casado/a
## 3     0065537P         Prat Salom Pedro Hombre   19400315     Casado/a
## 4     0000002J           Jones Nicholas Hombre   19110808     Soltero/a
## 5     0000003B         Burton Alexander Hombre   19420417     Casado/a
## 6     0065538S           Sales Deborah    Mujer  19410526     Casado/a
## 7     0065539C             Cruise Tony  Hombre   19641108     Soltero/a
## 8     0131072C             Coleman Tony Hombre   19421027     Casado/a
## 9     0131073S             Shaver Jane    Mujer  19641114     Casado/a
## 10    0196608M             Mills Thomas Hombre   19390923 Divorciado/a
## 11    0196609S           Shepherd Emily   Mujer  19650828     Casado/a
```

```
## 12    0131074N                     Nika    <NA>  19690209
## 13    0131075E             Embury Lewis Hombre   19711204     Casado/a
## 14    0196610G             Gadd Deborah   Mujer  19410514     Casado/a
## 15    0196611P           Porter Gerald  Hombre   19450331     Casado/a
## 16    0000004N                   Nirupa    <NA>  19390404
## 17    0000005E                   Embers    <NA>  19650909
## 18    0065540A Avellaneda Alcázar Pilar   Mujer  19430723     Casado/a
## 19    0065541H         Holmes Jennifer    Mujer  19631115     Casado/a
## 20    0000006C             Calder Jhon  Hombre   19380322     Soltero/a
##                                  direccion
## 1  Piazzale Suppercortemaggiore 4 , Milano
## 2               C/ Niza 73 08032 Barcelona
## 3       corso Vittorio Emanuele, 102 Roma
## 4      1 Place de la Sorbonne , 75003 Paris
## 5    46 Stockwell Place ,Liverpool L69 2DH
## 6               Leopoldstraße 44, München
## 7      2 Renfleld Street ,Liverpool L69 7HY
## 8        67 Eldridge St  New York, NY 10006
## 9      432 Lafayette St  New York, NY 10006
## 10     68 Avenue de Villiers , 75015 Paris
## 11          Senefelderstrasse 12, München
## 12        28 E 12th St  New York, NY 10004
## 13   125 E 23rd St Fl 1  New York, NY 10015
## 14            2 Bellevue Road ,London SW1
## 15    22 Elizabeth St  New York, NY 10013
## 16                via Montebello, 109 Roma
## 17                    via Sicilia, 24 Roma
## 18       Corso Di Porta Romana 68 , Milano
## 19         482 E 6th St  New York, NY 10011
## 20       2630 NE 203rd St  Miami, FL 33028
##                                profesion num_hijos       region
## 1  Economistas,Abogados & Admin.Empresas          0   Sur Europa
## 2              Ingenieros & Especialistas         1   Sur Europa
## 3    Doctores & Profesionales de la Salud         2   Sur Europa
## 4              Ingenieros & Especialistas         0 Norte Europa
## 5    Doctores & Profesionales de la Salud         2 Norte Europa
## 6  Economistas,Abogados & Admin.Empresas          1 Norte Europa
## 7              Ingenieros & Especialistas         0 Norte Europa
## 8    Doctores & Profesionales de la Salud         0 Norteamérica
## 9  Economistas,Abogados & Admin.Empresas          3 Norteamérica
## 10 Economistas,Abogados & Admin.Empresas          0 Norte Europa
## 11                 Gerentes & Directivos         3 Norte Europa
## 12                             Catering        NA Norteamérica
## 13             Ingenieros & Especialistas         2 Norteamérica
## 14 Economistas,Abogados & Admin.Empresas          2 Norte Europa
## 15   Architectos,Decoradores & Humanistas         2 Norteamérica
## 16                             Catering        NA   Sur Europa
## 17                            Servicios        NA   Sur Europa
## 18             Ingenieros & Especialistas         1   Sur Europa
## 19 Economistas,Abogados & Admin.Empresas          3 Norteamérica
## 20             Ingenieros & Especialistas         0 Norteamérica
##      nacionalidad total_compras puntos_cumul tipo_cliente
## 1          España             4            7   Particular
## 2          España            16           13   Particular
```

```
## 3          España            14           10   Particular
## 4    Reino Unido             2            9   Particular
## 5    Reino Unido            13            9   Particular
## 6    Reino Unido             7           11   Particular
## 7    Reino Unido            10           12   Particular
## 8  Estados Unidos            2            6   Particular
## 9  Estados Unidos           21           15   Particular
## 10   Reino Unido             5            9   Particular
## 11   Reino Unido            11            8   Particular
## 12 Estados Unidos           10           14      Empresa
## 13 Estados Unidos            3            9   Particular
## 14   Reino Unido             6            8   Particular
## 15 Estados Unidos            2           10   Particular
## 16         España            6           18      Empresa
## 17         España            7           10      Empresa
## 18         España            3            8   Particular
## 19 Estados Unidos            3            9   Particular
## 20 Estados Unidos            5            6   Particular
```

```
# Completamos las columnas vacías en "datos_promocion"
# col "nom_pais": haremos un match con la tabla "datos_tienda" haciendo matching de la col "nom_tienda"
as.character(datos_tienda$nombre)
```

```
##  [1] "Barcelona "       "Florencia "       "Fort Lauderdale "
##  [4] "Liverpool "       "Londres I "       "Londres II"
##  [7] "Madrid"           "Manhattan I "     "Manhattan II"
## [10] "Miami Beach "     "Milán "           "Munich"
## [13] "París I "         "París II"         "Roma"
```

```
as.character(datos_promocion$nom_tienda)
```

```
## [1] ""            ""            "Manhattan I" "Barcelona"   "Londres I"
```

```
# elimino los espacios en blanco que hay en los valores de ambas columnas
datos_tienda$nombre<-trimws(datos_tienda$nombre)
datos_promocion$nom_tienda<-trimws(datos_promocion$nom_tienda)
# hago el matching de valores
datos_promocion$nom_pais<-datos_tienda$pais[match(datos_promocion$nom_tienda, datos_tienda$nombre)]
head(datos_promocion)
```

```
##                 nom_promo   tipo_promo coste fecha_ini fecha_fin
## 1            Semillon 5%  Descuento 5%    NA  20000901  20000930
## 2     Merlot Introduction          3x2     NA  20001001  20001031
## 3         Mahon-Chardonnay     Cruzada     NA  20001001  20001031
## 4 Carquiñolis-GranReserva      Cruzada     NA  20001101  20001130
## 5     Chocolate-Champagne      Cruzada     NA  20001101  20001130
##   cod_producto nom_familia nom_seccion  nom_tienda nom_region
## 1        295GS          NA          NA                    NA
## 2        308ME          NA          NA                    NA
## 3        077MA          NA          NA Manhattan I         NA
## 4        108CA          NA          NA   Barcelona         NA
## 5        123CB          NA          NA   Londres I         NA
##         nom_pais
## 1           <NA>
## 2           <NA>
## 3 Estados Unidos
```

```
## 4         España
## 5   Reino Unido
```

```
# col "nom_region": haremos un match con la tabla "datos_pais" haciendo matching de la col "nom_pais"
datos_promocion$nom_region<-datos_pais$nom_region[match(datos_promocion$nom_pais, datos_pais$nom_pais)]
head(datos_promocion)
```

```
##                 nom_promo   tipo_promo coste fecha_ini fecha_fin
## 1            Semillon 5%  Descuento 5%    NA  20000901  20000930
## 2     Merlot Introduction          3x2     NA  20001001  20001031
## 3         Mahon-Chardonnay     Cruzada     NA  20001001  20001031
## 4 Carquiñolis-GranReserva      Cruzada     NA  20001101  20001130
## 5     Chocolate-Champagne      Cruzada     NA  20001101  20001130
##   cod_producto nom_familia nom_seccion  nom_tienda   nom_region
## 1        295GS          NA          NA                    <NA>
## 2        308ME          NA          NA                    <NA>
## 3        077MA          NA          NA Manhattan I Norteamérica
## 4        108CA          NA          NA   Barcelona   Sur Europa
## 5        123CB          NA          NA   Londres I Norte Europa
##         nom_pais
## 1           <NA>
## 2           <NA>
## 3 Estados Unidos
## 4         España
## 5   Reino Unido
```

```
# col "nom_subfamilia": haremos primero un match entre "cod_producto" de tabla "datos_producto con la t
# y creamos la nueva columna "nom_subfamilia"
datos_promocion$nom_subfamilia<-datos_producto$nom_subfamilia[match(datos_promocion$cod_producto, datos_
head(datos_promocion)
```

```
##                 nom_promo   tipo_promo coste fecha_ini fecha_fin
## 1            Semillon 5%  Descuento 5%    NA  20000901  20000930
## 2     Merlot Introduction          3x2     NA  20001001  20001031
## 3         Mahon-Chardonnay     Cruzada     NA  20001001  20001031
## 4 Carquiñolis-GranReserva      Cruzada     NA  20001101  20001130
## 5     Chocolate-Champagne      Cruzada     NA  20001101  20001130
##   cod_producto nom_familia nom_seccion  nom_tienda   nom_region
## 1        295GS          NA          NA                    <NA>
## 2        308ME          NA          NA                    <NA>
## 3        077MA          NA          NA Manhattan I Norteamérica
## 4        108CA          NA          NA   Barcelona   Sur Europa
## 5        123CB          NA          NA   Londres I Norte Europa
##         nom_pais             nom_subfamilia
## 1           <NA> D.O. Barossa Valley-Blanco
## 2           <NA>             Mendoza-Tinto
## 3 Estados Unidos               Vaca Curado
## 4         España          Pastas de almendra
## 5   Reino Unido      Galletas de chocolate
```

```
# col "nom_familia": haremos match utilizando "nom_subfamilia" con la tabla "datos_subfamilia"
datos_promocion$nom_familia<-datos_subfamilia$nom_familia[match(datos_promocion$nom_subfamilia, datos_su
head(datos_promocion)
```

```
##                 nom_promo   tipo_promo coste fecha_ini fecha_fin
## 1            Semillon 5%  Descuento 5%    NA  20000901  20000930
```

```
## 2     Merlot Introduction          3x2     NA  20001001  20001031
## 3         Mahon-Chardonnay     Cruzada     NA  20001001  20001031
## 4 Carquiñolis-GranReserva      Cruzada     NA  20001101  20001130
## 5     Chocolate-Champagne      Cruzada     NA  20001101  20001130
##   cod_producto          nom_familia nom_seccion  nom_tienda   nom_region
## 1        295GS D.O. Barossa Valley           NA                    <NA>
## 2        308ME             Mendoza           NA                    <NA>
## 3        077MA                 Vaca          NA Manhattan I Norteamérica
## 4        108CA             Galletas          NA   Barcelona   Sur Europa
## 5        123CB             Galletas          NA   Londres I Norte Europa
##         nom_pais             nom_subfamilia
## 1           <NA> D.O. Barossa Valley-Blanco
## 2           <NA>             Mendoza-Tinto
## 3 Estados Unidos               Vaca Curado
## 4         España         Pastas de almendra
## 5   Reino Unido      Galletas de chocolate
```

```
# col "nom_seccion": haremos match utilizando "nom_seccion" con la tabla "datos_familia"
datos_promocion$nom_seccion<-datos_familia$nom_seccion[match(datos_promocion$nom_familia, datos_familia$
head(datos_promocion)
```

```
##                 nom_promo   tipo_promo coste fecha_ini fecha_fin
## 1            Semillon 5%  Descuento 5%    NA  20000901  20000930
## 2     Merlot Introduction          3x2     NA  20001001  20001031
## 3         Mahon-Chardonnay     Cruzada     NA  20001001  20001031
## 4 Carquiñolis-GranReserva      Cruzada     NA  20001101  20001130
## 5     Chocolate-Champagne      Cruzada     NA  20001101  20001130
##   cod_producto          nom_familia nom_seccion  nom_tienda   nom_region
## 1        295GS D.O. Barossa Valley       Vinos                    <NA>
## 2        308ME             Mendoza       Vinos                    <NA>
## 3        077MA                 Vaca      Quesos Manhattan I Norteamérica
## 4        108CA             Galletas    Postres    Barcelona   Sur Europa
## 5        123CB             Galletas    Postres    Londres I Norte Europa
##         nom_pais             nom_subfamilia
## 1           <NA> D.O. Barossa Valley-Blanco
## 2           <NA>             Mendoza-Tinto
## 3 Estados Unidos               Vaca Curado
## 4         España         Pastas de almendra
## 5   Reino Unido      Galletas de chocolate
```

```
# Eliminamos atributos vacíos que no se pueden completar:
# Tabla "datos_sección", col "descripcion"
datos_seccion<-datos_seccion[,-2]
# Tabla "datos_proveedor", col "pago_pendiente", "tipo_proveedor"
View(datos_proveedor)
datos_proveedor<-datos_proveedor[,-7:-8]
# Tabla "datos_promocion", col "coste"
datos_promocion<-datos_promocion[,-3]

# Compruebo los valores nulos de las tablas
list<-list(datos_tienda, datos_pais, datos_region, datos_cliente, datos_cabecera, datos_lineas, datos_pr

# Cambio los valores en blanco de la columna "cod_cliente" de la tabla "datos_cabecera" a NA
datos_cabecera$cod_cliente[which(datos_cabecera$cod_cliente =="")]<-NA
length(datos_cabecera$cod_cliente[which(!is.na(datos_cabecera$cod_cliente))])
```

```
## [1] 35517
```

```
length(datos_cabecera$cod_cliente[which(is.na(datos_cabecera$cod_cliente))])
```

```
## [1] 38810
```

```
# Añadimos nueva variable llamada "edad" calculada a partir de la fecha de nacimiento
library(eeptools)
```

```
## Warning: package 'eeptools' was built under R version 3.4.4
```

```
## Loading required package: ggplot2
```

```
# Transformo las variables "fecha_nac" de tabla "datos_cliente" y "fecha" de "datos_cabecera" de tipo "
datos_cliente<-transform(datos_cliente, fecha_nac = as.Date(as.character(fecha_nac), "%Y%m%d"))
datos_cabecera<-transform(datos_cabecera, fecha = as.Date(as.character(fecha), "%Y%m%d"))
head(datos_cabecera)
```

```
##   cod_venta nom_tienda      fecha hora         forma_pago cod_cliente
## 1 P20000000   París II 2000-09-18   16 Tarjeta de Crédito        <NA>
## 2 P20000001   París II 2000-09-08   17           Efectivo        <NA>
## 3 P20065536   París II 2000-09-15   13 Tarjeta de Crédito        <NA>
## 4 P20065537   París II 2000-09-15   14 Tarjeta de Crédito        <NA>
## 5 P20000002   París II 2000-09-02   10             Cheque        <NA>
## 6 P20000003   París II 2000-10-13   11             Cheque        <NA>
##   importe_tot tot_unid puntos_ticket
## 1     33.1875        3             0
## 2     61.9400        2             1
## 3     26.9175        2             0
## 4     22.9500        3             0
## 5    106.8200        6             1
## 6     49.1300        6             0
```

```
# Calculo la edad a partir de la fecha de nacimiento usando floor() de eeptools
datos_cliente$edad<- floor(age_calc(datos_cliente$fecha_nac, units = "years"))
head(datos_cliente)
```

```
##   cod_cliente            nom_cliente    sexo  fecha_nac estado_civil
## 1    0000001R Roca Sacristán Narciso Hombre  1955-12-20    Soltero/a
## 2    0065536F Fuentes Mohedano Rosa    Mujer 1942-01-08    Casado/a
## 3    0065537P       Prat Salom Pedro Hombre  1940-03-15    Casado/a
## 4    0000002J         Jones Nicholas Hombre  1911-08-08    Soltero/a
## 5    0000003B       Burton Alexander Hombre  1942-04-17    Casado/a
## 6    0065538S         Sales Deborah    Mujer 1941-05-26    Casado/a
##                                 direccion
## 1 Piazzale Suppercortemaggiore 4 , Milano
## 2               C/ Niza 73 08032 Barcelona
## 3       corso Vittorio Emanuele, 102 Roma
## 4     1 Place de la Sorbonne , 75003 Paris
## 5   46 Stockwell Place ,Liverpool L69 2DH
## 6               Leopoldstraße 44, München
##                               profesion num_hijos       region
## 1 Economistas,Abogados & Admin.Empresas         0   Sur Europa
## 2             Ingenieros & Especialistas        1   Sur Europa
## 3   Doctores & Profesionales de la Salud        2   Sur Europa
## 4             Ingenieros & Especialistas        0 Norte Europa
## 5   Doctores & Profesionales de la Salud        2 Norte Europa
## 6 Economistas,Abogados & Admin.Empresas         1 Norte Europa
```

```
##   nacionalidad total_compras puntos_cumul tipo_cliente edad
## 1       España             4            7   Particular   63
## 2       España            16           13   Particular   76
## 3       España            14           10   Particular   78
## 4 Reino Unido              2            9   Particular  107
## 5 Reino Unido             13            9   Particular   76
## 6 Reino Unido              7           11   Particular   77
```

```
# Reordeno los atributos
names(datos_cliente)
```

```
##  [1] "cod_cliente"   "nom_cliente"   "sexo"          "fecha_nac"
##  [5] "estado_civil"  "direccion"     "profesion"     "num_hijos"
##  [9] "region"        "nacionalidad"  "total_compras" "puntos_cumul"
## [13] "tipo_cliente"  "edad"
```

```
datos_cliente<-datos_cliente[,c("cod_cliente","tipo_cliente","nom_cliente","sexo","fecha_nac","edad","es
head(datos_cliente)
```

```
##   cod_cliente tipo_cliente            nom_cliente    sexo  fecha_nac edad
## 1    0000001R   Particular Roca Sacristán Narciso Hombre  1955-12-20   63
## 2    0065536F   Particular Fuentes Mohedano Rosa    Mujer 1942-01-08   76
## 3    0065537P   Particular       Prat Salom Pedro Hombre  1940-03-15   78
## 4    0000002J   Particular         Jones Nicholas Hombre  1911-08-08  107
## 5    0000003B   Particular       Burton Alexander Hombre  1942-04-17   76
## 6    0065538S   Particular         Sales Deborah    Mujer 1941-05-26   77
##   estado_civil                                direccion
## 1    Soltero/a Piazzale Suppercortemaggiore 4 , Milano
## 2    Casado/a                C/ Niza 73 08032 Barcelona
## 3    Casado/a        corso Vittorio Emanuele, 102 Roma
## 4    Soltero/a     1 Place de la Sorbonne , 75003 Paris
## 5    Casado/a    46 Stockwell Place ,Liverpool L69 2DH
## 6    Casado/a                Leopoldstraße 44, München
##                               profesion num_hijos       region
## 1 Economistas,Abogados & Admin.Empresas          0   Sur Europa
## 2             Ingenieros & Especialistas         1   Sur Europa
## 3   Doctores & Profesionales de la Salud         2   Sur Europa
## 4             Ingenieros & Especialistas         0 Norte Europa
## 5   Doctores & Profesionales de la Salud         2 Norte Europa
## 6 Economistas,Abogados & Admin.Empresas          1 Norte Europa
##   nacionalidad total_compras puntos_cumul
## 1       España             4            7
## 2       España            16           13
## 3       España            14           10
## 4 Reino Unido              2            9
## 5 Reino Unido             13            9
## 6 Reino Unido              7           11
```

```
# Análisis descriptivo de los datos
# Tiendas
# Desglosamos por pais
table(datos_tienda$pais)
```

```
##
##       Alemania         España Estados Unidos       Francia          Italia
##              1              2              4              2              3
```

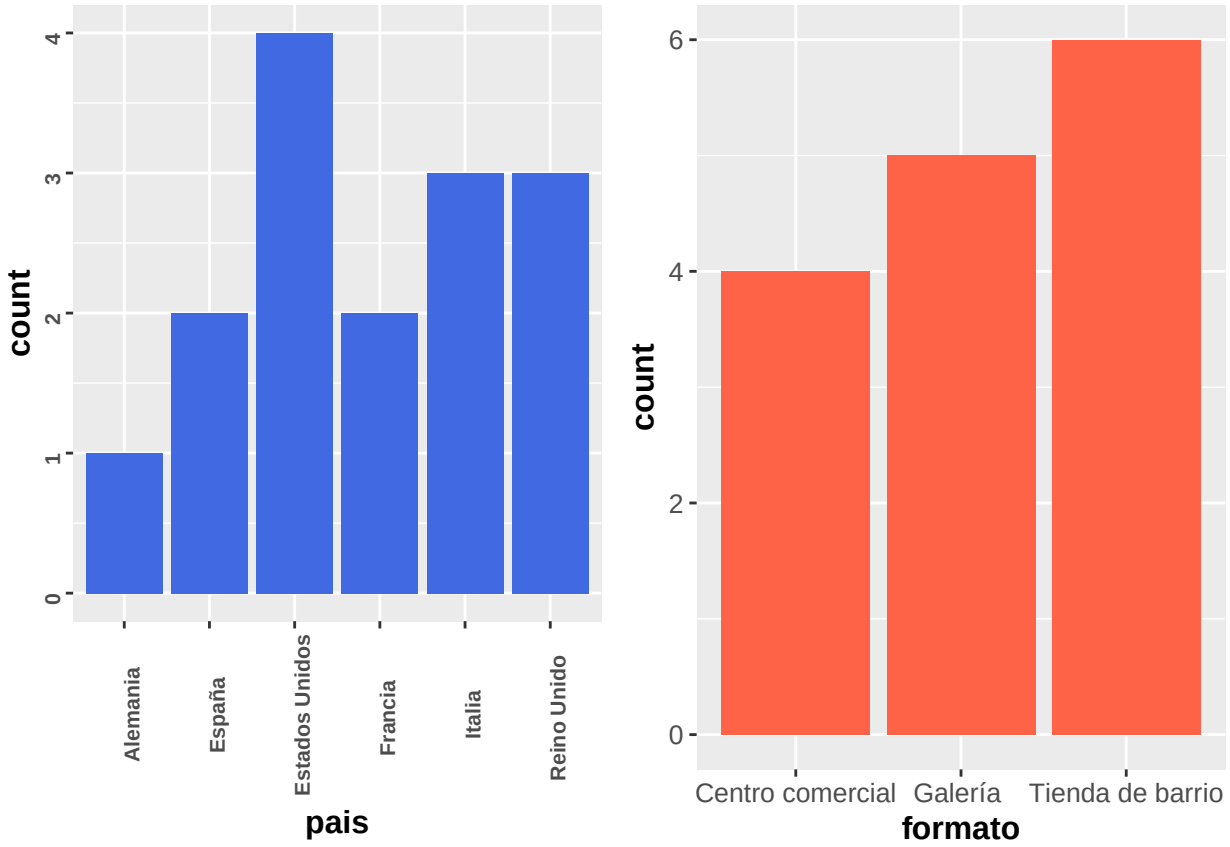
```
##   Reino Unido
##             3
```

```
library(ggplot2)
library(grid)
library(gridExtra)
```

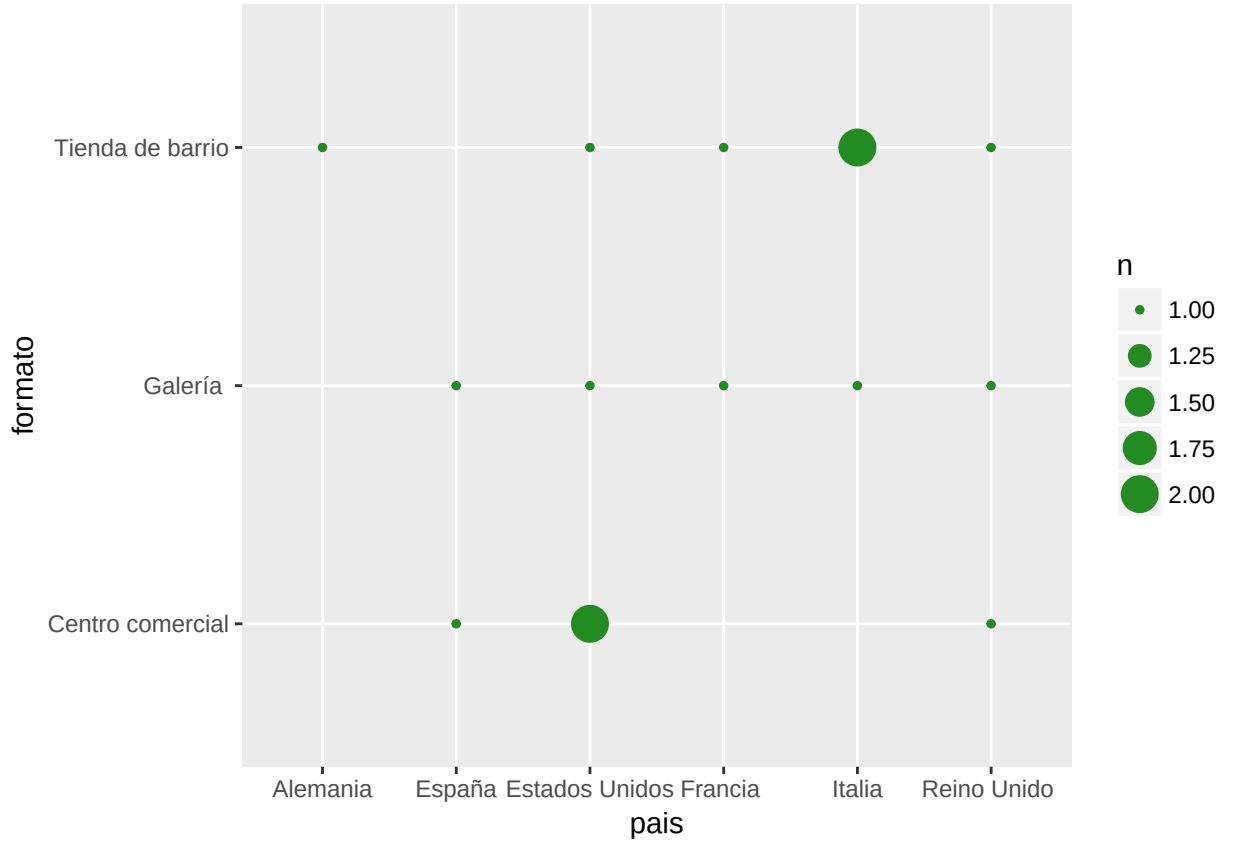
```
##
## Attaching package: 'gridExtra'
```

```
## The following object is masked from 'package:dplyr':
##
##     combine
```

```
g1<-ggplot(datos_tienda, aes(pais)) +
  geom_bar(fill = "royalblue") +
  theme(axis.text=element_text(size=8, face="bold", angle =90),
        axis.title=element_text(size=12,face="bold"))

g2<-ggplot(datos_tienda, aes(formato)) +
  geom_bar(fill = "tomato") +
  theme(axis.text=element_text(size=10),
        axis.title=element_text(size=12,face="bold"))

grid.arrange(g1, g2,ncol=2)
```




```
ggplot(datos_tienda, aes(pais, formato))+
  geom_count(color="forestgreen")
```




```
# Analizamos las ventas por pais o formato de tienda
#Analizamos las ventas por tienda

group_tienda <- group_by(datos_cabecera, nom_tienda)
summaryTable <- summarise(group_tienda, sumimporte = sum(importe_tot))
ventas_tienda<-summaryTable[order(summaryTable$sumimporte, decreasing=TRUE),]

library(hrbrthemes)
```

```
## Warning: package 'hrbrthemes' was built under R version 3.4.4
```

```
## NOTE: Either Arial Narrow or Roboto Condensed fonts are *required* to use these themes.
```

```
##       Please use hrbrthemes::import_roboto_condensed() to install Roboto Condensed and
```

```
##       if Arial Narrow is not on your system, please see http://bit.ly/arialnarrow
```

```
library(scales)
```

```
## Warning: package 'scales' was built under R version 3.4.4
```

```
g3<-ggplot(ventas_tienda,aes(x=nom_tienda, y=sumimporte) ) +
    geom_segment(aes(x=nom_tienda ,xend=nom_tienda, y=0, yend=sumimporte), color="grey") +
    geom_point(size=3, color="darkorchid") +
    scale_y_continuous(labels = comma)+
    coord_flip() +
    theme_ipsum() +
    theme(
      panel.grid.minor.y = element_blank(),
```

```
      panel.grid.major.y = element_blank(),
      legend.position="none"
    ) +
    xlab("") +
    ylab("Importe total (Eur)")

# Primero cruzamos las tablas "ventas_tienda" y "datos_pais" por el nombre de tienda para obtener el pa
# Comprobamos que no haya espacios en blanco en "nom_tienda" de "datos_tienda":
as.character(datos_tienda$nombre)
```

```
##  [1] "Barcelona"       "Florencia"       "Fort Lauderdale"
##  [4] "Liverpool"       "Londres I"       "Londres II"
##  [7] "Madrid"          "Manhattan I"     "Manhattan II"
## [10] "Miami Beach"     "Milán"           "Munich"
## [13] "París I"         "París II"        "Roma"
```

```
as.character(ventas_tienda$nom_tienda)
```

```
##  [1] "Londres I "       "Manhattan I "     "París I "
##  [4] "Milán "           "Munich"           "Londres II"
##  [7] "Miami Beach "     "Roma"             "Madrid"
## [10] "Barcelona "       "París II"         "Liverpool "
## [13] "Manhattan II"     "Florencia "       "Fort Lauderdale "
```

```
# Quitamos los espacios en blanco
ventas_tienda$nom_tienda<-trimws(ventas_tienda$nom_tienda)
# Hacemos el cruce de tablas
ventas_tienda$pais<-datos_tienda$pais[match(ventas_tienda$nom_tienda, datos_tienda$nombre)]
ventas_tienda
```

```
## # A tibble: 15 x 3
##    nom_tienda      sumimporte pais
##    <chr>                <dbl> <fct>
##  1 Londres I          587197. "Reino Unido "
##  2 Manhattan I        469652. Estados Unidos
##  3 París I            294287. "Francia "
##  4 Milán              269567. Italia
##  5 Munich             264247. Alemania
##  6 Londres II         252588. "Reino Unido "
##  7 Miami Beach        239320. Estados Unidos
##  8 Roma               213240. Italia
##  9 Madrid             156950. España
## 10 Barcelona          154486. España
## 11 París II           147728. "Francia "
## 12 Liverpool          141646. "Reino Unido "
## 13 Manhattan II        64016. Estados Unidos
## 14 Florencia           59510. Italia
## 15 Fort Lauderdale     47175. Estados Unidos
```

```
# Agrupamos las ventas por país en una nueva tabla: "ventas_pais"

group_pais <- group_by(ventas_tienda, pais)
summaryTable2 <- summarise(group_pais, sumimporte = sum(sumimporte))
ventas_pais<-summaryTable2[order(summaryTable2$sumimporte, decreasing=TRUE),]
ventas_pais
```

```
## # A tibble: 6 x 2
##   pais           sumimporte
##   <fct>               <dbl>
## 1 "Reino Unido "    981431.
## 2 Estados Unidos    820163.
## 3 Italia            542317.
## 4 "Francia "        442015.
## 5 España            311436.
## 6 Alemania          264247.
```

```
# Hacemos el gráfico para visualizar mejor los datos:
g4<-ggplot(ventas_pais,aes(x=pais, y=sumimporte) ) +
    geom_segment(aes(x=pais ,xend=pais, y=0, yend=sumimporte), color="grey") +
    geom_point(size=3, color="darkorchid") +
    scale_y_continuous(labels = comma)+
    coord_flip() +
    theme_ipsum() +
    theme(
      panel.grid.minor.y = element_blank(),
      panel.grid.major.y = element_blank(),
      legend.position="none"
    ) +
    xlab("") +
    ylab("Importe total (Eur)")

# Ahora estudiaremos si hay correlación entre los ingresos por pais y el número de tiendas por pais
# Creamos una tabla temporal con la información del número de tiendas por país
d<-as.data.frame(table(datos_tienda$pais))
# Cruzamos las tablas "ventas_pais" y la tabla temporal recién creada
# Creamos una nueva columna en "ventas_pais" con la información del número de tiendas
ventas_pais$num_tiendas<-d$Freq[match(ventas_pais$pais, d$Var1)]
# Graficamos la correlación entre número de tiendas y facturación por pais
g5<-ggplot(ventas_pais, aes(x=num_tiendas, y=sumimporte, color=pais)) +
    geom_point(size=6, alpha=0.6)+
    scale_y_continuous(labels = comma)
# Sacamos los datos de correlación
library(corrplot)
```

```
## Warning: package 'corrplot' was built under R version 3.4.4
```

```
## corrplot 0.84 loaded
```

```
cor(ventas_pais[,2:3])
```

```
##             sumimporte num_tiendas
## sumimporte   1.0000000   0.8129952
## num_tiendas  0.8129952   1.0000000
```

```
# Ahora estudiaremos si hay correlación entre los ingresos por pais y el formato de tienda
# Creamos una tabla temporal con los datos del número de tiendas con cada uno de los formatos
d2<-as.data.frame(table(datos_tienda$formato))
# Cruzamos las tablas "ventas_tienda" y "la tabla temporal recién creada "datos_tienda""
# Creamos una nueva columna en "ventas_pais" con la información del formato de tienda
ventas_tienda$formato_tienda<-datos_tienda$formato[match(ventas_tienda$nom_tienda, datos_tienda$nombre)]
ventas_tienda$formato_tienda
```

```
##  [1] Galería          Galería          Galería          Tienda de barrio
```

```
##  [5] Tienda de barrio Centro comercial Centro comercial Galería
##  [9] Galería          Centro comercial Tienda de barrio Tienda de barrio
## [13] Tienda de barrio Tienda de barrio Centro comercial
## Levels: Centro comercial Galería  Tienda de barrio
```

```
# Creamos una nueva tabla temporal con el sumatorio de ingresos por formato de tienda
group_formato <- group_by(ventas_tienda, formato_tienda)
summaryTable2 <- summarise(group_formato, sumimporte = sum(sumimporte))
# Hacemos un cruce entre las tablas temporales "summaryTable2" y "d2" para tener toda la información ju
summaryTable2$count_tiendas<-d2$Freq[match(d2$Var1, summaryTable2$formato_tienda)]
# Volcamos los datos en la tabla definitiva "ventas_formato"
ventas_formato<-summaryTable2
# Graficamos la correlación entre la facturación y el formato de la tienda
g6<-ggplot(ventas_tienda, aes(formato_tienda, sumimporte)) +
    geom_boxplot(fill="tomato")+
    geom_dotplot(binaxis='y', stackdir='center', dotsize=1)+
    scale_y_continuous(labels = comma)
```

```
# Análisis descriptivo de los datos

# Clientes

# Desglosamos por tipo de cliente
table(datos_cliente$tipo_cliente)
```

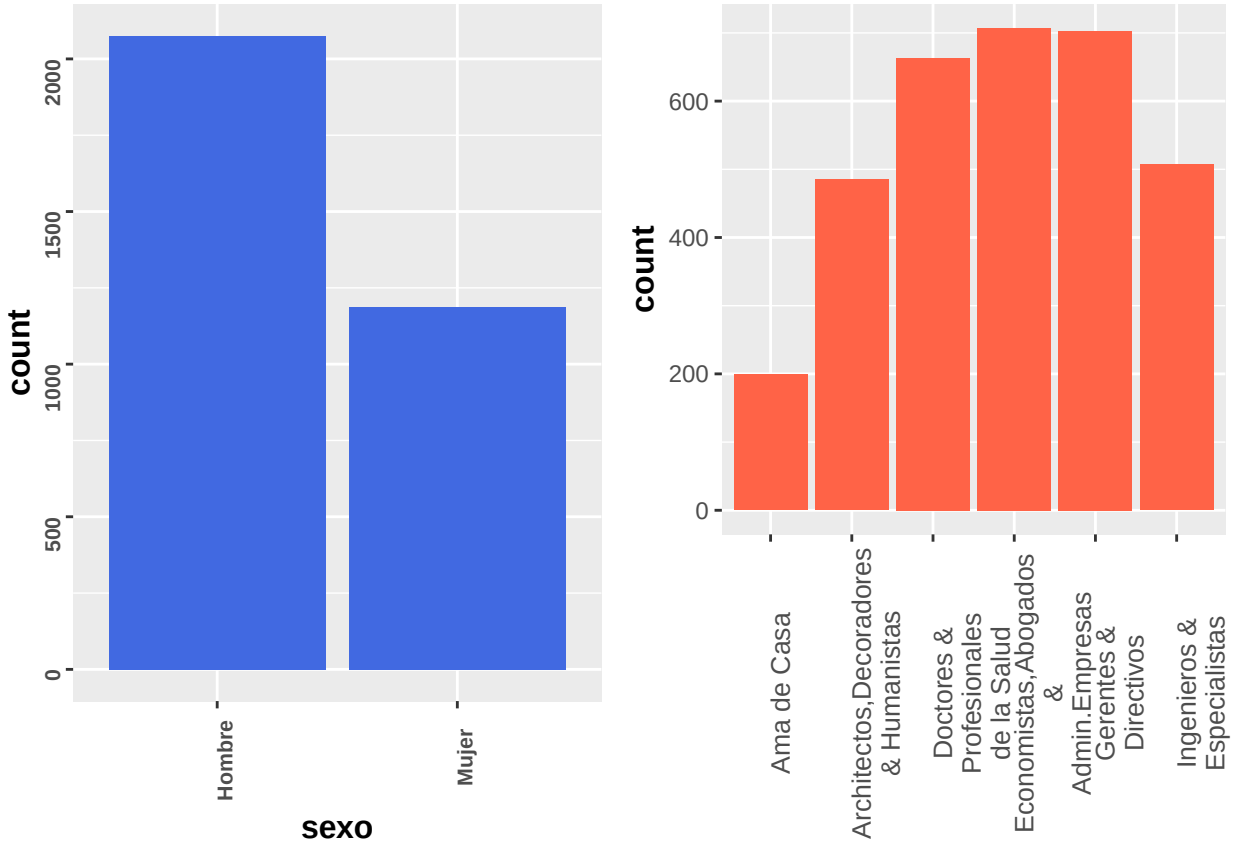
```
##
##    Empresa Particular
##        805       3264
```

```
# Graficamos
g7<-ggplot(datos_cliente,aes(tipo_cliente))+
  geom_bar(fill="royalblue")

# Desglosamos por tipo de empresa
table(datos_cliente$profesion[which(datos_cliente$tipo_cliente=="Empresa")])
```

```
##
##                            Alimentación
##                                     271
##                            Ama de Casa
##                                       0
##   Architectos,Decoradores & Humanistas
##                                       0
##                                Catering
##                                     339
##   Doctores & Profesionales de la Salud
##                                       0
## Economistas,Abogados & Admin.Empresas
##                                       0
##                                    Food
##                                       2
##                 Gerentes & Directivos
##                                       0
##             Ingenieros & Especialistas
##                                       0
##                              Servicios
```

```
##                                  193
```

```
# Desglosamos por sexo de cliente
g8<-ggplot(data=subset(datos_cliente, !is.na(sexo)), aes(sexo))+
  geom_bar(fill = "royalblue") +
  theme(axis.text=element_text(size=8, face="bold", angle =90),
        axis.title=element_text(size=12,face="bold"))

g9<-ggplot(data=subset(datos_cliente, datos_cliente$tipo_cliente=="Particular"), aes(profesion)) +
  geom_bar(fill = "tomato") +
  theme(axis.text.x=element_text(size=10,angle =90),
        axis.title=element_text(size=12,face="bold"))+
  aes(stringr::str_wrap(profesion, 15)) + xlab(NULL)

grid<-grid.arrange(g8, g9,ncol=2)
```




```
g10<-ggplot(data=subset(datos_cliente, datos_cliente$tipo_cliente=="Particular"), aes(x=profesion, fill=
  geom_bar()+
  theme(axis.text.x=element_text(size=10,angle =90),
        axis.title=element_text(size=12,face="bold"))+
  aes(stringr::str_wrap(profesion, 15)) + xlab(NULL)

# Estudiamos los clientes por edad

summary(subset(datos_cliente$edad, datos_cliente$tipo_cliente=="Particular"))
```

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
```

```
##   38.00   50.00   66.00   65.67   78.00  108.00
```

```
g11<-ggplot(data=subset(datos_cliente, datos_cliente$tipo_cliente=="Particular"), aes(edad))+
  geom_histogram(binwidth=0.65, fill="royalblue", colour="")

g12<-ggplot(data=subset(datos_cliente, datos_cliente$tipo_cliente=="Particular"), aes(edad, fill=sexo))+
  geom_histogram(binwidth=0.65, colour="royalblue")

datos_cliente[datos_cliente$edad=="59",]
```

```
##      cod_cliente tipo_cliente              nom_cliente    sexo  fecha_nac
## 60       0393222T   Particular           Thornton Tony  Hombre  1959-04-05
## 66       0065544M   Particular           Mateo Mir Raúl Hombre  1959-09-30
## 215      0589839M   Particular     Molina Escriche Luis Hombre  1959-03-20
## 218      0720908L   Particular     López Martín Natalia   Mujer 1959-10-22
## 309      0262167W   Particular         Warburton Edgar  Hombre  1959-04-17
## 333      0131099E   Particular           Embury Andrew  Hombre  1959-12-11
## 352      0262168M   Particular             Mclean Edgar Hombre  1958-12-31
## 382      0458782R   Particular   Rovira Soriano Natalia   Mujer 1959-04-15
## 450      0589848E   Particular           Embury Olivia    Mujer 1959-07-08
## 512      1048576S   Particular Sandoval Romero Ignacio  Hombre  1959-09-16
## 552      1441792S   Particular       Sáez Abellán Tomás Hombre  1959-03-17
## 553      1441793S   Particular         Sanz Ruiz Pilar    Mujer 1959-03-23
## 607      1245199G   Particular       García Rojo Leire    Mujer 1959-02-25
## 690      1900548P   Particular   Puertas Alquézar Inés    Mujer 1959-04-20
## 913      1572885G   Particular             Grove Andrew Hombre  1959-04-02
## 925      1703959S   Particular         Soto Ros Beatriz   Mujer 1959-09-29
## 1048     0131108H   Particular             Hall Charles Hombre  1959-06-18
## 1118     0196654C      Empresa                 Cousins     <NA> 1959-01-02
## 1122     0327720S   Particular Sánchez Noguera Agustín  Hombre  1959-09-12
## 1128     0393256C   Particular     Corrales Díaz Ramón  Hombre  1959-04-21
## 1170     0589860P   Particular     Pons Romera Agustín  Hombre  1959-06-25
## 1193     0917537P   Particular           Porter Deborah   Mujer 1959-07-20
## 1205     0786471H   Particular              Hall Henry Hombre  1959-03-05
## 1229     0655403G   Particular             Grant Agatha   Mujer 1959-10-31
## 1355     0196665H   Particular       Hacker Cristopher  Hombre  1959-06-15
## 1421     0655411G   Particular             Green Clare    Mujer 1959-12-02
## 1473     0524345H   Particular               Hill Mary    Mujer 1959-09-14
## 1482     0720952M      Empresa             Mahatejaswi     <NA> 1959-07-09
## 1706     2031648G   Particular           Green Deborah    Mujer 1959-04-28
## 1832     1441840M   Particular   Marqués Acereda Mario  Hombre  1959-09-27
## 1906     1376316W   Particular         Warburton Esther   Mujer 1959-10-03
## 1928     1703984E   Particular           Efemey William Hombre  1959-12-18
## 1948     1703990C   Particular           Cruise Gregory Hombre  1959-01-09
## 1961     1966129C   Particular           Chellew Daniel Hombre  1959-08-28
## 1998     1769530M   Particular             Mckay Lewis  Hombre  1959-09-24
## 2010     1769532K   Particular             King Michael Hombre  1959-07-26
## 2270     2818062M   Particular         Mateo Mir Irene    Mujer 1959-10-27
## 2308     2097170M   Particular     Marqués Acereda Xavi Hombre  1959-11-22
## 2393     2228253H   Particular         Holdsworth Peter Hombre  1958-12-22
## 2434     2686992M      Empresa              Mulino Café     <NA> 1958-12-25
## 2435     2686993C   Particular   Castro Morales Emilia    Mujer 1959-03-03
## 2483     2949141S   Particular             Spencer Eve    Mujer 1959-03-19
## 2572     3276802M   Particular             Morgan Mary    Mujer 1959-05-26
## 2614     3473414O   Particular     O'Connor Jacqueline    Mujer 1959-10-31
```

```
## 2703    3866627L      Empresa                 Lazcania    <NA> 1959-11-30
## 2706    3735556S   Particular     Salas Figueroa Elena   Mujer 1959-07-11
## 2875    3604501D   Particular         Docherty Gerald  Hombre  1959-06-29
## 2991    4128787S   Particular           Skydel Donald  Hombre  1959-07-16
## 3136    2097192S   Particular             Santer Clare   Mujer 1959-08-18
## 3415    2162751G   Particular               Grant Eve    Mujer 1959-09-22
## 3448    2490428P   Particular   Puertas Alquézar Pedro Hombre  1959-01-16
## 3470    2818098L   Particular         Lights Nicholas  Hombre  1959-06-28
## 3642    3604516P   Particular Puertas Alquézar Néstor  Hombre  1959-09-14
## 3663    3342379L      Empresa                 Luc Casa    <NA> 1959-05-04
## 3810    3997736T      Empresa                   Talia     <NA> 1958-12-31
## 3899    3604533W   Particular             Wigens Clare   Mujer 1959-08-27
## 3912    3276856S   Particular           Sullivan Edgar Hombre  1959-06-15
## 3925    3145791C   Particular   Colomer Costa Antonio  Hombre  1959-10-07
## 4035    3735609M   Particular   Martí Márquez Roberto  Hombre  1959-05-27
##       edad  estado_civil                                        direccion
## 60      59 Divorciado/a                  1528 NE 152nd Ter  Miami, FL 33013
## 66      59     Casado/a        Via F Aprile 11, Piazza Repubblica , Milano
## 215     59     Casado/a                           via Santa Lucia, 10 Roma
## 218     59 Divorciado/a                         Via L. Galvani 12 , Milano
## 309     59     Soltero/a              9245 NW 9th Pl  Plantation, FL 33030
## 333     59     Casado/a                      Povey Cross Road ,London EC1
## 352     59     Casado/a                   441 NW 41st St  Miami, FL 33017
## 382     59       Viudo/a                                via Sforza, 10 Roma
## 450     59 Divorciado/a          394 Indian Trce  Fort Lauderdale, FL 33031
## 512     59     Casado/a                         Via Fabio Filzi, 3 , Milano
## 552     59     Soltero/a                           via Saturnia, 18, Milano
## 553     59       Viudo/a     Av. Recinto Ferial Juan Carlos I, Madrid 28011
## 607     59 Divorciado/a                        via delle Carrozze, 93 Roma
## 690     59     Casado/a                      C/ Provenza 21 08033 Barcelona
## 913     59     Casado/a                         224 Piccadilly ,London W2
## 925     59     Casado/a                         Viale Suzzani 13 , Milano
## 1048    59     Casado/a            18 Doyers St Frnt B  New York, NY 10013
## 1118    59                                    Hyde Park Corner ,London EC3
## 1122    59     Casado/a                     V. Favencia 43 08035 Barcelona
## 1128    59     Casado/a                       Piazza Mentana, 7 ,Florencia
## 1170    59     Soltero/a                        Via Trebbio 1r ,Florencia
## 1193    59     Casado/a                   76 W 3rd St  New York, NY 10005
## 1205    59 Divorciado/a                   145 2nd Ave  New York, NY 10008
## 1229    59 Divorciado/a    Design Museum, Butlers Wharf, London ,London SW1
## 1355    59     Casado/a                      27 Norfolk Square ,London EC1
## 1421    59       Viudo/a         601 NE 11th St  Fort Lauderdale, FL 33029
## 1473    59     Casado/a                   33 Rue des Ecoles , 75002 Paris
## 1482    59                                175 Avenue C  New York, NY 10005
## 1706    59     Casado/a              49 Cowcaddens Road ,Liverpool L69 2DH
## 1832    59     Casado/a              Isabel La Catòlica 56 08025 Barcelona
## 1906    59     Casado/a                           Residenzstr. 21, München
## 1928    59     Soltero/a                    63 Clerkenwell Road ,London W2
## 1948    59     Casado/a                   242 10th Ave  New York, NY 10003
## 1961    59 Divorciado/a                286 1st Ave # A  New York, NY 10007
## 1998    59     Casado/a                  42 Clyde Street ,Liverpool L69 7HY
## 2010    59     Soltero/a Waterstone'S, Searcy'S, 203 Piccadilly ,London W2
## 2270    59     Casado/a                           D'Elx 74 08019 Barcelona
## 2308    59     Casado/a                    Via Broletto 46 · Milano, Milano
```

```
## 2393   59     Casado/a                    117 Avenue A  New York, NY 10015
## 2434   59                               Via Bolognese Vecchia, 224 ,Florencia
## 2435   59     Casado/a                                 Via Tonale 2 , Milano
## 2483   59 Divorciado/a                      33 Rue Delambre , 75015 Paris
## 2572   59     Casado/a                     Menzinger Strasse 103, München
## 2614   59     Casado/a                   67 Clyde Place ,Liverpool L69 7HY
## 2703   59                                    50 Mott St  New York, NY 10011
## 2706   59     Soltero/a                              via Sforza, 10 Roma
## 2875   59     Casado/a                     12 Berkeley Square ,London SW1
## 2991   59     Casado/a                     94 Rue Daguerre , 75003 Paris
## 3136   59 Divorciado/a                     15 Rue d'Odessa , 75003 Paris
## 3415   59     Casado/a                             Altenhofstr.4, München
## 3448   59 Divorciado/a                       via Principe Amedeo, 9 Roma
## 3470   59     Casado/a                      Hohenzollernstr. 37, München
## 3642   59     Soltero/a             Polígon Sant Benet 49 08024 Barcelona
## 3663   59                            4 Park Ave # 6d  New York, NY 10015
## 3810   59                              3479 NE 163rd St  Miami, FL 33015
## 3899   59 Divorciado/a                   228 W 4th St  New York, NY 10011
## 3912   59 Divorciado/a                  8 Cortlandt St  New York, NY 10011
## 3925   59 Divorciado/a                          Gran Via, 53, Madrid 28010
## 4035   59     Soltero/a     Carrera de San Jerónimo, 32, 3º, Madrid 28020
##                                    profesion num_hijos       region
## 60                    Gerentes & Directivos          2 Norteamérica
## 66                    Gerentes & Directivos          2   Sur Europa
## 215                   Gerentes & Directivos          2   Sur Europa
## 218    Architectos,Decoradores & Humanistas          0   Sur Europa
## 309    Doctores & Profesionales de la Salud          0 Norteamérica
## 333              Ingenieros & Especialistas          4 Norte Europa
## 352                   Gerentes & Directivos          3 Norteamérica
## 382    Architectos,Decoradores & Humanistas          0   Sur Europa
## 450                   Gerentes & Directivos          0 Norteamérica
## 512    Doctores & Profesionales de la Salud          2   Sur Europa
## 552                   Gerentes & Directivos          0   Sur Europa
## 553  Economistas,Abogados & Admin.Empresas          3   Sur Europa
## 607  Economistas,Abogados & Admin.Empresas          2   Sur Europa
## 690  Economistas,Abogados & Admin.Empresas          2   Sur Europa
## 913  Economistas,Abogados & Admin.Empresas          0 Norte Europa
## 925                   Gerentes & Directivos          3   Sur Europa
## 1048                  Gerentes & Directivos          0 Norteamérica
## 1118                            Servicios         NA Norte Europa
## 1122                  Gerentes & Directivos          0   Sur Europa
## 1128   Doctores & Profesionales de la Salud          3   Sur Europa
## 1170                          Ama de Casa          0   Sur Europa
## 1193   Doctores & Profesionales de la Salud          2 Norteamérica
## 1205                  Gerentes & Directivos          2 Norteamérica
## 1229 Economistas,Abogados & Admin.Empresas          0 Norte Europa
## 1355   Doctores & Profesionales de la Salud          2 Norte Europa
## 1421 Economistas,Abogados & Admin.Empresas          2 Norteamérica
## 1473 Economistas,Abogados & Admin.Empresas          0 Norte Europa
## 1482                             Catering         NA Norteamérica
## 1706 Economistas,Abogados & Admin.Empresas          3 Norte Europa
## 1832   Architectos,Decoradores & Humanistas          2   Sur Europa
## 1906                  Gerentes & Directivos          3 Norte Europa
## 1928 Economistas,Abogados & Admin.Empresas          1 Norte Europa
```

```
## 1948   Architectos,Decoradores & Humanistas         2 Norteamérica
## 1961              Ingenieros & Especialistas         2 Norteamérica
## 1998 Economistas,Abogados & Admin.Empresas          2 Norte Europa
## 2010   Doctores & Profesionales de la Salud         0 Norte Europa
## 2270   Doctores & Profesionales de la Salud         1   Sur Europa
## 2308                 Gerentes & Directivos         3   Sur Europa
## 2393                 Gerentes & Directivos         2 Norteamérica
## 2434                             Alimentación        NA   Sur Europa
## 2435   Doctores & Profesionales de la Salud         0   Sur Europa
## 2483 Economistas,Abogados & Admin.Empresas          3 Norte Europa
## 2572 Economistas,Abogados & Admin.Empresas          2 Norte Europa
## 2614   Doctores & Profesionales de la Salud         0 Norte Europa
## 2703                                 Catering        NA Norteamérica
## 2706              Ingenieros & Especialistas         0   Sur Europa
## 2875 Economistas,Abogados & Admin.Empresas          2 Norte Europa
## 2991 Economistas,Abogados & Admin.Empresas          0 Norte Europa
## 3136   Doctores & Profesionales de la Salud         3 Norte Europa
## 3415   Architectos,Decoradores & Humanistas         3 Norte Europa
## 3448   Doctores & Profesionales de la Salud         2   Sur Europa
## 3470   Doctores & Profesionales de la Salud         3 Norte Europa
## 3642              Ingenieros & Especialistas         0   Sur Europa
## 3663                             Alimentación        NA Norteamérica
## 3810                                 Catering        NA Norteamérica
## 3899   Doctores & Profesionales de la Salud         2 Norteamérica
## 3912   Doctores & Profesionales de la Salud         3 Norteamérica
## 3925 Economistas,Abogados & Admin.Empresas          0   Sur Europa
## 4035   Doctores & Profesionales de la Salud         0   Sur Europa
##        nacionalidad total_compras puntos_cumul
## 60   Estados Unidos            21           28
## 66           España            14           13
## 215          España            14           10
## 218          España             1            7
## 309  Estados Unidos             3            9
## 333    Reino Unido            11            9
## 352  Estados Unidos            21           24
## 382          España            16           15
## 450  Estados Unidos            10            6
## 512          España             4            8
## 552          España             9            6
## 553          España            18           16
## 607          España             9            8
## 690          España            15           10
## 913    Reino Unido            11            7
## 925          España             4            8
## 1048 Estados Unidos             6           12
## 1118   Reino Unido            21           20
## 1122         España             8            8
## 1128         España             8            5
## 1170         España            14            9
## 1193 Estados Unidos             6            6
## 1205 Estados Unidos             8           11
## 1229   Reino Unido             1            7
## 1355   Reino Unido            12            6
## 1421 Estados Unidos             5           10
```

```
## 1473   Reino Unido              2            8
## 1482 Estados Unidos             7           11
## 1706   Reino Unido              4           10
## 1832          España            7           10
## 1906   Reino Unido             14           15
## 1928   Reino Unido              7           11
## 1948 Estados Unidos             2           11
## 1961 Estados Unidos             8           12
## 1998   Reino Unido             10            8
## 2010   Reino Unido              8            9
## 2270          España            3            5
## 2308          España           20           14
## 2393 Estados Unidos             0            5
## 2434          España           10           11
## 2435          España            7            7
## 2483   Reino Unido              5            8
## 2572   Reino Unido             12            6
## 2614   Reino Unido             10            6
## 2703 Estados Unidos            11           11
## 2706          España            4            8
## 2875   Reino Unido              5            6
## 2991   Reino Unido             11           10
## 3136   Reino Unido             17           23
## 3415   Reino Unido             10            8
## 3448          España            6           11
## 3470   Reino Unido              8            7
## 3642          España            3            6
## 3663 Estados Unidos             6           12
## 3810 Estados Unidos            20           15
## 3899 Estados Unidos            10           11
## 3912 Estados Unidos            12           18
## 3925          España           17           17
## 4035          España            6            9
```

```
nrow(datos_cliente[datos_cliente$edad=="59",])
```

```
## [1] 59
```

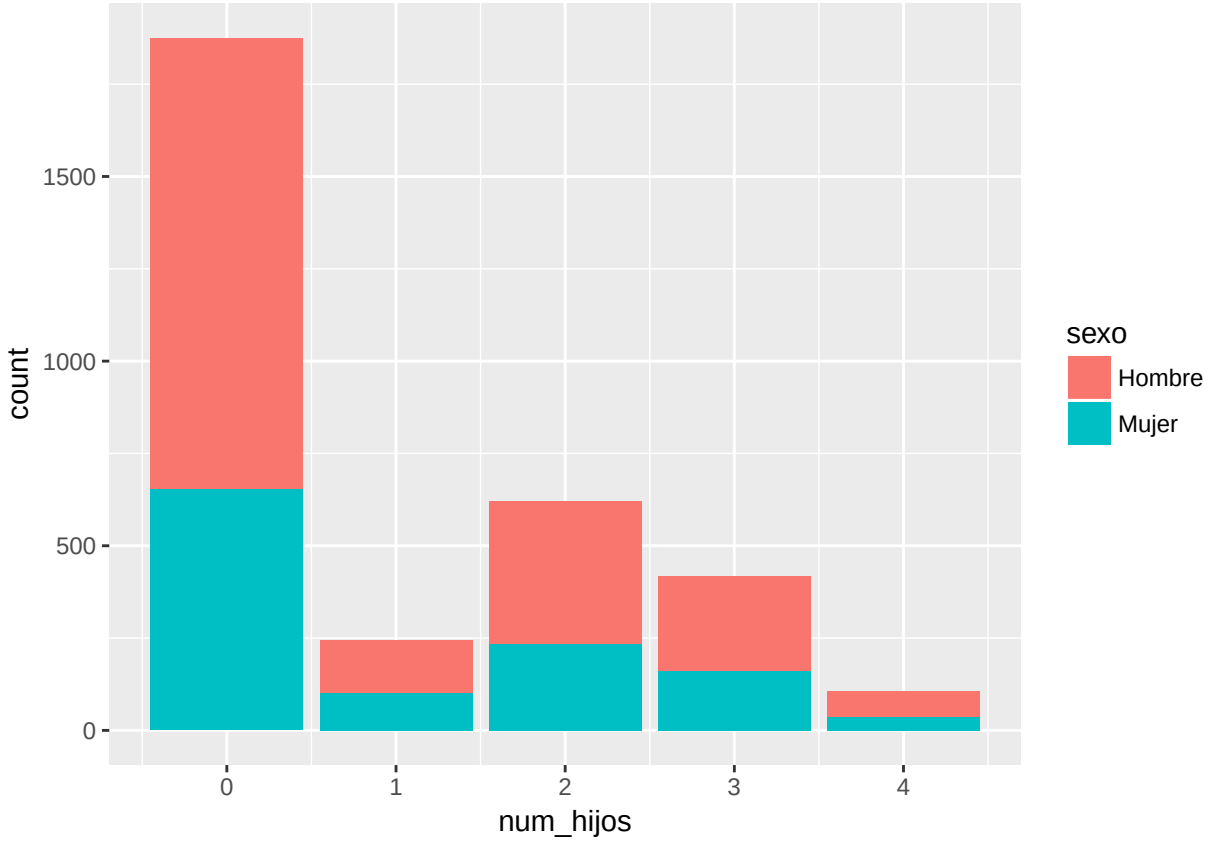
```
# Estudiamos los clientes por estado civil:
cliente_part<-datos_cliente[datos_cliente$tipo_cliente=="Particular",]
cliente_part<-droplevels(cliente_part)
table(cliente_part$estado_civil, cliente_part$sexo)
```

```
##
##                 Hombre  Mujer
##   Casado/a          820   498
##   Divorciado/a      400   251
##   Soltero/a         805   414
##   Viudo/a            51    25
```

```
g13<-ggplot(data=subset(datos_cliente, datos_cliente$tipo_cliente=="Particular"), aes(estado_civil, fil
  geom_bar()

# Estudiamos los clientes por número de hijos:
table(cliente_part$num_hijos, cliente_part$sexo)
```

```
##
##      Hombre  Mujer
##   0    1221   655
##   1     142   102
##   2     387   234
##   3     256   161
##   4      70    36
```

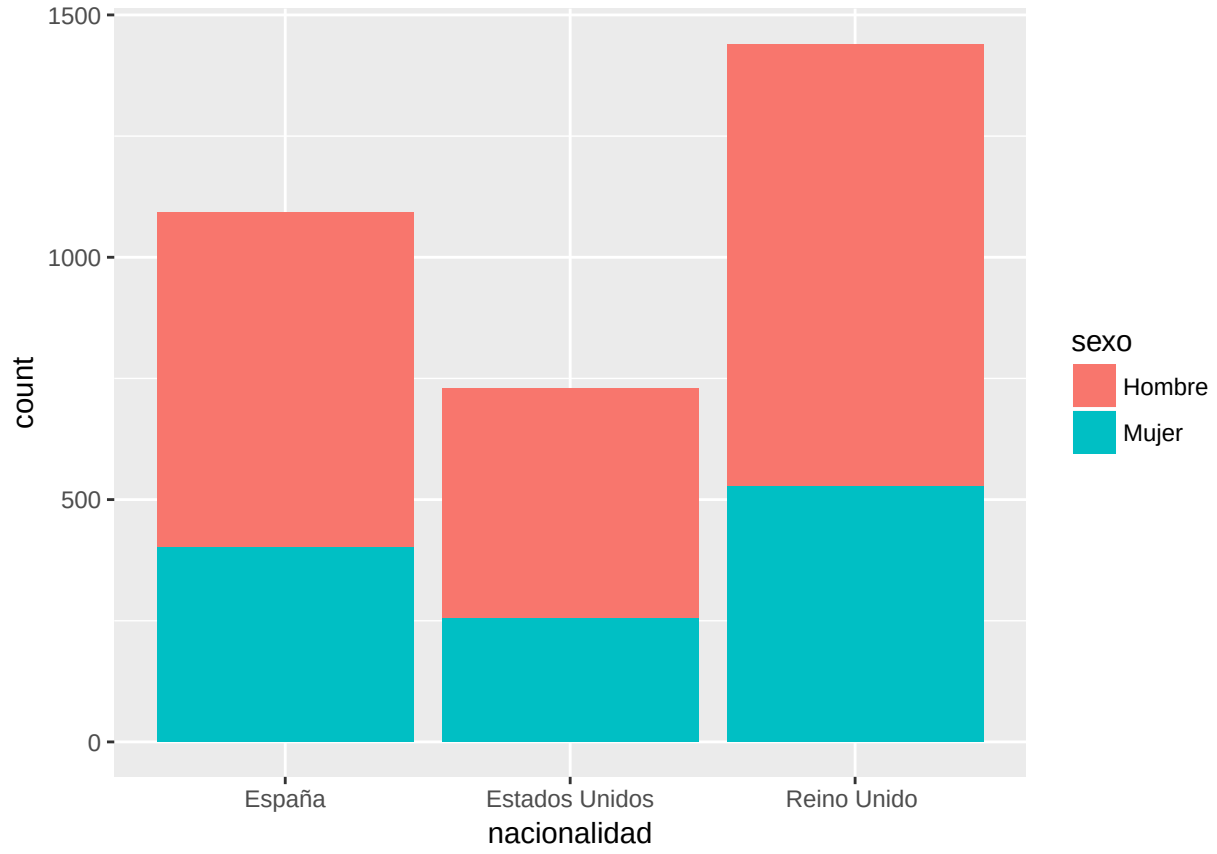
```
ggplot(data=subset(datos_cliente, datos_cliente$tipo_cliente=="Particular"), aes(num_hijos, fill=sexo))+
  geom_bar()
```




```
# Estudiamos los clientes por nacionalidad:
table(cliente_part$nacionalidad, cliente_part$sexo)
```

```
##
##                   Hombre  Mujer
##   España             690   402
##   Estados Unidos     474   257
##   Reino Unido        912   529
```

```
ggplot(data=subset(datos_cliente, datos_cliente$tipo_cliente=="Particular"), aes(nacionalidad, fill=sexo
  geom_bar()
```




```
#Clustering analysis (RFM analysis)
# Recency ("Compra más reciente de cada usuario")
# Creo una nueva tabla con aquellos registros de "datos_cabecera" que no contengan valores nulos en "co
datos_cabecera$cod_cliente<-trimws(datos_cabecera$cod_cliente)
datos_cabecera_cod<-datos_cabecera[which(!is.na(datos_cabecera$cod_cliente)),]
# Agrupo los registros por código de cliente
group_cod<-group_by(datos_cabecera_cod,cod_cliente)
# Calculo "recency", es decir los días que han pasado de la última compra
recency <- summarise(group_cod, recency = as.numeric(as.Date("2000-12-31")-max(fecha)))
# Sólo me interesan los códigos de clientes particulares, hago un crossmatch con "cliente_part"
# Creamos una nueva columna "recency" en la tabla "cliente_part" y añadimos la info
cliente_part$recency<-recency$recency[match(cliente_part$cod_cliente,recency$cod_cliente)]

# "Frequency" sería el equivalente a la variable "total_compras" (número de comprar realizadas por usua
cliente_part$frequency <- cliente_part$total_compras

# Calculo "Monetary" (importe total de compras realizadas por usuario)
monetary <- summarise(group_cod, monetary = sum(importe_tot))

# Añado la columna "monitery" a "cliente_part", antes hago crossmatch con "cod_cliente"
cliente_part$monetary<-monetary$monetary[match(cliente_part$cod_cliente,monetary$cod_cliente)]

# Saco la estadística de los 3 parámetros
summary(cliente_part$recency)
```

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.    NA's
```

```
##    0.00    0.00    8.00   26.23   43.00  121.00     122
```

```
summary(cliente_part$frequency)
```

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##   0.000   4.000   7.000   7.804  11.000  33.000
```

```
summary(cliente_part$monetary)
```

```
##     Min.  1st Qu.   Median     Mean  3rd Qu.     Max.     NA's
##    3.425   98.203  196.002  312.467  389.883 3227.520      122
```

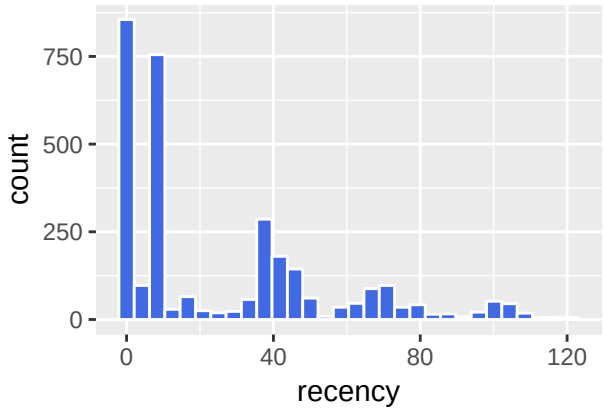
```
g13<-ggplot(cliente_part, aes(recency))+
  geom_histogram(colour="white", fill="royalblue")

g14<-ggplot(cliente_part, aes(frequency))+
  geom_histogram(colour="white", fill="royalblue")

g15<-ggplot(cliente_part, aes(monetary))+
  geom_histogram(colour="white", fill="royalblue")

grid<-grid.arrange(g13, g14, g15, nrow=2, ncol=2)
```

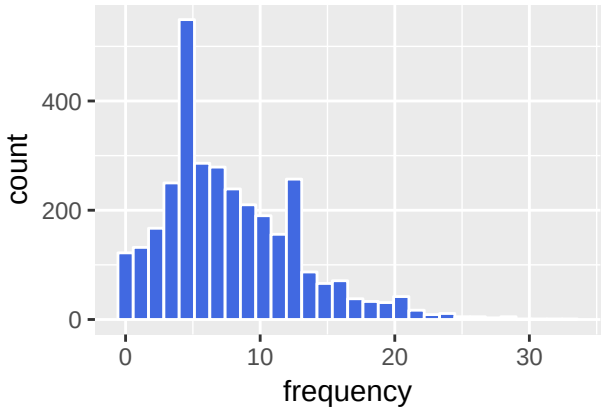
```
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
```

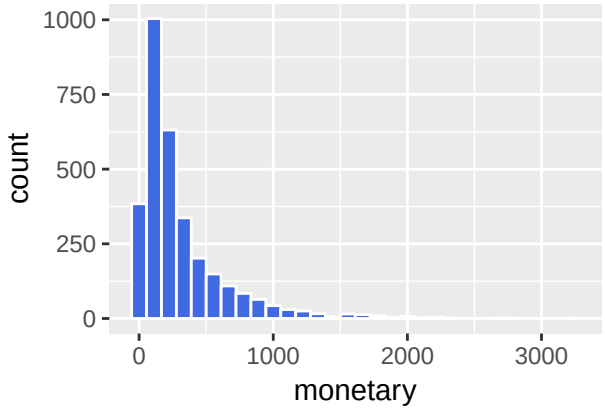
```
## Warning: Removed 122 rows containing non-finite values (stat_bin).
```

```
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
```

```
## Warning: Removed 122 rows containing non-finite values (stat_bin).
```








```
# Normalizo los datos de las 3 variables usando scale(): media=0, STDEV=1
data_cluster<-cliente_part
data_cluster$monitery<-scale(data_cluster$monetary)
data_cluster$recency<-scale(data_cluster$recency)
data_cluster$frequency<-scale(data_cluster$frequency)

# Aplico clustering a los datos de tipo numérico mediante kmeans
# Fijando en 2, 4 u 8 centroides:
library (cluster)
head(data_cluster)
```

```
##   cod_cliente tipo_cliente            nom_cliente    sexo  fecha_nac edad
## 1    0000001R   Particular Roca Sacristán Narciso Hombre  1955-12-20   63
## 2    0065536F   Particular Fuentes Mohedano Rosa    Mujer 1942-01-08   76
## 3    0065537P   Particular       Prat Salom Pedro Hombre  1940-03-15   78
## 4    0000002J   Particular         Jones Nicholas Hombre  1911-08-08  107
## 5    0000003B   Particular       Burton Alexander Hombre  1942-04-17   76
## 6    0065538S   Particular         Sales Deborah    Mujer 1941-05-26   77
##   estado_civil                                direccion
## 1    Soltero/a Piazzale Suppercortemaggiore 4 , Milano
## 2    Casado/a                C/ Niza 73 08032 Barcelona
## 3    Casado/a        corso Vittorio Emanuele, 102 Roma
## 4    Soltero/a     1 Place de la Sorbonne , 75003 Paris
## 5    Casado/a    46 Stockwell Place ,Liverpool L69 2DH
## 6    Casado/a               Leopoldstraße 44, München
##                              profesion num_hijos       region
```

```
## 1 Economistas,Abogados & Admin.Empresas          0   Sur Europa
## 2             Ingenieros & Especialistas         1   Sur Europa
## 3   Doctores & Profesionales de la Salud         2   Sur Europa
## 4             Ingenieros & Especialistas         0 Norte Europa
## 5   Doctores & Profesionales de la Salud         2 Norte Europa
## 6 Economistas,Abogados & Admin.Empresas          1 Norte Europa
##   nacionalidad total_compras puntos_cumul    recency  frequency monetary
## 1       España             4            7  0.3263587 -0.7393687  68.1750
## 2       España            16           13 -0.8760872  1.5932607 659.2050
## 3       España            14           10 -0.8760872  1.2044891 588.3425
## 4 Reino Unido              2            9 -0.6088770 -1.1281403 218.0450
## 5 Reino Unido             13            9 -0.8760872  1.0101033 242.3200
## 6 Reino Unido              7           11  1.2949958 -0.1562114 379.1875
##     monitery
## 1 -0.7105975
## 2  1.0085939
## 3  0.8024686
## 4 -0.2746548
## 5 -0.2040436
## 6  0.1940774
```

```
data_cluster[,15:17]
```

```
##          recency   frequency  monetary
## 1     0.326358750 -0.73936872   68.1750
## 2    -0.876087208  1.59326068  659.2050
## 3    -0.876087208  1.20448911  588.3425
## 4    -0.608876995 -1.12814028  218.0450
## 5    -0.876087208  1.01010333  242.3200
## 6     1.294995771 -0.15621137  379.1875
## 7    -0.542074442  0.42694598  386.2175
## 8    -0.809284655 -1.12814028   20.5825
## 9    -0.876087208  2.56518959  911.3675
## 10    0.359760026 -0.54498293  128.5950
## 11   -0.876087208  0.62133176  375.6950
## 13    1.528804707 -0.93375450   46.0000
## 14    0.626970239 -0.35059715  143.9250
## 15   -0.608876995 -1.12814028   88.0800
## 18   -0.642278272 -0.93375450   73.3225
## 19   -0.876087208 -0.93375450  128.7850
## 20    2.297034069 -0.54498293  134.2450
## 21   -0.608876995  0.62133176  825.1325
## 22   -0.642278272 -0.35059715  110.8975
## 23    0.393161303  0.42694598  509.3475
## 24   -0.608876995 -1.12814028   39.5950
## 25   -0.876087208  1.20448911  569.2750
## 26   -0.608876995  1.01010333  196.6900
## 27   -0.876087208  1.01010333  672.9000
## 30    1.462002154 -0.54498293  235.2950
## 31   -0.642278272 -0.73936872  116.9625
## 32   -0.876087208  1.98203224  760.0050
## 33   -0.876087208  0.42694598  547.8575
## 34   -0.876087208  0.81571754  271.2675
## 35   -0.642278272  1.20448911 1039.3950
## 36   -0.876087208  0.03817441  439.0200
```

```
## 37   -0.876087208 -0.35059715   94.0325
## 39    0.593568963  0.23256020  683.9050
## 40   -0.876087208  0.62133176  657.3025
## 41    0.393161303 -0.73936872   23.1825
## 43    3.065263431 -1.32252606   11.4250
## 44   -0.876087208  0.62133176  190.9150
## 47   -0.876087208  0.81571754  296.6500
## 48    0.159352367 -0.15621137  477.2325
## 49    0.426562580  0.03817441  276.3300
## 50   -0.876087208  2.17641802  967.9675
## 51    1.027785558 -0.73936872   95.7875
## 52    0.326358750  1.98203224  796.0850
## 53             NA -1.51691185        NA
## 54   -0.876087208  1.01010333  184.8150
## 55   -0.809284655  2.37080381 1130.6500
## 56   -0.608876995  0.62133176  376.0425
## 57   -0.876087208 -0.54498293  100.8050
## 58   -0.876087208  0.03817441  264.4200
## 59             NA -1.51691185        NA
## 60   -0.709080825  2.56518959 2007.7575
## 62   -0.876087208  0.23256020  324.0750
## 63    0.727174069 -0.93375450  100.1875
## 64   -0.876087208  0.23256020  369.5850
## 65    1.328397048 -0.15621137  170.5100
## 66   -0.608876995  1.20448911  635.4950
## 67   -0.642278272 -0.35059715  410.6975
## 68    1.261594495 -0.93375450   76.6925
## 69   -0.876087208 -0.15621137  162.5125
## 70   -0.642278272 -0.15621137  161.8450
## 71   -0.876087208  0.03817441  328.8400
## 74   -0.876087208  0.81571754  297.6350
## 76    1.261594495 -0.35059715  148.7350
## 77   -0.876087208  0.03817441  226.5000
## 78   -0.642278272 -0.73936872  161.8675
## 80   -0.809284655  0.42694598  272.3400
## 82   -0.642278272 -1.12814028   37.7250
## 83    2.764651942 -0.93375450   95.3550
## 84   -0.876087208  0.42694598  196.8725
## 85   -0.608876995 -0.73936872  134.0400
## 86   -0.876087208  0.42694598  383.9425
## 87   -0.876087208  0.23256020  178.0175
## 89             NA -1.51691185        NA
## 90    0.593568963  1.39887489  978.7400
## 91   -0.608876995  0.23256020  212.3475
## 92   -0.608876995  0.62133176  764.4625
## 93   -0.575475718  0.03817441  188.7500
## 95    1.127989388 -1.32252606   28.0000
## 98   -0.642278272 -0.15621137  262.7650
## 99   -0.642278272 -0.73936872   42.0625
## 100   1.929620027 -0.93375450   76.4000
## 101   0.226154920 -0.54498293  163.1725
## 102   0.326358750  0.03817441  112.7875
## 105  -0.876087208  0.23256020  266.4000
## 107   0.660371516 -1.12814028   27.4375
```

```
## 108   1.127989388 -0.93375450  128.4600
## 109  -0.876087208  1.98203224 1020.4625
## 110  -0.876087208  0.23256020  144.9000
## 111  -0.876087208  1.20448911  625.4925
## 112  -0.642278272 -0.93375450   99.5700
## 114   0.326358750  0.42694598  192.8875
## 115            NA -1.51691185        NA
## 116  -0.876087208 -0.35059715  177.9500
## 117   1.662409814 -1.12814028   30.6900
## 118  -0.642278272 -0.54498293   63.8875
## 119   0.693772792 -0.15621137  299.3675
## 120   2.397237899 -0.93375450   59.4500
## 121  -0.876087208  0.62133176  549.3900
## 122   0.359760026  1.78764646 1368.4350
## 123   0.326358750  0.03817441  258.6600
## 124   0.493365133  0.62133176 1045.7125
## 125   0.326358750 -0.73936872  115.8025
## 126   0.560167686 -0.73936872   75.0375
## 127  -0.876087208 -0.93375450   16.1500
## 128  -0.642278272  0.42694598  214.6300
## 129  -0.876087208  0.62133176  357.0500
## 130   0.192753643 -0.73936872   83.0475
## 131            NA -1.51691185        NA
## 132  -0.608876995 -0.35059715  187.2775
## 133  -0.274864229 -1.32252606   11.2500
## 134   0.192753643 -0.15621137  117.9625
## 135  -0.642278272 -0.35059715   54.8375
## 136   2.597645559 -1.12814028   69.6025
## 137  -0.876087208  1.01010333  535.2850
## 139   0.560167686 -0.15621137  197.7650
## 140   0.560167686 -1.32252606   12.2000
## 141   1.094588112 -1.12814028   36.5200
## 142  -0.608876995  0.23256020  244.6575
## 143   1.495403431 -0.93375450   64.8125
## 144  -0.876087208  1.98203224 1119.1175
## 145            NA -1.51691185        NA
## 146  -0.876087208  1.01010333  784.8300
## 147  -0.608876995  0.81571754  380.9300
## 148  -0.876087208  1.39887489 1380.5750
## 149   1.862817473 -0.93375450   78.8800
## 151   1.328397048 -1.32252606   21.9250
## 152   1.261594495 -0.54498293  113.8275
## 154   2.464040452 -0.73936872  180.5750
## 155   1.762613644 -1.32252606   46.0975
## 156  -0.642278272  0.42694598  129.1850
## 157   0.292957473  0.42694598  652.9950
## 158   0.560167686  0.62133176  558.5600
## 159   1.294995771  0.23256020  287.0575
## 160  -0.475271889 -0.54498293   89.9725
## 162   0.593568963  0.81571754  452.0000
## 163   0.493365133 -1.32252606   15.6100
## 164  -0.876087208  0.03817441  522.7800
## 165  -0.642278272 -0.93375450   85.5850
## 166  -0.642278272 -0.54498293  126.2550
```

```
## 167   0.292957473 -0.35059715  204.1900
## 168   1.094588112 -0.73936872   65.2000
## 169  -0.642278272  0.62133176  391.5825
## 170  -0.775883378  0.03817441  153.9675
## 171  -0.608876995  0.23256020  276.5275
## 172  -0.876087208  1.01010333  380.7325
## 173  -0.642278272  0.81571754  351.5375
## 174   1.328397048 -0.15621137   86.4500
## 176   0.827377899 -0.15621137  185.1125
## 177  -0.642278272 -0.35059715  182.9500
## 178  -0.876087208  1.39887489  374.2250
## 179  -0.642278272 -0.15621137  119.3625
## 180   1.528804707 -0.15621137  327.2350
## 181   0.626970239 -0.93375450   67.2950
## 182   0.626970239 -1.12814028   21.7375
## 183  -0.876087208  1.59326068  570.6850
## 184  -0.876087208 -0.35059715  186.1625
## 185  -0.642278272  1.59326068 1256.7475
## 186  -0.608876995 -0.54498293  257.3075
## 188  -0.508673165 -0.15621137   97.6025
## 189  -0.608876995  0.23256020  188.9150
## 190   0.560167686 -1.12814028   17.6500
## 193  -0.876087208  0.23256020  202.9750
## 195  -0.508673165 -1.12814028   54.7800
## 196  -0.608876995 -0.54498293   88.6250
## 197  -0.876087208  0.03817441  186.4250
## 198  -0.876087208  1.20448911  635.5925
## 199   2.898257048 -1.12814028   21.7475
## 200  -0.642278272 -0.73936872   56.3125
## 201   0.359760026 -0.54498293  199.7000
## 202  -0.675679548  1.39887489  564.1775
## 203  -0.642278272  0.03817441  251.9600
## 204  -0.876087208 -0.15621137  100.0475
## 205  -0.876087208  0.62133176  336.1575
## 206  -0.608876995 -0.54498293  243.0700
## 207   0.660371516  0.03817441  136.0000
## 208            NA -1.51691185        NA
## 209  -0.876087208  3.92589007 1240.1500
## 210  -0.876087208  0.42694598  533.8100
## 211  -0.642278272 -0.93375450   51.5675
## 212   0.393161303  0.62133176  431.7125
## 213  -0.608876995  1.39887489  273.4425
## 214   1.328397048  1.01010333  646.4100
## 215  -0.876087208  1.20448911  448.8850
## 216   0.393161303  2.95396115 1325.3225
## 217  -0.608876995 -0.15621137  106.1500
## 218   0.860779175 -1.32252606    3.5000
## 219   0.359760026 -0.73936872  211.0100
## 220  -0.642278272  0.42694598  539.0150
## 221   1.194791941  0.03817441  261.2450
## 223  -0.876087208  0.42694598  195.6600
## 224  -0.876087208 -0.54498293  138.5050
## 225  -0.642278272 -0.73936872  181.0050
## 229   0.526766409 -0.15621137  107.2025
```

```
## 230   0.593568963 -0.73936872  104.0200
## 231  -0.809284655  2.17641802 1356.2950
## 232  -0.876087208  1.01010333  236.2500
## 234   0.092549814  0.81571754  776.6875
## 235  -0.642278272 -0.54498293  117.1375
## 236   0.560167686 -0.73936872   65.4500
## 237   0.560167686 -0.35059715  141.8600
## 238  -0.876087208  0.03817441  457.1425
## 239            NA -1.51691185        NA
## 240  -0.876087208  1.01010333  279.9650
## 241   1.261594495  0.23256020  746.0250
## 242   0.793976622 -1.12814028   45.6750
## 244   0.560167686  0.62133176  327.9650
## 245  -0.876087208  0.62133176  230.2850
## 246   0.359760026  1.20448911  682.5400
## 247   2.631046835 -1.12814028   47.3375
## 248  -0.876087208 -0.35059715   92.1625
## 250  -0.274864229 -1.12814028   56.2850
## 251  -0.876087208 -0.15621137  283.0600
## 252  -0.876087208 -0.35059715   64.2500
## 253  -0.742482101  0.42694598  258.6975
## 254  -0.642278272 -1.32252606   39.9500
## 255  -0.642278272  0.03817441  166.3450
## 257  -0.308265506  0.81571754  570.7550
## 258  -0.876087208  0.23256020  201.9975
## 259   2.664448112 -1.32252606   25.0000
## 260   1.762613644 -1.32252606   27.1000
## 261  -0.642278272  0.42694598  276.4350
## 262  -0.608876995  1.59326068 1673.3525
## 263   1.695811090 -1.32252606   12.5000
## 264  -0.876087208  1.20448911  735.7050
## 266  -0.642278272  3.14834694 1903.5425
## 267  -0.876087208 -0.35059715  485.3300
## 269  -0.642278272 -0.54498293   56.4350
## 270   1.695811090 -0.93375450   38.4250
## 271   1.261594495  0.42694598  391.7450
## 272  -0.876087208  0.23256020  209.3600
## 273            NA -1.51691185        NA
## 275  -0.642278272 -0.15621137  140.0500
## 279   2.430639176 -0.93375450   81.5400
## 280   0.560167686 -0.15621137  163.7200
## 281  -0.608876995  0.23256020  249.7625
## 282  -0.642278272  0.62133176  245.6100
## 284  -0.642278272  0.23256020  201.2900
## 286   0.660371516 -0.54498293   79.3400
## 287  -0.809284655  0.81571754  634.0775
## 288  -0.508673165 -0.93375450  170.9525
## 289   0.593568963  1.59326068  769.1725
## 290  -0.642278272  0.62133176  237.2475
## 291  -0.341666782  0.23256020  299.2275
## 294  -0.608876995  0.23256020  326.3250
## 295  -0.876087208  2.37080381 1524.2175
## 296  -0.608876995  0.62133176  500.2475
## 297  -0.876087208 -0.73936872  109.5250
```

```
## 298   2.497441729 -0.15621137  563.3550
## 299   2.464040452 -0.73936872  474.2200
## 300   0.560167686  0.03817441  197.9925
## 301  -0.608876995 -0.73936872  112.9825
## 302  -0.642278272  2.56518959 1585.8625
## 303  -0.876087208  0.42694598  208.9350
## 304  -0.876087208 -0.35059715  175.5175
## 305  -0.141259123 -0.35059715  192.5200
## 306   0.860779175 -0.93375450   49.9275
## 307   0.593568963 -0.73936872   32.1700
## 308  -0.876087208 -0.73936872   45.4050
## 309   0.626970239 -0.93375450   78.3575
## 310  -0.876087208 -0.15621137   89.2875
## 311  -0.876087208  0.62133176  307.2075
## 312  -0.876087208  0.42694598  374.5600
## 313  -0.876087208  1.59326068  436.5925
## 315   1.261594495 -0.93375450   52.7000
## 316   0.226154920 -0.15621137  174.4325
## 317   0.626970239 -0.93375450   60.5225
## 318  -0.842685931  1.39887489  520.7325
## 319  -0.642278272  0.42694598  292.4375
## 320  -0.608876995 -0.54498293  125.7150
## 321   0.359760026 -0.73936872  285.5400
## 323  -0.876087208  1.59326068  764.4550
## 324  -0.642278272 -0.73936872  106.4700
## 325  -0.876087208  0.62133176  349.9850
## 326   0.593568963  0.23256020  253.4325
## 328  -0.575475718  0.23256020  135.3975
## 330   0.560167686 -0.35059715  118.4575
## 331  -0.642278272 -0.54498293  168.0950
## 333  -0.608876995  0.62133176  286.0125
## 334  -0.642278272  1.59326068  558.3325
## 336   0.359760026 -0.93375450   39.2550
## 337  -0.876087208  0.23256020  233.3475
## 338   1.528804707 -0.15621137  162.0525
## 339   0.626970239  0.23256020  222.1375
## 341  -0.675679548  0.03817441  132.7200
## 342   1.996422580 -1.32252606    8.0500
## 343   0.560167686  0.42694598  535.5100
## 344   2.430639176 -0.73936872  191.1350
## 345   2.664448112 -0.93375450  151.9700
## 346  -0.876087208 -0.73936872   81.8450
## 347  -0.876087208 -0.35059715  111.7125
## 349   0.292957473  1.39887489  752.7625
## 350  -0.642278272 -0.15621137  160.1075
## 351   0.459963856 -0.15621137  231.6000
## 352  -0.608876995  2.56518959 1372.6875
## 353  -0.876087208  0.23256020  332.6525
## 354  -0.608876995  0.23256020  188.1800
## 355  -0.876087208 -1.12814028   62.3575
## 356  -0.876087208  0.23256020  286.6175
## 357  -0.876087208  2.37080381 1030.1175
## 358   0.359760026 -0.54498293  311.5850
## 359  -0.642278272  4.50904742 2027.0100
```

```
## 361  -0.876087208  0.03817441  302.0150
## 362  -0.642278272 -0.93375450   82.5750
## 363  -0.876087208  0.81571754  769.1725
## 364            NA -1.51691185        NA
## 368            NA -1.51691185        NA
## 369  -0.876087208 -0.15621137  197.8275
## 370   0.226154920  0.81571754  367.9325
## 371  -0.876087208  0.81571754  486.3150
## 372   1.061186835 -0.93375450   74.5500
## 374  -0.608876995  0.42694598  263.6225
## 375  -0.876087208 -0.35059715  147.1700
## 376  -0.642278272  1.59326068  870.2800
## 377  -0.642278272 -0.73936872   66.9700
## 378  -0.876087208  0.42694598  670.7850
## 380   0.393161303 -0.35059715  144.6100
## 381   0.793976622 -0.73936872   81.7625
## 382  -0.608876995  1.59326068 1005.1925
## 383  -0.608876995  0.81571754  489.5775
## 384  -0.642278272 -0.15621137  459.8425
## 385  -0.341666782 -0.15621137  136.4400
## 387  -0.642278272  1.39887489  311.3150
## 388   0.860779175 -0.54498293  173.2725
## 389   0.359760026  2.37080381  854.9900
## 390  -0.876087208  1.01010333  540.3975
## 392   0.393161303  0.03817441  179.6950
## 393  -0.876087208  0.81571754  322.3575
## 395  -0.642278272  0.23256020  305.8075
## 397  -0.308265506 -0.54498293   81.6300
## 398  -0.876087208  1.98203224  818.3775
## 400  -0.608876995  1.78764646  980.9900
## 401  -0.608876995 -0.35059715   69.6000
## 404  -0.608876995  0.03817441  404.9375
## 405   0.326358750 -0.35059715  146.8450
## 406   2.096626410 -1.32252606    5.7250
## 409   1.595607261 -0.54498293   72.3700
## 410  -0.876087208  2.17641802  919.5100
## 411   1.695811090 -0.15621137  252.5425
## 412  -0.876087208 -1.12814028   26.5750
## 413   0.560167686  1.01010333  921.9825
## 415  -0.608876995  0.42694598  201.4725
## 416  -0.608876995  0.62133176  311.5575
## 417   0.426562580  1.39887489  518.4050
## 420   1.495403431 -0.54498293  243.4825
## 421  -0.341666782 -0.54498293  120.5475
## 422  -0.608876995 -0.73936872   49.3750
## 423  -0.608876995  0.62133176  712.1900
## 424   1.595607261 -0.93375450   62.4450
## 426   1.294995771  0.42694598  403.3350
## 427  -0.876087208 -0.15621137   73.1000
## 428   2.497441729 -0.35059715  108.4825
## 429   1.796014920 -1.32252606   38.6250
## 430  -0.876087208  0.23256020  245.7200
## 431  -0.608876995 -0.15621137  256.1775
## 432  -0.575475718 -0.54498293  233.3350
```

```
## 434  -0.876087208  0.62133176  618.5525
## 435   1.027785558 -1.32252606   60.4300
## 437   0.560167686 -0.73936872  146.1375
## 438   0.560167686  0.03817441  460.7100
## 440   1.261594495 -0.93375450   49.5625
## 441  -0.642278272 -0.73936872  112.9475
## 442   1.428600878 -0.73936872  127.0875
## 443  -0.876087208 -0.93375450   62.7550
## 444  -0.876087208 -1.12814028   75.9700
## 445   0.326358750  0.03817441  276.9275
## 446   0.426562580  0.62133176  470.1800
## 447   2.664448112 -1.12814028   23.5625
## 448   0.292957473  1.59326068  948.2900
## 449  -0.876087208 -0.54498293   63.7650
## 450  -0.642278272  0.42694598  242.4300
## 451  -0.642278272 -0.73936872   79.3700
## 452  -0.876087208  2.37080381  633.4350
## 453  -0.642278272 -0.73936872   88.5825
## 454  -0.642278272 -0.15621137  185.6375
## 455  -0.709080825  2.75957537 1503.1875
## 457  -0.642278272  1.20448911  572.7675
## 458   0.593568963  0.42694598  517.5625
## 460  -0.876087208  0.42694598  443.0575
## 461  -0.876087208 -1.12814028   57.8750
## 462  -0.876087208  0.23256020  582.3650
## 463   1.562205984 -1.12814028   22.7750
## 464  -0.642278272  0.23256020  390.8550
## 467   2.597645559 -0.93375450   92.9900
## 468  -0.876087208 -1.12814028   47.5800
## 469   1.495403431  0.62133176  422.8275
## 470  -0.608876995 -0.54498293  115.0675
## 471  -0.876087208  2.75957537  862.6250
## 472           NA -1.51691185        NA
## 474  -0.642278272 -0.54498293   86.6300
## 475  -0.876087208  1.01010333  374.9300
## 476   0.359760026 -0.35059715  342.5125
## 477  -0.608876995 -0.93375450   23.0625
## 480   0.326358750 -0.35059715  113.8625
## 481   1.194791941  0.42694598  308.2000
## 483  -0.007654016 -0.93375450  131.8700
## 484   0.626970239 -0.54498293   99.5050
## 485   0.626970239  0.03817441  136.4675
## 486   0.827377899 -0.35059715  138.7350
## 487  -0.876087208 -0.15621137  173.1800
## 488   0.226154920  0.23256020  196.9100
## 490  -0.642278272  0.62133176  240.4300
## 491   0.326358750  2.75957537 1949.1300
## 492  -0.642278272 -1.32252606   33.3250
## 493  -0.642278272  0.81571754  216.9225
## 494   0.660371516  0.42694598  372.0775
## 495           NA -1.51691185        NA
## 497  -0.608876995 -0.73936872   70.0550
## 498  -0.642278272 -0.15621137  242.8600
## 499   2.697849388 -1.32252606    3.5000
```

```
## 501  -0.876087208 -0.73936872   89.4875
## 502   0.393161303 -0.54498293  129.8900
## 503   0.593568963 -0.93375450   58.9500
## 504  -0.876087208  1.39887489  665.2550
## 505  -0.608876995 -0.35059715  117.8950
## 506   0.560167686 -0.35059715  409.5400
## 507   1.528804707 -0.54498293   97.0200
## 508   2.063225133 -1.12814028   76.6575
## 509  -0.642278272 -0.54498293   92.3750
## 510  -0.642278272  0.81571754  469.2550
## 511  -0.775883378 -0.54498293  104.3125
## 512   0.827377899 -0.73936872  139.9600
## 513  -0.642278272 -0.93375450   65.0000
## 514  -0.642278272 -0.73936872  193.2325
## 515  -0.642278272  0.23256020  392.4225
## 516   2.664448112 -0.73936872  123.1875
## 517  -0.876087208 -0.35059715  171.2600
## 518  -0.642278272  0.42694598  207.5150
## 519  -0.642278272 -0.15621137  305.1900
## 520  -0.876087208  0.03817441  265.5675
## 521  -0.608876995 -0.73936872   46.5775
## 522  -0.876087208  1.59326068  547.8200
## 523  -0.341666782 -0.15621137  156.8975
## 524  -0.642278272 -0.73936872  145.8850
## 525  -0.608876995  0.62133176  424.7075
## 526  -0.675679548 -0.15621137  290.7750
## 527   0.459963856  1.78764646  875.1950
## 528  -0.642278272  0.81571754  366.0475
## 529   0.593568963 -0.15621137  261.5150
## 530   0.459963856 -0.73936872   55.2500
## 531  -0.375068059 -1.12814028   38.8250
## 532   0.560167686  0.23256020  265.5900
## 533   2.430639176  0.03817441  471.7600
## 534  -0.876087208 -0.35059715  125.2350
## 535  -0.876087208  0.42694598  546.5300
## 536            NA -1.51691185        NA
## 537  -0.642278272  0.42694598  266.6700
## 538   0.593568963 -0.54498293  209.3275
## 540  -0.642278272 -0.73936872   67.7500
## 541  -0.642278272  0.42694598  586.8275
## 542   0.526766409 -0.73936872  112.4000
## 544  -0.876087208  2.17641802 1058.6450
## 545  -0.876087208  2.17641802  879.6100
## 547  -0.608876995 -0.54498293   78.2100
## 549   1.562205984 -1.12814028   26.1250
## 550   0.393161303  0.23256020  528.4750
## 551   0.326358750 -0.15621137  230.8100
## 552  -0.608876995  0.23256020  206.6725
## 553  -0.876087208  1.98203224  707.2250
## 554  -0.575475718  1.59326068  713.1075
## 555  -0.608876995 -0.15621137  266.7150
## 557   0.326358750 -0.15621137  256.2450
## 558            NA -1.51691185        NA
## 559  -0.642278272  0.62133176  306.2575
```

```
## 560   1.996422580 -0.93375450  121.6500
## 561   2.063225133 -1.32252606   49.9500
## 562  -0.642278272  0.81571754  261.6150
## 563  -0.608876995 -0.54498293  293.1100
## 565   0.493365133 -1.12814028   32.3125
## 566  -0.876087208  1.39887489  343.5825
## 570  -0.341666782  1.59326068  347.8425
## 571   0.459963856  1.01010333  605.3100
## 572  -0.608876995 -1.32252606   16.1100
## 573  -0.842685931  0.42694598  214.0300
## 574   1.963021303 -0.35059715  141.3175
## 575   1.729212367 -1.12814028   25.5200
## 576  -0.608876995 -0.73936872   79.4100
## 577   1.495403431 -0.93375450   48.8150
## 578  -0.608876995 -0.15621137  193.3500
## 580  -0.608876995 -0.35059715  110.0075
## 581   0.359760026 -0.54498293  153.4500
## 582  -0.876087208 -0.54498293  125.9150
## 584   0.660371516 -0.35059715  256.8025
## 585  -0.341666782 -0.93375450  115.2950
## 586  -0.642278272  0.23256020  251.6250
## 587   0.359760026  0.42694598  254.0850
## 588  -0.642278272  0.03817441  136.0350
## 589  -0.608876995 -0.73936872  104.9950
## 590   0.426562580  0.23256020  207.8750
## 591  -0.876087208 -0.15621137  385.4700
## 592   1.762613644 -0.73936872  293.1850
## 593  -0.876087208 -0.35059715   80.2825
## 595   0.326358750  0.62133176  159.6075
## 596   1.495403431 -0.35059715  362.6325
## 598   0.359760026 -1.12814028   69.7100
## 599  -0.876087208  0.81571754 1204.8075
## 600   0.560167686  0.03817441  157.1850
## 602  -0.876087208  1.98203224  610.6675
## 603   0.359760026  1.39887489 1041.2650
## 604   0.326358750  1.39887489  643.8575
## 605  -0.642278272 -0.15621137   88.1075
## 607  -0.608876995  0.23256020  238.0850
## 608  -0.642278272  1.98203224  846.6075
## 610  -0.876087208 -0.73936872   81.2775
## 612  -0.876087208  0.23256020  261.0325
## 613  -0.876087208  0.03817441  399.9475
## 614  -0.876087208  0.62133176  179.5525
## 615   0.426562580 -0.93375450  120.4350
## 616   0.326358750 -0.35059715  148.5475
## 617  -0.876087208  0.81571754  738.1150
## 618  -0.876087208  0.03817441  197.7825
## 619   1.562205984 -0.15621137  128.2125
## 620  -0.842685931 -0.35059715  143.8725
## 621   0.326358750  0.42694598  528.3850
## 622   0.560167686 -0.35059715  262.2850
## 623  -0.876087208  2.17641802  523.3650
## 624   0.560167686 -0.35059715  133.5050
## 625            NA -1.51691185        NA
```

```
## 626           NA -1.51691185        NA
## 629  -0.876087208  0.81571754  448.3525
## 630  -0.876087208  1.39887489 1000.7300
## 631  -0.876087208 -0.35059715  135.9950
## 632           NA -1.51691185        NA
## 633   0.560167686 -0.54498293  113.7000
## 634  -0.876087208  3.53711850 1599.1525
## 635  -0.876087208  0.23256020  152.7225
## 638   0.426562580  2.37080381 1818.5975
## 639  -0.876087208  0.62133176 1150.0475
## 641  -0.709080825  0.23256020  167.7350
## 643  -0.642278272 -0.54498293  222.7625
## 644   0.226154920  0.42694598  364.6375
## 645  -0.876087208 -0.54498293  111.4650
## 646   0.459963856  0.03817441  196.4200
## 647   2.697849388 -0.93375450   35.3500
## 648  -0.876087208 -0.15621137  248.8500
## 649   2.697849388 -0.73936872   85.0300
## 650   0.560167686 -0.54498293   47.8425
## 651   1.294995771 -0.54498293  297.0975
## 652  -0.642278272  0.42694598  149.9325
## 653   2.430639176 -0.54498293  173.1725
## 654   1.929620027 -1.32252606   15.7250
## 655  -0.876087208  1.01010333  544.7775
## 658  -0.375068059 -0.73936872   47.3000
## 659  -0.642278272 -0.35059715  146.3150
## 660   0.693772792 -0.35059715  126.4800
## 661  -0.876087208  0.03817441  168.0025
## 662  -0.642278272 -0.15621137  208.9975
## 663   2.497441729 -1.12814028   36.1575
## 664   1.562205984  0.03817441  513.8925
## 665  -0.876087208  2.56518959  894.6225
## 666  -0.642278272 -0.15621137  428.1325
## 667   0.660371516 -0.35059715  161.0975
## 668   0.793976622 -0.54498293  203.1375
## 669   1.996422580 -0.73936872   28.7525
## 670   0.727174069 -0.93375450   39.5200
## 671   0.326358750  0.23256020  214.9575
## 672   0.393161303 -0.15621137  185.7100
## 673   0.459963856  0.62133176  265.9500
## 674   0.593568963  0.23256020  325.2750
## 675  -0.876087208  0.62133176  692.5300
## 676           NA -1.51691185        NA
## 677   0.560167686  0.81571754  221.5625
## 679   2.664448112 -1.32252606   14.5600
## 680  -0.775883378  2.75957537 1374.8300
## 682   0.359760026 -0.73936872  102.9950
## 683   1.294995771 -0.54498293   72.0075
## 684   0.626970239  0.81571754  798.8400
## 685   0.359760026  0.81571754  452.9850
## 687   1.929620027 -1.32252606    4.7250
## 688  -0.608876995 -0.54498293  128.0750
## 690  -0.642278272  1.39887489  513.7300
## 692   0.560167686 -0.93375450   32.5275
```

```
## 693   2.430639176 -1.12814028  139.2600
## 694  -0.642278272  1.59326068  963.5400
## 695  -0.575475718 -0.35059715  333.6625
## 696   0.927581729 -0.93375450   35.9500
## 698   0.326358750  0.81571754  311.1175
## 699  -0.876087208  2.56518959 1257.7350
## 702  -0.876087208  0.03817441  333.4500
## 703   2.731250665 -1.12814028   20.2400
## 704  -0.876087208  0.03817441  357.5700
## 706  -0.876087208  0.03817441  343.4200
## 707  -0.642278272  2.37080381 1638.9500
## 708  -0.775883378  2.37080381  485.3600
## 709   0.292957473 -1.32252606    4.9750
## 710  -0.876087208  0.03817441  212.4700
## 711  -0.876087208 -0.15621137  287.2775
## 713   2.664448112 -0.93375450  261.0750
## 714  -0.608876995 -0.35059715  147.7750
## 715  -0.375068059 -0.93375450  212.0175
## 716  -0.608876995  0.62133176  217.5050
## 717  -0.642278272 -0.73936872  111.4900
## 718   2.664448112 -1.12814028   80.7675
## 719   0.292957473  1.59326068 1220.2650
## 720  -0.375068059 -0.15621137  675.6725
## 721  -0.241462952 -0.93375450   71.4875
## 722  -0.876087208 -0.15621137  228.3250
## 723  -0.876087208  1.01010333  373.8800
## 724   0.192753643  1.78764646  525.3750
## 725  -0.642278272  1.39887489  449.4000
## 726  -0.876087208  1.20448911  748.4175
## 727   2.363836622 -0.35059715  197.6050
## 728  -0.107857846 -0.15621137  153.9300
## 729  -0.876087208  1.20448911  624.2675
## 730   0.526766409  0.03817441  319.1750
## 731   0.593568963 -0.73936872   65.0450
## 732  -0.876087208  0.23256020   86.2000
## 735  -0.876087208  0.62133176  238.3725
## 736  -0.876087208  0.23256020  268.0625
## 737   0.593568963 -1.12814028   13.6375
## 738  -0.775883378  0.62133176  667.1275
## 739   0.326358750  0.23256020  253.3975
## 740  -0.876087208  1.20448911  819.2950
## 741  -0.876087208  0.42694598  258.2275
## 742  -0.642278272  0.81571754  755.3800
## 743  -0.742482101  0.42694598  296.6550
## 744   0.727174069 -1.32252606    8.1100
## 745  -0.642278272  1.20448911  457.4850
## 746   0.626970239 -0.93375450   24.2125
## 747  -0.608876995 -0.15621137  134.5225
## 749  -0.876087208 -0.35059715  297.4550
## 750   0.593568963 -0.35059715  106.5150
## 752   0.560167686 -0.93375450  162.9775
## 753   0.626970239 -0.54498293  199.8575
## 755   0.560167686 -0.73936872   82.0500
## 756  -0.876087208  0.23256020  527.9050
```

```
## 757   1.462002154 -0.93375450  122.8875
## 758  -0.876087208  0.42694598  589.7325
## 761  -0.642278272  0.81571754  841.7325
## 762   0.326358750 -0.54498293  117.4550
## 763            NA -1.51691185        NA
## 764  -0.876087208  0.03817441  113.8500
## 765   1.528804707  0.23256020  536.9875
## 766  -0.508673165 -0.93375450   77.2075
## 767  -0.608876995 -0.35059715  143.2475
## 768            NA -1.51691185        NA
## 769  -0.608876995 -1.32252606   27.6700
## 770  -0.842685931  1.39887489  329.0900
## 771  -0.675679548  1.39887489  464.4100
## 772  -0.876087208  0.23256020  284.3425
## 773  -0.876087208  4.12027585 1592.3300
## 774   1.495403431 -0.73936872  162.1275
## 777   0.793976622 -0.15621137   90.6400
## 778   0.326358750  0.81571754  453.3675
## 779  -0.876087208  1.59326068  215.0925
## 781  -0.642278272  3.14834694 1243.5575
## 782  -0.642278272 -1.12814028  154.1750
## 785  -0.642278272 -0.54498293   99.1675
## 786   2.464040452 -1.12814028   26.0000
## 788   1.729212367 -1.32252606   63.1000
## 789  -0.608876995 -0.15621137  300.2600
## 790  -0.842685931  0.03817441  249.8675
## 791  -0.642278272  0.03817441  106.0050
## 792   1.395199601 -0.73936872  108.7700
## 793  -0.608876995 -0.15621137  109.2675
## 794  -0.608876995  1.01010333  675.5800
## 795   0.560167686 -0.93375450   53.9350
## 796  -0.608876995 -0.35059715  133.7100
## 797   1.261594495 -0.73936872   81.1875
## 798   0.593568963 -0.54498293   80.4325
## 799  -0.642278272 -0.15621137  447.7950
## 802   1.127989388 -1.32252606   14.6025
## 804  -0.809284655  0.23256020  129.9500
## 805  -0.642278272  0.81571754  321.0575
## 806  -0.876087208  1.20448911  838.0675
## 807   0.560167686 -0.54498293   46.9925
## 808   0.626970239 -1.12814028   33.0550
## 809   0.626970239  0.03817441  186.3825
## 810   0.560167686 -0.35059715  128.5325
## 811  -0.842685931  2.75957537 1994.8350
## 812   2.697849388 -0.35059715  230.9350
## 813   0.560167686 -0.93375450  151.9800
## 814  -0.642278272 -0.35059715  190.7575
## 817   1.294995771 -0.54498293  155.8275
## 818  -0.876087208  1.78764646  803.8050
## 819   2.130027686 -1.32252606   29.9500
## 820   1.328397048  0.23256020  396.9775
## 822   1.729212367 -0.73936872  188.8850
## 823  -0.642278272  0.42694598  871.6050
## 824  -0.642278272 -0.93375450  136.1125
```

```
## 825  -0.642278272  0.23256020  405.6350
## 826   0.359760026  0.81571754  634.0750
## 827   0.626970239 -0.73936872  350.0125
## 828   0.092549814  0.81571754  314.1700
## 829  -0.876087208  0.23256020  501.6775
## 830  -0.608876995 -0.54498293  149.9300
## 831  -0.876087208  0.42694598  473.3300
## 832   2.631046835 -0.93375450   72.3200
## 833  -0.876087208  0.42694598  347.7425
## 834  -0.876087208  0.42694598  474.1025
## 835  -0.876087208 -0.35059715  181.0350
## 836   1.127989388 -1.32252606   29.1800
## 837  -0.141259123 -0.15621137   77.7075
## 838   0.426562580  0.42694598  177.3950
## 839   1.361798324  0.03817441  847.2825
## 840   0.560167686  1.01010333  708.8500
## 841  -0.642278272 -0.15621137  170.0075
## 842  -0.375068059 -0.15621137  149.6925
## 843  -0.876087208  0.03817441  304.0475
## 845  -0.876087208  1.01010333  519.2025
## 846  -0.876087208  0.42694598  294.3775
## 847  -0.608876995 -0.15621137  117.4800
## 849  -0.876087208  0.42694598  148.8125
## 850  -0.876087208  1.78764646  725.9100
## 853  -0.608876995 -0.15621137  183.9250
## 854   0.326358750 -0.35059715   48.3075
## 855   2.664448112 -1.12814028  115.2625
## 856   0.125951090 -0.54498293  117.7875
## 857  -0.876087208  0.23256020  246.7450
## 858   0.793976622 -0.35059715  126.9300
## 859   0.326358750 -0.54498293  157.9600
## 860  -0.642278272  1.39887489  618.0575
## 861  -0.876087208  0.81571754  295.0650
## 862   1.695811090 -1.32252606   29.2500
## 863   0.326358750 -0.35059715  309.0600
## 864   1.495403431 -0.93375450   36.6750
## 865   0.660371516 -1.12814028   21.0125
## 866            NA -1.51691185        NA
## 867  -0.876087208  1.20448911  311.7050
## 868  -0.608876995  0.62133176  144.9225
## 870            NA -1.51691185        NA
## 871   0.526766409 -0.73936872  161.3075
## 873  -0.876087208  2.95396115 1251.1375
## 874  -0.642278272 -1.12814028  103.8750
## 875   0.459963856  0.03817441  202.0725
## 876   1.528804707 -0.35059715  155.5250
## 877  -0.642278272  0.42694598  201.8100
## 878   1.328397048 -0.73936872  236.3850
## 879   1.061186835 -0.54498293  113.8050
## 880  -0.876087208  1.59326068 1151.0175
## 882   0.526766409  0.81571754  499.6975
## 883            NA -1.51691185        NA
## 884  -0.876087208 -0.35059715  156.7575
## 885  -0.876087208 -0.15621137  609.9300
```

```
## 886  -0.308265506 -0.93375450  100.9525
## 887   0.560167686 -1.32252606    9.0400
## 889   0.326358750 -0.35059715  110.0475
## 890  -0.876087208  1.01010333  475.9725
## 892  -0.575475718 -0.93375450   32.1975
## 893  -0.608876995 -0.35059715  173.7200
## 895  -0.642278272 -0.54498293   71.7100
## 896   2.631046835 -1.12814028  133.5125
## 897  -0.876087208  0.62133176  246.9650
## 898  -0.876087208  2.56518959 1095.2275
## 899   0.092549814 -0.73936872   68.6500
## 900  -0.642278272  0.03817441  370.1250
## 901  -0.876087208 -0.35059715   86.2625
## 902  -0.876087208  1.59326068  661.6600
## 903  -0.809284655 -1.12814028   17.3450
## 904  -0.642278272 -0.15621137  212.8950
## 905  -0.876087208  3.34273272 1207.2350
## 906  -0.608876995 -0.93375450  169.2075
## 907   0.526766409  0.62133176  862.4500
## 908  -0.608876995  0.23256020  183.5075
## 909   2.330435346  0.23256020  362.7275
## 910  -0.642278272 -0.54498293   79.3800
## 911   1.562205984 -0.93375450  110.4175
## 912  -0.775883378  0.42694598  252.9000
## 913  -0.642278272  0.62133176  236.6975
## 914   2.664448112 -0.93375450  172.6225
## 915   1.294995771 -0.73936872  101.9100
## 916  -0.842685931  0.62133176  575.3225
## 917  -0.642278272  0.62133176  348.5850
## 918   0.326358750  0.62133176  160.2625
## 919   0.793976622 -1.32252606    4.7250
## 920  -0.876087208 -0.35059715   82.2750
## 921   0.393161303 -0.35059715   99.8925
## 922  -0.642278272 -0.15621137  191.6950
## 923   0.326358750 -0.15621137  327.4175
## 925  -0.775883378 -0.73936872   82.6125
## 926  -0.742482101 -0.15621137   64.0475
## 927   0.359760026 -0.54498293  113.5825
## 928  -0.642278272 -0.73936872  200.1500
## 929  -0.876087208 -0.35059715  107.6225
## 932   0.359760026  1.78764646  943.4800
## 934   0.326358750  0.42694598  409.6025
## 935  -0.642278272 -0.35059715  146.5850
## 936  -0.742482101  1.20448911  753.1450
## 937  -0.809284655  2.95396115 1586.7100
## 938   1.061186835 -0.73936872   88.1000
## 939  -0.876087208  1.39887489  471.3650
## 941  -0.876087208  1.01010333  610.3000
## 942  -0.842685931  0.62133176  293.8650
## 943  -0.876087208 -0.54498293  308.6000
## 944   0.393161303  1.78764646 1105.4225
## 946   1.495403431  0.03817441  351.7050
## 947  -0.876087208 -1.32252606    6.2250
## 948   1.061186835 -0.15621137   74.6725
```

```
## 949   2.664448112 -0.73936872  104.9575
## 950   1.562205984  1.20448911  994.9775
## 951  -0.876087208 -0.15621137  185.2650
## 952   0.560167686  0.42694598  237.5800
## 953   0.693772792  1.78764646  690.7800
## 954            NA -1.51691185        NA
## 956  -0.608876995  0.42694598  282.8400
## 957            NA -1.51691185        NA
## 958   0.326358750  0.62133176  234.3925
## 959   0.560167686  0.42694598  217.2275
## 960  -0.876087208  0.23256020  322.8950
## 961  -0.876087208  2.37080381  780.4375
## 962   1.328397048 -0.93375450   76.1625
## 963  -0.876087208  0.23256020  139.5350
## 965   2.464040452 -0.93375450  115.0075
## 966  -0.642278272 -0.54498293   67.0250
## 967  -0.642278272  0.03817441  322.6675
## 969   0.025747260  1.01010333  432.0325
## 970  -0.876087208 -0.73936872   87.3500
## 972   2.430639176 -0.93375450   52.0775
## 974  -0.876087208  0.81571754  340.5450
## 975  -0.608876995 -0.15621137  288.1625
## 976  -0.608876995  0.03817441  277.2450
## 977   0.192753643  0.03817441  263.6725
## 978  -0.876087208  0.42694598  481.5075
## 979  -0.642278272 -0.73936872  138.4150
## 980  -0.642278272  0.62133176  427.9550
## 981  -0.876087208  0.23256020  172.4075
## 982   0.560167686 -1.12814028   27.9075
## 983  -0.642278272  1.01010333  263.8375
## 984  -0.876087208  0.03817441  124.6125
## 985   0.359760026 -0.54498293   93.5250
## 986  -0.608876995  0.62133176  261.8575
## 987  -0.775883378 -0.35059715  105.9825
## 988   1.662409814 -1.12814028   26.6450
## 989  -0.809284655  0.03817441  268.3650
## 992   1.294995771 -0.73936872  134.3075
## 996   2.063225133 -0.35059715  201.3675
## 997   0.192753643  0.03817441  307.9800
## 998   1.027785558 -1.32252606   39.2500
## 999   2.263632793 -0.93375450  208.6800
## 1000 -0.642278272 -0.35059715  263.1250
## 1001  0.626970239 -0.35059715  155.5750
## 1002 -0.876087208 -0.35059715  203.8825
## 1003  1.294995771  1.20448911  934.4925
## 1004  0.359760026  0.03817441  227.5675
## 1006 -0.642278272 -0.15621137  616.5850
## 1007  1.963021303 -1.32252606   44.3500
## 1008 -0.642278272 -1.12814028   93.0975
## 1009           NA -1.51691185        NA
## 1010  0.459963856 -0.35059715  146.7700
## 1012 -0.608876995 -0.35059715  374.6850
## 1013  0.393161303  0.62133176  431.2175
## 1014  2.664448112 -0.73936872   66.0450
```

```
## 1015  0.326358750 -0.93375450  122.6600
## 1017 -0.876087208  0.03817441  236.1375
## 1019  2.697849388 -1.32252606   30.2250
## 1020  0.326358750  0.03817441  807.2250
## 1021  0.593568963 -1.12814028   17.2200
## 1022 -0.642278272 -0.35059715  157.0450
## 1023  0.760575346 -1.32252606    4.9750
## 1024  0.560167686 -0.93375450   22.0375
## 1026 -0.642278272  0.62133176  212.1250
## 1027 -0.542074442  0.03817441  264.6200
## 1028  0.526766409 -0.73936872  137.8125
## 1029  1.228193218 -0.35059715  144.0700
## 1030 -0.608876995 -0.93375450  111.9675
## 1031 -0.876087208 -0.35059715  219.5225
## 1032 -0.709080825  0.42694598  285.1475
## 1033 -0.608876995 -0.15621137  253.8075
## 1035  1.161390665  0.23256020  819.2250
## 1038 -0.642278272 -0.73936872  109.4725
## 1039  0.359760026 -0.73936872   95.1550
## 1040 -0.876087208  0.03817441   85.4100
## 1041  0.393161303  0.03817441  121.4450
## 1042 -0.809284655  0.62133176  258.5250
## 1043 -0.876087208  1.59326068  590.7475
## 1044 -0.475271889 -0.54498293   85.5700
## 1045 -0.876087208 -0.73936872  252.1200
## 1046 -0.876087208  2.37080381 1165.3975
## 1048 -0.642278272 -0.35059715  207.9250
## 1049 -0.876087208  0.42694598  548.6000
## 1050 -0.876087208  0.03817441  140.6700
## 1051  0.359760026 -0.15621137  138.8900
## 1052 -0.876087208 -0.35059715  121.4875
## 1053  0.793976622 -0.73936872   73.1500
## 1055  0.159352367  1.59326068 1186.0925
## 1056 -0.375068059  0.62133176  600.2175
## 1057  0.025747260 -0.93375450   33.3000
## 1058 -0.074456569 -0.54498293   86.0675
## 1060 -0.642278272 -1.32252606   51.1200
## 1061 -0.608876995  0.03817441  224.3875
## 1062 -0.608876995  0.03817441  114.9000
## 1063 -0.642278272  0.03817441  186.2775
## 1064  1.495403431 -0.93375450   32.3650
## 1065 -0.876087208  0.03817441  202.0875
## 1067 -0.876087208  0.42694598  231.4375
## 1068 -0.642278272  1.20448911  527.9575
## 1069 -0.508673165 -1.12814028   29.1700
## 1071 -0.876087208  0.42694598  248.0500
## 1072  0.626970239  0.23256020  150.5525
## 1073 -0.074456569  0.03817441  350.0775
## 1075 -0.608876995  0.42694598  627.5000
## 1077  1.796014920 -0.35059715   79.5325
## 1079 -0.775883378 -0.35059715  105.8475
## 1083  0.593568963  0.62133176  656.9375
## 1084 -0.876087208  1.20448911  457.0125
## 1086 -0.876087208  0.62133176  534.3675
```

```
## 1087 -0.642278272 -0.15621137  144.8925
## 1088 -0.608876995  0.42694598  146.5025
## 1090 -0.775883378  0.81571754  321.6575
## 1091 -0.876087208  0.42694598  231.4575
## 1092 -0.742482101 -0.54498293  216.3525
## 1093  0.359760026 -0.93375450   64.2000
## 1094  0.426562580  1.01010333  637.0175
## 1096 -0.876087208  0.62133176  204.9300
## 1099 -0.876087208 -0.35059715  145.4800
## 1100 -0.876087208  3.53711850 2243.4150
## 1101 -0.876087208  1.39887489  604.3100
## 1102 -0.876087208 -0.15621137  261.0800
## 1103 -0.308265506 -0.35059715  132.8825
## 1104 -0.876087208  1.20448911  420.4300
## 1106 -0.876087208 -0.15621137  160.4425
## 1107 -0.876087208  0.42694598  165.9700
## 1108 -0.876087208  1.01010333  279.4900
## 1109 -0.608876995  1.98203224  640.6375
## 1111  1.495403431 -0.73936872  110.4425
## 1112 -0.809284655  0.62133176  406.5175
## 1113  0.326358750  0.62133176  272.5050
## 1114  0.292957473  0.03817441  372.1300
## 1116  0.326358750 -0.35059715  124.4575
## 1117  0.493365133  0.62133176 1121.8625
## 1119 -0.876087208 -0.35059715  242.1150
## 1120 -0.642278272 -0.54498293  179.7100
## 1122  0.493365133  0.03817441  241.7575
## 1123 -0.842685931  0.42694598  143.8975
## 1124 -0.375068059  0.23256020  383.5625
## 1125           NA -1.51691185        NA
## 1126 -0.642278272 -0.73936872  206.1750
## 1127 -0.876087208  1.39887489  619.7225
## 1128  0.326358750  0.03817441   64.2975
## 1129 -0.375068059 -0.54498293  102.0350
## 1130 -0.876087208  1.98203224  736.0200
## 1133  2.464040452 -1.32252606   37.8200
## 1135  0.593568963 -0.54498293  173.3700
## 1137  0.626970239 -1.32252606    4.0625
## 1138  1.261594495  0.03817441  507.1525
## 1139 -0.642278272  0.23256020  564.8400
## 1141 -0.876087208 -0.35059715  803.3125
## 1142 -0.876087208  3.14834694 2035.9475
## 1143  1.462002154 -1.12814028   82.0975
## 1144  1.528804707 -0.93375450   64.2000
## 1145  0.560167686  0.81571754  939.5675
## 1146 -0.876087208  0.03817441  315.3375
## 1147 -0.876087208  0.81571754  154.4600
## 1148  0.693772792 -0.93375450   73.9125
## 1149  1.328397048 -0.93375450  155.4450
## 1151 -0.876087208  0.03817441  359.3225
## 1152 -0.876087208  0.62133176  290.0650
## 1153           NA -1.51691185        NA
## 1154  0.359760026  1.20448911  766.1550
## 1155 -0.876087208  0.42694598  182.5500
```

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## 1156 -0.375068059  0.03817441  162.3950
## 1157  1.662409814 -0.54498293   62.0775
## 1160  0.493365133  0.81571754  352.5850
## 1163 -0.876087208  1.59326068 1366.0250
## 1164  0.326358750  2.37080381 2189.7700
## 1165 -0.876087208 -0.35059715   82.3400
## 1166 -0.642278272 -0.93375450  112.4675
## 1167           NA -1.51691185        NA
## 1168 -0.642278272  0.81571754  382.5700
## 1170  1.294995771  1.20448911  279.7600
## 1171 -0.876087208 -0.93375450   36.7650
## 1172 -0.341666782 -0.73936872   64.0250
## 1174  0.560167686  0.03817441  163.7525
## 1175 -0.274864229 -0.93375450   88.2300
## 1176  0.326358750 -0.93375450   60.1050
## 1177  0.292957473 -0.73936872   83.5150
## 1178 -0.876087208  1.98203224 1256.3150
## 1179 -0.876087208 -0.54498293  111.4250
## 1182  0.292957473 -0.73936872  364.7650
## 1183 -0.608876995 -1.12814028   42.6200
## 1184  1.361798324  0.42694598  654.7100
## 1188 -0.876087208  1.59326068 1322.7575
## 1189 -0.608876995  0.03817441  250.7725
## 1191 -0.876087208  0.42694598  217.6750
## 1192  0.827377899  2.17641802 1205.7075
## 1193  0.560167686 -0.35059715  141.2050
## 1194 -0.642278272 -0.15621137  206.0125
## 1195 -0.642278272 -0.15621137  115.9500
## 1196  0.626970239  0.23256020  230.8075
## 1197  1.094588112 -1.32252606    5.5625
## 1198  2.464040452 -0.93375450  166.3150
## 1199 -0.876087208  1.01010333  342.8650
## 1200 -0.876087208  0.42694598 1003.3450
## 1201 -0.876087208 -0.15621137  214.5525
## 1203           NA -1.51691185        NA
## 1204  2.029823856 -1.32252606   12.4500
## 1205 -0.642278272  0.03817441  280.1875
## 1206           NA -1.51691185        NA
## 1207  2.530843005 -0.73936872   37.3325
## 1208 -0.642278272 -0.93375450   39.6375
## 1209 -0.709080825  0.23256020  149.5075
## 1210 -0.642278272 -0.15621137  117.6750
## 1211 -0.876087208 -0.35059715  226.2900
## 1212  1.662409814 -0.93375450   46.4050
## 1213 -0.876087208  1.01010333  415.4400
## 1214 -0.107857846  1.39887489 1015.9175
## 1215 -0.642278272 -0.93375450  109.5000
## 1217  0.426562580 -0.15621137  212.2175
## 1218  0.326358750 -0.73936872  149.6175
## 1219 -0.876087208  1.01010333  416.4350
## 1220  1.528804707  0.42694598  408.4675
## 1221 -0.375068059 -0.73936872   67.5875
## 1222 -0.608876995 -0.73936872  107.8250
## 1223  3.065263431 -1.32252606   16.8325
```

```
## 1224 -0.608876995 -0.15621137  251.4925
## 1225 -0.876087208 -0.93375450   50.4875
## 1226 -0.642278272 -0.73936872   70.3500
## 1228 -0.642278272  1.98203224  974.2675
## 1229 -0.809284655 -1.32252606    5.3000
## 1230 -0.876087208 -0.73936872  153.0600
## 1231  1.261594495  0.81571754  462.6800
## 1232 -0.141259123  0.03817441  228.3400
## 1233 -0.642278272  0.42694598  348.4625
## 1234  3.031862154 -1.32252606   23.6500
## 1235  2.230231516 -0.93375450   33.4375
## 1236  2.297034069 -0.73936872  105.5725
## 1238 -0.608876995  0.81571754  300.3575
## 1239  0.493365133 -0.73936872   63.5450
## 1240  1.862817473 -0.35059715  128.2050
## 1241 -0.876087208  0.03817441  631.3550
## 1242  1.729212367 -1.32252606   20.0575
## 1243 -0.876087208 -0.15621137  535.6625
## 1245 -0.876087208 -0.93375450   70.2600
## 1246  0.560167686  0.23256020  228.2600
## 1247  0.560167686  0.03817441  187.8150
## 1249 -0.876087208  1.01010333  275.0225
## 1252 -0.642278272  1.98203224  929.6550
## 1253 -0.608876995 -0.93375450   41.6100
## 1254 -0.642278272  0.03817441  473.2675
## 1255  2.731250665 -1.32252606   27.4000
## 1256 -0.642278272 -0.15621137  230.2175
## 1257  2.631046835 -1.12814028  110.3500
## 1258 -0.876087208 -0.54498293  143.0900
## 1259 -0.876087208  1.78764646  687.1975
## 1260  0.359760026 -0.35059715   94.9425
## 1261  2.464040452 -0.15621137  272.7950
## 1262  1.428600878  0.81571754  362.7450
## 1263  1.294995771  1.78764646 1772.0950
## 1264  1.261594495 -0.15621137  214.4350
## 1265 -0.876087208  0.81571754  421.0850
## 1266 -0.809284655 -0.15621137  129.1400
## 1267 -0.608876995  2.56518959  863.9025
## 1268  0.326358750  1.39887489  901.5300
## 1269 -0.876087208  0.23256020  344.3925
## 1270 -0.642278272 -0.54498293  147.3050
## 1272 -0.876087208  2.17641802 1100.3300
## 1273  0.560167686 -0.54498293   76.3375
## 1274 -0.876087208 -0.35059715  205.1575
## 1275 -0.876087208  1.01010333  519.8225
## 1277  1.963021303 -0.93375450   61.1150
## 1280  1.896218750 -0.73936872   56.6300
## 1281 -0.675679548 -0.35059715  100.6725
## 1282  0.626970239  0.23256020  289.9675
## 1283  2.597645559 -0.73936872   51.2450
## 1284 -0.876087208  0.23256020  355.5600
## 1285  0.226154920 -0.54498293  381.7325
## 1287  1.261594495 -0.93375450   93.4500
## 1288  0.192753643  1.01010333  539.2900
```

```
## 1289 -0.876087208 -0.15621137  178.4600
## 1291  1.729212367 -0.54498293   94.0300
## 1292 -0.876087208  0.03817441  443.7000
## 1293  0.526766409 -0.15621137  493.2050
## 1294  0.326358750  0.42694598  651.9300
## 1295 -0.675679548 -0.15621137  222.1100
## 1296  0.593568963 -0.35059715  132.2700
## 1297  0.560167686 -1.12814028   31.9200
## 1298 -0.642278272  1.39887489  784.8575
## 1299 -0.876087208  1.20448911  286.7000
## 1300 -0.876087208 -0.73936872  111.8800
## 1301  0.359760026  0.03817441  271.3275
## 1303  0.326358750  0.42694598  249.8425
## 1304 -0.375068059  0.23256020  259.5575
## 1305  2.664448112 -0.93375450   83.2825
## 1306  1.261594495  0.42694598 1087.2300
## 1309 -0.341666782  1.01010333  678.2950
## 1310 -0.642278272 -0.15621137  119.6025
## 1311  0.593568963 -0.93375450   63.4150
## 1314  1.261594495 -0.15621137  213.5700
## 1316  0.593568963 -0.93375450   65.8225
## 1317 -0.608876995  1.01010333  509.5750
## 1318 -0.876087208 -0.15621137  386.1825
## 1319  1.261594495 -0.93375450 1016.2375
## 1320  1.328397048 -1.12814028   15.4625
## 1322 -0.608876995 -0.15621137  358.0950
## 1324 -0.642278272 -1.12814028   57.5000
## 1325 -0.642278272 -0.54498293   85.4950
## 1326 -0.341666782 -0.15621137   85.5575
## 1327  2.664448112 -0.15621137  953.6500
## 1328 -0.642278272  0.42694598  150.0750
## 1329 -0.542074442 -0.54498293  200.1600
## 1330  0.326358750  0.23256020  266.4550
## 1331  0.359760026 -0.54498293   87.3775
## 1332 -0.876087208  0.42694598  164.8675
## 1334  2.731250665 -0.93375450   49.0800
## 1335  0.560167686 -0.93375450   27.6100
## 1336 -0.642278272 -0.54498293   84.7150
## 1337 -0.876087208  0.42694598  310.0800
## 1338 -0.876087208  1.01010333  725.8850
## 1339 -0.608876995 -1.32252606   12.1100
## 1340 -0.876087208  0.03817441  297.0850
## 1341 -0.876087208  0.62133176  717.9175
## 1343  2.965059601 -1.32252606    7.1875
## 1344  1.261594495  0.03817441  320.7875
## 1345  1.662409814 -0.73936872   35.5975
## 1347  0.560167686  0.03817441  335.2025
## 1348 -0.876087208 -0.54498293  110.8200
## 1350 -0.642278272 -0.73936872  101.6525
## 1351  1.261594495 -0.35059715  137.0500
## 1352 -0.876087208 -0.15621137  199.3150
## 1353 -0.642278272  0.03817441  124.1975
## 1354 -0.775883378  0.62133176  249.3625
## 1355 -0.308265506  0.81571754  228.0250
```

```
## 1356 -0.642278272 -0.54498293  116.3150
## 1357 -0.809284655  2.17641802 1098.6150
## 1358 -0.876087208  1.78764646  598.7375
## 1359  0.560167686 -0.54498293  133.1300
## 1360  0.426562580 -1.12814028   63.0125
## 1362 -0.709080825  0.03817441  102.9525
## 1364  0.326358750 -0.35059715   74.7275
## 1365           NA -1.51691185        NA
## 1366  0.560167686 -1.12814028   10.2250
## 1367 -0.608876995  0.23256020  208.1850
## 1368  1.361798324 -0.73936872   68.6550
## 1369 -0.642278272 -0.54498293  209.3500
## 1370 -0.542074442 -0.54498293   86.6650
## 1371 -0.642278272  0.03817441  352.0650
## 1372 -0.775883378  0.23256020  200.8000
## 1373 -0.174660399  1.01010333  272.6175
## 1374  1.495403431 -0.15621137  243.8150
## 1375  1.294995771  0.23256020  194.9175
## 1376 -0.709080825 -0.93375450   28.4800
## 1378 -0.876087208  2.37080381 1224.9050
## 1379 -0.375068059 -0.54498293  200.3475
## 1381  1.294995771 -0.35059715 1021.7175
## 1382 -0.642278272  0.23256020  236.0700
## 1385 -0.876087208  0.42694598  218.2900
## 1386 -0.608876995 -0.54498293  150.2700
## 1387  1.495403431 -0.73936872   62.1900
## 1388 -0.608876995 -0.15621137   81.0525
## 1389 -0.642278272 -0.54498293   98.4575
## 1390 -0.876087208  0.62133176  291.0425
## 1391  0.359760026 -0.54498293  170.0900
## 1392  0.426562580  0.23256020  395.8800
## 1393 -0.876087208 -0.73936872   36.8025
## 1397  0.560167686 -0.15621137  306.7100
## 1399 -0.608876995  0.62133176  198.8500
## 1401  0.359760026  0.23256020  195.6250
## 1402 -0.876087208  0.03817441  118.4225
## 1403  0.526766409  0.23256020 1046.2175
## 1405           NA -1.51691185        NA
## 1407  2.464040452 -0.73936872   80.0825
## 1408 -0.642278272  0.81571754  650.0050
## 1410 -0.775883378 -0.73936872   82.9725
## 1411 -0.876087208 -0.73936872  498.0225
## 1412  0.326358750 -0.54498293  168.4125
## 1413 -0.876087208  0.03817441  221.1950
## 1414 -0.876087208  1.01010333  550.3950
## 1418  0.326358750 -0.54498293  127.6750
## 1419  1.595607261 -1.12814028   66.0450
## 1420  0.593568963  0.81571754  834.6675
## 1421  0.393161303 -0.54498293  284.4850
## 1423 -0.876087208  0.62133176  380.9300
## 1424  0.894180452 -0.54498293  187.4375
## 1425  0.359760026 -0.15621137   98.3350
## 1426 -0.809284655  0.62133176  234.9550
## 1427  0.393161303  1.01010333  386.9425
```

```
## 1428 -0.742482101  1.39887489  822.3375
## 1429 -0.876087208  1.39887489  816.7850
## 1430 -0.809284655 -0.73936872   49.2650
## 1432           NA -1.51691185        NA
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## 1434 -0.642278272 -0.35059715   61.4625
## 1435  0.292957473 -0.35059715  181.4950
## 1437 -0.642278272 -0.35059715  139.5600
## 1438  1.294995771 -0.15621137  119.9800
## 1439  1.762613644 -1.12814028   68.6150
## 1440 -0.642278272 -0.54498293  155.6850
## 1441 -0.876087208  1.98203224  803.3650
## 1443  1.328397048 -0.15621137  160.3725
## 1444 -0.876087208  3.14834694 2051.2925
## 1445 -0.675679548 -0.15621137  159.6900
## 1448 -0.608876995 -0.35059715  112.7075
## 1450 -0.876087208 -0.73936872  165.9500
## 1451 -0.876087208 -0.35059715  222.3300
## 1452  1.328397048 -0.35059715  293.2675
## 1453  2.430639176 -0.93375450   77.4300
## 1454 -0.642278272 -0.35059715  119.9800
## 1455  0.827377899  0.03817441  279.6050
## 1456  1.328397048 -0.54498293   67.5750
## 1458  2.564244282 -1.12814028   28.8200
## 1459 -0.876087208  1.20448911  585.3075
## 1460 -0.876087208  0.42694598  198.5225
## 1462  0.326358750  0.03817441  169.5475
## 1463 -0.876087208  0.81571754  912.0475
## 1464  0.092549814 -0.35059715   79.2300
## 1465  0.359760026 -0.15621137  205.1425
## 1467 -0.876087208 -0.93375450  262.6250
## 1468 -0.642278272  0.23256020  289.5825
## 1470 -0.876087208  3.53711850 2184.6225
## 1471  1.629008537  0.03817441  213.5925
## 1472 -0.608876995  0.62133176  175.9325
## 1473  1.127989388 -1.12814028   75.3600
## 1474 -0.876087208  0.81571754  437.3800
## 1475  0.793976622 -0.93375450   51.8825
## 1476 -0.876087208 -0.35059715  256.5275
## 1478 -0.775883378  0.62133176  284.6050
## 1479  2.664448112 -0.93375450   63.2725
## 1481 -0.876087208  1.20448911  249.4600
## 1484 -0.876087208 -0.35059715  284.8325
## 1485           NA -1.51691185        NA
## 1487 -0.575475718  0.81571754  254.9425
## 1488           NA -1.51691185        NA
## 1489  0.860779175 -1.12814028   86.5600
## 1490  0.760575346 -0.54498293  220.8750
## 1491  0.560167686 -0.93375450   54.6025
## 1492  0.459963856 -0.35059715  149.0100
## 1493 -0.876087208  1.01010333  286.6350
## 1494  0.326358750 -0.54498293   69.4500
## 1495 -0.876087208 -0.54498293  412.2175
## 1497  1.729212367 -1.12814028   40.2375
```

```
## 1499 -0.575475718 -0.54498293  150.2125
## 1500 -0.441870612 -1.12814028   40.1750
## 1501 -0.608876995  0.62133176  363.4275
## 1502 -0.575475718 -0.73936872  157.2300
## 1503 -0.876087208 -1.32252606   39.9000
## 1504 -0.876087208  2.75957537 1643.6300
## 1505 -0.876087208 -0.15621137  179.8075
## 1506 -0.608876995 -1.32252606    9.7000
## 1507 -0.876087208  0.03817441  138.2425
## 1508 -0.608876995  0.42694598  159.3825
## 1509 -0.876087208 -0.93375450  134.5600
## 1510 -0.876087208  2.37080381 1390.2200
## 1511 -0.441870612 -0.93375450  110.5050
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## 1514           NA -1.51691185        NA
## 1516  2.697849388 -1.32252606   18.0000
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## 1518  1.528804707 -1.32252606   49.6000
## 1519  1.027785558 -0.35059715  118.3300
## 1520 -0.876087208  0.81571754  628.6100
## 1521 -0.642278272  1.20448911  550.4275
## 1522  0.226154920  1.01010333  450.7175
## 1523  0.426562580 -0.93375450  198.4125
## 1524 -0.876087208  0.81571754  649.4400
## 1525  0.159352367  1.59326068 1566.5875
## 1526 -0.876087208 -0.73936872   62.4375
## 1528 -0.876087208 -0.15621137  172.9225
## 1530 -0.642278272 -0.93375450   66.2100
## 1531 -0.441870612 -1.32252606   34.0000
## 1532 -0.608876995  1.39887489  425.7550
## 1534 -0.642278272 -1.12814028   53.0775
## 1535  0.560167686  1.59326068  620.7900
## 1537 -0.642278272  2.17641802  963.0925
## 1538  0.326358750 -0.35059715  126.4650
## 1539  0.226154920  0.62133176 1540.0875
## 1540  0.359760026 -1.32252606   18.0000
## 1541  1.495403431 -0.73936872  136.2100
## 1542           NA -1.51691185        NA
## 1543 -0.876087208 -0.35059715  306.2225
## 1544  1.629008537  1.98203224 1264.1700
## 1545  0.326358750  0.81571754  603.3800
## 1547  2.430639176 -0.54498293  237.6425
## 1548  0.393161303 -0.15621137  222.5800
## 1551 -0.876087208  0.42694598  454.5225
## 1552 -0.709080825  1.98203224 1659.8575
## 1553 -0.876087208  1.01010333  305.9975
## 1554 -0.876087208  0.62133176  160.9875
## 1556 -0.608876995 -0.15621137  126.1400
## 1557 -0.642278272 -0.15621137  133.4075
## 1558  0.226154920  0.42694598  251.8075
## 1559           NA -1.51691185        NA
## 1560 -0.642278272  1.20448911  601.5700
## 1561  1.294995771  0.03817441  468.8200
## 1565 -0.608876995 -0.93375450   87.2800
```

```
## 1566  1.294995771  0.62133176  694.7225
## 1567 -0.876087208 -0.54498293  163.9625
## 1568 -0.876087208 -0.54498293  104.2775
## 1569 -0.876087208 -0.93375450  145.7400
## 1570 -0.341666782  1.01010333  509.4350
## 1571 -0.876087208  1.01010333  292.7400
## 1572  1.361798324  0.23256020  330.8175
## 1573 -0.642278272 -0.15621137  188.7800
## 1574 -0.508673165 -0.35059715  106.9450
## 1575 -0.642278272  0.81571754  338.1400
## 1577 -0.608876995  1.20448911  812.3300
## 1578  0.626970239 -0.93375450   88.8400
## 1580 -0.608876995 -0.15621137  361.2175
## 1581 -0.642278272  1.59326068  680.2100
## 1584 -0.709080825  0.42694598  674.0325
## 1587  0.860779175 -0.54498293   75.4450
## 1588 -0.876087208  0.23256020  293.3975
## 1589 -0.608876995  0.62133176  160.1025
## 1590 -0.642278272  2.17641802  618.1625
## 1591  0.560167686  1.59326068  914.5000
## 1592  2.530843005 -1.32252606    3.7500
## 1594           NA -1.51691185        NA
## 1595  1.595607261 -0.73936872  300.3825
## 1596 -0.642278272  0.03817441  422.8575
## 1597  0.593568963  1.20448911  585.0500
## 1598  0.560167686  0.42694598  459.5600
## 1599  0.359760026  0.62133176  306.8275
## 1600  1.361798324 -0.54498293   71.8900
## 1601 -0.876087208  0.03817441  366.5800
## 1602 -0.876087208  0.03817441  290.7200
## 1603 -0.608876995  1.01010333  551.5350
## 1604 -0.375068059 -0.93375450   37.7150
## 1605 -0.608876995 -0.73936872  123.0175
## 1607 -0.642278272 -0.54498293   32.8775
## 1608  0.359760026 -0.35059715   99.7475
## 1609 -0.876087208  1.01010333  322.5825
## 1611  0.493365133 -0.15621137  125.1325
## 1612 -0.642278272 -0.93375450   78.4375
## 1614  0.226154920 -0.93375450   39.8300
## 1615 -0.642278272  2.37080381 1351.5275
## 1616           NA -1.51691185        NA
## 1618 -0.642278272 -1.12814028   96.4325
## 1619  0.593568963 -1.32252606    6.4750
## 1620 -0.642278272  1.20448911 1203.9400
## 1622  0.626970239 -0.93375450   71.1125
## 1623  2.664448112 -1.12814028   44.9550
## 1624           NA -1.51691185        NA
## 1625 -0.876087208  0.62133176  274.1050
## 1626 -0.642278272  0.81571754  469.4700
## 1628  2.664448112 -0.93375450  137.5750
## 1629 -0.742482101  0.81571754  323.6975
## 1630 -0.642278272 -0.73936872   66.8650
## 1631  0.626970239  1.01010333  814.0850
## 1632  0.626970239  1.01010333  547.9600
```

```
## 1633 -0.876087208 -0.54498293   60.7650
## 1634  0.326358750 -0.15621137  347.6600
## 1635 -0.608876995 -0.73936872   82.4250
## 1637 -0.608876995  1.39887489  299.7275
## 1638 -0.876087208 -0.54498293  132.3325
## 1639  1.261594495 -0.15621137  414.8825
## 1640  1.996422580 -1.12814028   34.9500
## 1642 -0.408469335 -0.35059715  181.8900
## 1643  1.261594495 -0.73936872  126.7000
## 1644  2.430639176 -0.54498293  224.4875
## 1645 -0.642278272  0.62133176  214.3175
## 1646  1.729212367 -1.32252606   26.4500
## 1649           NA -1.51691185        NA
## 1650  0.326358750 -1.12814028   64.9250
## 1651 -0.876087208  1.78764646  559.9650
## 1652  0.326358750 -1.32252606   22.4000
## 1653 -0.876087208  0.23256020  410.9275
## 1654  0.860779175 -0.15621137  452.8600
## 1655  0.626970239  0.03817441  814.2850
## 1656 -0.876087208  1.20448911  359.1475
## 1657 -0.876087208  0.62133176  527.1775
## 1658 -0.876087208  0.03817441  159.4375
## 1659 -0.876087208  0.42694598  492.3725
## 1660 -0.876087208 -0.35059715  170.7400
## 1661  0.359760026  1.20448911 1102.8050
## 1662 -0.876087208  0.81571754  907.6750
## 1663  1.528804707  0.03817441  251.4200
## 1665  0.092549814 -1.32252606   25.5000
## 1666 -0.709080825 -0.35059715   59.9000
## 1667  0.359760026 -0.15621137  136.8350
## 1669  1.528804707  0.03817441  153.4600
## 1670 -0.642278272  1.20448911  381.2350
## 1672 -0.308265506  0.23256020  159.8325
## 1673  0.125951090 -0.35059715  119.8825
## 1674 -0.876087208  1.01010333  300.8250
## 1675 -0.375068059  0.42694598  215.4700
## 1676  1.729212367 -1.12814028   88.5600
## 1677 -0.375068059  1.59326068  708.0950
## 1678  0.326358750 -0.35059715  263.0950
## 1679 -0.642278272 -0.54498293   79.7400
## 1681  2.430639176 -0.15621137  261.4750
## 1682 -0.642278272 -0.35059715  199.5100
## 1683  1.729212367 -1.32252606   25.0000
## 1684 -0.642278272  1.59326068  718.8350
## 1685           NA -1.51691185        NA
## 1686  0.393161303  0.42694598  224.8925
## 1687  1.495403431  0.62133176  534.7975
## 1688  0.359760026  0.23256020  365.1150
## 1689 -0.608876995  0.42694598  186.0250
## 1690  2.430639176 -0.73936872   82.6375
## 1691 -0.709080825  1.59326068 1586.7800
## 1692 -0.876087208  0.42694598  184.8900
## 1693  0.560167686  1.59326068  566.3400
## 1694  0.226154920  0.42694598  250.7425
```

```
## 1695 -0.308265506  0.23256020  244.2550
## 1696  0.326358750 -0.54498293  384.9750
## 1697  1.428600878 -0.54498293  251.3700
## 1698 -0.608876995  0.62133176  159.2625
## 1699 -0.107857846  0.03817441  240.0300
## 1700 -0.642278272  0.62133176  339.4925
## 1701 -0.876087208  1.39887489  456.1025
## 1702  1.027785558 -1.32252606   21.9700
## 1703  0.192753643  0.62133176  380.8225
## 1704  0.359760026  0.81571754  446.1900
## 1706  1.729212367 -0.73936872  103.9800
## 1707           NA -1.51691185        NA
## 1708 -0.876087208  0.03817441  208.5950
## 1710 -0.608876995 -0.54498293  207.4075
## 1711  0.693772792 -0.15621137   94.8250
## 1712  2.697849388 -0.93375450   85.7275
## 1713  0.326358750 -0.35059715  175.5350
## 1714  0.593568963 -0.15621137  312.1800
## 1715 -0.642278272 -0.93375450   54.2450
## 1716 -0.675679548  0.62133176  345.8075
## 1717 -0.642278272  0.81571754  138.2100
## 1718 -0.642278272 -1.12814028   42.0350
## 1719 -0.775883378  0.62133176  380.4350
## 1722 -0.876087208 -0.54498293   81.2025
## 1723  0.226154920  2.37080381 1662.9575
## 1724 -0.876087208  1.78764646  428.6675
## 1725  1.294995771 -0.15621137  252.8000
## 1726  0.192753643  0.81571754  563.2075
## 1727 -0.642278272 -0.15621137  157.1525
## 1728 -0.876087208  0.42694598  312.4325
## 1730 -0.876087208  1.20448911  338.2900
## 1732 -0.642278272 -0.15621137   66.7650
## 1733  2.664448112 -0.93375450   98.9825
## 1734  0.326358750 -0.54498293  198.6525
## 1736 -0.876087208 -0.54498293   84.0500
## 1737 -0.608876995 -0.54498293  164.7275
## 1739           NA -1.51691185        NA
## 1740 -0.608876995  0.62133176 1064.7700
## 1741  0.326358750 -0.73936872  105.0250
## 1742  1.595607261 -0.93375450   24.3125
## 1743  0.560167686  0.62133176  853.0850
## 1745 -0.775883378 -0.15621137  138.8700
## 1746 -0.876087208 -0.35059715   95.7975
## 1747 -0.876087208  0.62133176  499.5425
## 1748  0.359760026 -0.15621137  173.8575
## 1749 -0.608876995 -1.32252606   18.0000
## 1750  1.294995771 -0.73936872  183.1575
## 1751 -0.642278272  0.23256020  282.3650
## 1754 -0.876087208  2.17641802  944.2725
## 1755  1.996422580 -1.12814028   44.5750
## 1756  0.626970239  0.23256020  259.2225
## 1758 -0.642278272 -0.54498293   98.1850
## 1759 -0.809284655  1.20448911 1422.6075
## 1761 -0.642278272 -0.35059715  116.2625
```

```
## 1762  2.464040452 -0.93375450  183.2975
## 1763  1.495403431 -0.73936872  129.7250
## 1765 -0.642278272  0.42694598  400.5950
## 1766  0.359760026 -0.54498293   98.2750
## 1767  2.430639176 -0.73936872  175.3350
## 1768  0.426562580 -0.93375450  142.1375
## 1769  2.430639176 -1.32252606    3.4250
## 1770 -0.642278272  1.01010333  246.2675
## 1771 -0.642278272 -0.93375450   44.5125
## 1772  1.294995771 -0.73936872  104.5000
## 1773  0.025747260  1.39887489 1099.4625
## 1774 -0.876087208  1.98203224  634.6725
## 1775 -0.876087208  2.75957537  781.7200
## 1776 -0.642278272  1.59326068  638.5775
## 1777  0.125951090 -0.93375450   90.3375
## 1778 -0.775883378 -0.73936872   87.8750
## 1780 -0.408469335  0.03817441  181.6025
## 1781  0.359760026 -0.15621137  311.3125
## 1784 -0.608876995  0.23256020  341.5200
## 1785  0.326358750 -0.73936872  131.8025
## 1786 -0.642278272 -0.54498293  120.2500
## 1787  0.493365133 -0.15621137   94.8700
## 1788  2.297034069 -1.32252606   30.8375
## 1790 -0.775883378 -0.15621137  166.5200
## 1791  0.526766409 -0.35059715  338.0900
## 1792 -0.876087208  2.95396115 1237.0350
## 1793 -0.775883378 -0.73936872   45.1650
## 1794 -0.876087208  2.75957537  914.6225
## 1795 -0.775883378  1.59326068  626.8075
## 1797 -0.642278272  0.03817441  239.4975
## 1798  1.796014920 -0.35059715  135.0700
## 1800 -0.876087208  1.01010333  915.3000
## 1801  0.359760026  1.20448911  872.0500
## 1802 -0.742482101 -1.32252606   47.3500
## 1803           NA -1.51691185        NA
## 1804 -0.642278272 -0.35059715  103.8000
## 1805  1.528804707  0.03817441  221.4425
## 1806 -0.876087208 -0.35059715  200.9425
## 1807  1.294995771  0.03817441  261.2275
## 1808  0.326358750 -0.35059715  146.1325
## 1809  0.593568963  1.20448911  636.1500
## 1810 -0.809284655  0.23256020  161.1450
## 1811  2.898257048 -0.73936872   87.5150
## 1813 -0.876087208  0.42694598  181.9875
## 1814  0.159352367  2.37080381 1808.7650
## 1815 -0.642278272 -0.93375450   87.0500
## 1818           NA -1.51691185        NA
## 1819  1.261594495 -0.93375450   91.3375
## 1822  0.626970239  1.01010333  447.4300
## 1823  1.662409814 -0.15621137  198.8200
## 1825  1.528804707 -1.32252606   72.4500
## 1826           NA -1.51691185        NA
## 1827 -0.876087208  1.01010333  245.6600
## 1828 -0.876087208  3.14834694 1322.3150
```

```
## 1829  0.426562580 -0.15621137  229.7525
## 1831 -0.876087208  0.03817441  156.4325
## 1832  0.593568963 -0.15621137   69.1750
## 1835 -0.876087208  1.20448911  219.0975
## 1836 -0.809284655 -0.15621137  239.3725
## 1837  2.664448112 -0.93375450   55.4550
## 1838 -0.876087208  4.12027585 1731.6050
## 1840 -0.775883378 -0.73936872   84.5525
## 1841 -0.876087208  2.75957537 1196.6275
## 1842  3.132065984 -1.32252606    5.5625
## 1843           NA -1.51691185        NA
## 1844  0.393161303 -0.15621137  215.8925
## 1845 -0.642278272  0.42694598  172.6725
## 1846 -0.876087208  1.01010333  237.6525
## 1848  0.560167686 -0.93375450   60.7000
## 1852 -0.642278272 -0.54498293  108.4475
## 1853  1.762613644 -0.54498293   99.5500
## 1854  1.528804707 -0.93375450   70.3500
## 1855 -0.642278272  0.03817441  390.2775
## 1857 -0.876087208 -0.54498293   69.1725
## 1859 -0.876087208 -0.15621137   92.0075
## 1860 -0.375068059 -0.15621137  191.0600
## 1862  1.127989388 -0.54498293   91.7625
## 1865  1.294995771 -0.54498293   80.8075
## 1866 -0.876087208  0.42694598  245.7400
## 1867 -0.642278272  0.23256020  122.6125
## 1868  0.660371516 -0.93375450   34.3250
## 1869 -0.876087208  0.42694598  269.4150
## 1872 -0.575475718  0.03817441  141.3325
## 1874  1.495403431 -1.32252606   25.0000
## 1875 -0.876087208  3.34273272 1325.4175
## 1876  0.326358750  0.42694598  426.5500
## 1877           NA -1.51691185        NA
## 1878 -0.608876995  1.20448911  664.2050
## 1879 -0.876087208  3.73150428 2810.7575
## 1880  0.359760026 -0.73936872   64.5250
## 1881  0.593568963 -0.35059715  164.3200
## 1882  0.793976622 -0.35059715  182.8300
## 1884 -0.876087208  1.01010333  844.3025
## 1885 -0.876087208  2.17641802  603.8600
## 1887 -0.642278272  0.03817441  309.2975
## 1890 -0.876087208  1.01010333  721.1675
## 1892 -0.608876995 -0.93375450   28.0125
## 1893 -0.876087208 -0.54498293   74.8000
## 1894 -0.876087208  4.12027585 1533.0000
## 1895 -0.642278272  0.03817441  162.8675
## 1897  0.593568963 -0.54498293  123.3225
## 1898 -0.876087208  0.23256020  220.4850
## 1899 -0.375068059  1.01010333  679.1500
## 1900 -0.876087208 -0.15621137  139.2675
## 1901 -0.876087208  0.03817441  201.7075
## 1902 -0.608876995 -0.35059715  153.6200
## 1903  1.729212367  0.42694598  365.5975
## 1904 -0.608876995  0.23256020  202.2750
```

```
## 1905 -0.375068059 -0.35059715  140.6650
## 1906 -0.876087208  1.20448911  706.8775
## 1907  0.326358750  1.59326068 1078.6325
## 1908  0.827377899 -0.15621137  480.4650
## 1909 -0.608876995 -0.15621137  105.2075
## 1910 -0.876087208  0.42694598  357.6150
## 1911 -0.642278272 -0.73936872   37.1825
## 1912  2.664448112  0.23256020  500.9900
## 1914 -0.809284655  0.62133176  261.4875
## 1915  1.562205984 -0.54498293  225.1250
## 1916 -0.608876995 -1.32252606  126.2250
## 1917 -0.876087208 -0.73936872   99.4775
## 1918 -0.642278272  0.23256020  609.2000
## 1920 -0.642278272  0.81571754  279.2475
## 1921 -0.642278272  0.62133176  395.1800
## 1923  2.263632793 -0.54498293  159.9375
## 1924  0.359760026 -0.15621137  156.5500
## 1925 -0.642278272  1.20448911  402.0700
## 1926 -0.208061676  0.62133176  175.9450
## 1927 -0.642278272  1.59326068  979.4775
## 1928 -0.876087208 -0.15621137  243.3000
## 1929 -0.675679548 -0.54498293  185.6850
## 1930 -0.642278272  0.62133176  381.4600
## 1931  0.192753643  1.20448911  804.9050
## 1932  0.226154920 -0.73936872   53.9100
## 1934  0.459963856 -0.35059715  171.6100
## 1935  0.626970239 -0.35059715   57.8900
## 1939 -0.642278272 -1.32252606   11.2500
## 1940           NA -1.51691185        NA
## 1941 -0.642278272 -0.54498293  149.5825
## 1942  2.664448112 -0.93375450  134.2225
## 1943 -0.642278272  0.03817441  226.7925
## 1944 -0.608876995 -0.15621137  117.8550
## 1945           NA -1.51691185        NA
## 1946  3.165467261 -1.32252606   68.1500
## 1947  0.560167686 -0.73936872   42.9625
## 1948  1.061186835 -1.12814028  153.4750
## 1949  0.560167686  0.03817441  422.2700
## 1953 -0.876087208 -0.35059715  242.7350
## 1954  0.560167686 -0.73936872  157.9350
## 1955  0.560167686 -0.73936872  107.4100
## 1956 -0.308265506 -0.54498293  231.3150
## 1957  0.693772792 -0.93375450   45.8500
## 1958 -0.876087208  3.34273272 1916.3450
## 1959  0.426562580 -0.54498293   57.5050
## 1960 -0.876087208  3.73150428 1731.5250
## 1961 -0.642278272  0.03817441  290.9475
## 1962 -0.876087208  1.20448911  762.6850
## 1963  2.530843005 -0.93375450   55.0175
## 1964 -0.876087208  1.01010333  191.1600
## 1965 -0.642278272  1.39887489  569.5075
## 1966 -0.876087208  1.20448911  758.3375
## 1967 -0.642278272 -1.12814028   31.4100
## 1970 -0.876087208 -1.12814028   21.8400
```

```
## 1971  1.294995771 -0.93375450   94.2800
## 1972 -0.876087208  2.17641802 1005.8400
## 1973  0.560167686 -0.35059715  168.2225
## 1975 -0.709080825 -0.15621137  631.2825
## 1976 -0.608876995  1.01010333  333.6225
## 1977 -0.575475718 -0.73936872   68.5875
## 1978 -0.876087208 -0.73936872  100.1850
## 1979           NA -1.51691185       NA
## 1980  1.829416197 -0.35059715  114.9250
## 1981 -0.876087208  0.81571754  295.9775
## 1983  0.226154920  1.20448911  723.2550
## 1984           NA -1.51691185       NA
## 1985  0.259556197 -1.12814028   92.3125
## 1986 -0.876087208  0.62133176  648.8100
## 1987  1.294995771 -1.32252606   52.0400
## 1988  1.395199601  0.03817441  623.0575
## 1989 -0.876087208  1.01010333  716.9200
## 1990  0.560167686 -0.93375450   55.6350
## 1991           NA -1.51691185       NA
## 1993  0.626970239 -0.93375450   42.7900
## 1994 -0.876087208  1.01010333  486.2800
## 1995 -0.642278272  1.01010333  274.2075
## 1996 -0.575475718 -0.93375450   55.0625
## 1997 -0.642278272  0.03817441  120.8125
## 1998  0.326358750  0.42694598  256.6975
## 1999  1.127989388 -1.12814028   44.0050
## 2000  0.326358750 -0.35059715  224.2000
## 2001 -0.876087208  1.01010333  466.7675
## 2002  1.495403431 -0.35059715  261.2825
## 2003 -0.876087208 -0.35059715  145.2875
## 2006 -0.608876995 -0.15621137  209.3050
## 2007 -0.642278272 -1.12814028   31.7750
## 2008 -0.608876995  0.03817441  172.9775
## 2009 -0.876087208  1.59326068  448.3700
## 2010 -0.876087208  0.03817441  234.8550
## 2011  0.560167686 -0.35059715  106.4175
## 2012           NA -1.51691185       NA
## 2014  0.560167686 -0.54498293   87.3125
## 2015 -0.876087208  0.23256020  240.9750
## 2016 -0.876087208 -0.35059715  152.1500
## 2018  0.359760026  1.39887489 1060.4900
## 2020  0.827377899  1.78764646  894.8375
## 2021 -0.876087208  0.23256020  163.0625
## 2023  1.294995771 -0.35059715  253.3925
## 2024 -0.041055293  0.81571754  422.9475
## 2025 -0.642278272 -0.54498293  264.0775
## 2026 -0.876087208 -0.15621137  103.6300
## 2027  1.328397048 -0.73936872   91.5725
## 2028 -0.876087208  1.78764646  476.6200
## 2029 -0.876087208  0.42694598  650.3300
## 2030 -0.876087208  0.81571754  196.5350
## 2031 -0.608876995  0.23256020  106.5200
## 2032 -0.642278272 -0.15621137  166.8800
## 2034           NA -1.51691185       NA
```

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## 2035  0.159352367  0.03817441  218.9775
## 2036  0.493365133  0.23256020  144.0475
## 2039 -0.608876995 -0.15621137  191.5450
## 2040 -0.876087208  0.62133176  424.2800
## 2041 -0.876087208 -0.54498293  141.6975
## 2042 -0.809284655 -0.54498293   91.0075
## 2043           NA -1.51691185        NA
## 2045  1.127989388 -1.32252606   29.9500
## 2046  0.326358750  0.81571754  184.9425
## 2048 -0.876087208 -0.54498293  215.7725
## 2049 -0.508673165 -0.15621137  335.7575
## 2051 -0.642278272 -0.35059715  167.9100
## 2053  0.125951090 -0.35059715  370.9325
## 2054 -0.876087208 -0.73936872   61.5850
## 2055  1.395199601 -0.73936872  116.0200
## 2056  0.393161303 -0.73936872   77.1250
## 2057 -0.876087208  1.98203224  744.7125
## 2058  0.493365133 -0.35059715  199.7575
## 2059  1.562205984  0.03817441  236.3500
## 2063 -0.876087208  0.23256020  163.5125
## 2067 -0.642278272  2.17641802  530.0650
## 2068 -0.876087208  1.20448911  525.4275
## 2071  0.793976622 -0.15621137  102.3775
## 2073 -0.876087208  0.23256020  393.9575
## 2074 -0.876087208 -0.15621137  290.8875
## 2075 -0.876087208 -0.73936872   53.6875
## 2076 -0.642278272  0.23256020  215.3650
## 2077 -0.341666782  0.81571754  267.5800
## 2078  0.259556197  1.01010333  552.7925
## 2079           NA -1.51691185        NA
## 2081  0.593568963 -0.15621137  110.1925
## 2082  2.363836622 -0.93375450   63.5500
## 2083 -0.642278272  0.23256020  277.6925
## 2084  0.593568963  0.03817441  452.2825
## 2085  0.593568963  0.03817441  164.4800
## 2086 -0.876087208  1.59326068  631.4875
## 2087 -0.876087208 -0.73936872   46.1400
## 2088 -0.608876995 -0.93375450  143.1600
## 2089 -0.642278272 -0.35059715   55.2375
## 2090  0.326358750 -0.35059715  406.7150
## 2091  2.564244282 -0.54498293  160.3300
## 2092 -0.375068059 -0.54498293  184.9900
## 2093 -0.642278272  0.23256020  525.1900
## 2094 -0.876087208 -0.15621137  125.3175
## 2095 -0.642278272  0.23256020  209.9500
## 2096  0.359760026 -0.54498293  188.6500
## 2098 -0.642278272 -0.15621137  158.7625
## 2100  3.098664708 -1.32252606   34.4975
## 2101  0.560167686 -0.93375450   53.4350
## 2103  1.294995771 -0.35059715  283.4325
## 2104 -0.608876995  1.59326068  458.1150
## 2106  2.697849388 -1.12814028   46.7875
## 2107 -0.642278272  0.03817441  165.2225
## 2108  0.894180452 -0.73936872  156.9500
```

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## 2109 -0.876087208  0.03817441  175.7250
## 2110  0.827377899 -0.35059715  144.5575
## 2111 -0.809284655  0.03817441  121.7900
## 2112 -0.308265506 -0.73936872   85.9825
## 2113 -0.274864229  0.03817441  123.5200
## 2115 -0.642278272  2.17641802  600.9600
## 2116 -0.107857846 -0.15621137  158.5325
## 2117  2.029823856 -1.32252606   18.2600
## 2118  0.526766409  1.20448911  800.3350
## 2119  2.631046835 -0.93375450   49.1250
## 2120  0.125951090 -0.54498293   58.8300
## 2122 -0.642278272  0.23256020  488.4875
## 2123  0.560167686 -0.93375450   69.0550
## 2124  0.560167686 -0.54498293  209.5850
## 2125 -0.608876995  2.17641802  543.9400
## 2126 -0.876087208  2.37080381  938.7400
## 2127  0.560167686  0.42694598  392.3950
## 2128 -0.341666782  0.42694598  236.5000
## 2129 -0.876087208 -0.54498293  129.6800
## 2131  0.660371516 -0.54498293  110.3425
## 2132 -0.876087208  0.42694598  325.1350
## 2133 -0.608876995 -0.15621137  150.4675
## 2134 -0.642278272  2.75957537 1022.8350
## 2136 -0.876087208 -0.93375450   29.1750
## 2137 -0.642278272  0.23256020  465.3875
## 2138 -0.876087208 -0.15621137  374.3450
## 2139 -0.341666782  0.03817441  205.9375
## 2140 -0.876087208  0.23256020  244.4550
## 2141           NA -1.51691185        NA
## 2142  0.326358750 -0.35059715  288.2125
## 2143  0.560167686 -0.15621137  149.3800
## 2144  0.359760026 -0.73936872  167.9150
## 2145 -0.876087208  1.20448911 1312.1475
## 2146 -0.642278272 -0.15621137  523.2600
## 2148  2.430639176 -0.93375450   96.4850
## 2149  1.762613644 -0.93375450   64.0450
## 2150  1.595607261 -0.73936872  113.8950
## 2151 -0.876087208  1.98203224  776.2175
## 2152 -0.876087208 -0.54498293  144.7900
## 2153 -0.876087208  0.81571754  252.8650
## 2154  0.860779175 -0.54498293  119.7000
## 2155 -0.642278272 -0.54498293  210.9675
## 2156 -0.608876995  1.39887489  753.3300
## 2157 -0.642278272  0.03817441  196.1375
## 2160  0.292957473 -0.54498293  146.5125
## 2161 -0.642278272  1.59326068  388.5700
## 2162 -0.642278272 -0.35059715   94.3350
## 2163           NA -1.51691185        NA
## 2164 -0.876087208 -0.35059715  183.7475
## 2165  2.664448112 -0.54498293  139.2950
## 2166 -0.642278272  0.81571754  421.2150
## 2167  1.629008537 -1.12814028   78.3750
## 2168 -0.174660399 -0.93375450   32.4250
## 2169 -0.876087208  0.42694598  233.9525
```

```
## 2172 -0.608876995 -1.32252606    9.0400
## 2173 -0.141259123 -0.73936872  209.1975
## 2174 -0.642278272 -0.54498293   44.4725
## 2177 -0.876087208  1.78764646  918.1100
## 2178  1.562205984 -0.35059715  119.8025
## 2179           NA -1.51691185        NA
## 2180 -0.876087208  2.75957537 1625.6575
## 2183  0.560167686 -1.12814028   65.4900
## 2185  1.495403431 -0.93375450   13.6750
## 2187 -0.642278272  0.81571754  439.9850
## 2188  2.664448112 -1.12814028   24.5500
## 2189  0.092549814 -0.15621137  223.3525
## 2190 -0.876087208 -0.54498293   70.4000
## 2191 -0.876087208  1.01010333  604.6850
## 2192 -0.608876995 -0.35059715  273.0700
## 2193  1.495403431 -0.93375450   39.9550
## 2194 -0.508673165  0.23256020  112.5575
## 2195  0.560167686 -0.93375450   33.3400
## 2196 -0.642278272  0.23256020  743.3300
## 2197  1.562205984 -1.12814028    9.9500
## 2198  1.294995771  0.03817441  217.1200
## 2200  0.626970239  0.23256020  200.7175
## 2201  1.762613644 -0.73936872  119.3275
## 2202  0.326358750  1.20448911 1402.7500
## 2203  0.359760026 -0.35059715   84.6450
## 2204  0.326358750 -0.73936872  105.1350
## 2206 -0.876087208  0.03817441  227.0700
## 2207 -0.876087208  1.20448911  889.6100
## 2208 -0.642278272  0.23256020  243.3825
## 2209 -0.642278272 -1.12814028   37.7625
## 2210 -0.608876995 -0.35059715  216.8950
## 2211 -0.709080825  0.62133176  106.5150
## 2212 -0.742482101  0.62133176  138.3325
## 2213  0.393161303  0.42694598  415.7975
## 2214 -0.642278272 -0.35059715  131.8225
## 2216 -0.876087208  0.62133176  307.9525
## 2218 -0.876087208  1.20448911  356.4250
## 2220 -0.608876995 -0.35059715  399.5550
## 2221  0.994384282 -0.73936872  130.7500
## 2225  1.695811090 -1.32252606   17.2500
## 2226 -0.809284655  0.81571754  304.1175
## 2227 -0.876087208 -0.15621137  129.3875
## 2228  1.862817473 -1.12814028   24.2500
## 2229  1.495403431 -1.12814028   13.1375
## 2230 -0.508673165 -0.54498293   49.7100
## 2231  0.459963856  0.42694598  495.5275
## 2233 -0.542074442  0.03817441  168.9950
## 2234 -0.608876995 -0.54498293  591.4500
## 2236  0.393161303 -1.12814028   36.9250
## 2237           NA -1.51691185        NA
## 2238           NA -1.51691185        NA
## 2241 -0.608876995 -0.73936872   79.5375
## 2242  0.326358750  0.81571754  551.0325
## 2243 -0.642278272  0.03817441  140.5150
```

```
## 2244 -0.876087208  0.03817441  548.4425
## 2245  1.495403431 -1.12814028   70.6300
## 2247  0.393161303 -0.15621137  456.7775
## 2249 -0.876087208  0.03817441  235.9925
## 2250  0.894180452  0.03817441  207.0175
## 2251 -0.775883378  0.62133176  120.5850
## 2253  0.560167686 -0.35059715  172.7600
## 2254 -0.876087208 -0.15621137  212.2425
## 2256 -0.642278272  1.20448911  412.1825
## 2257 -0.876087208  1.59326068  388.7000
## 2258  1.862817473 -1.12814028  100.8500
## 2259 -0.709080825 -0.15621137  109.6800
## 2261  0.626970239 -0.73936872  246.3625
## 2263  2.564244282 -0.54498293  155.1350
## 2265  1.829416197 -1.12814028   25.9500
## 2266 -0.876087208  1.39887489  529.2200
## 2269 -0.642278272 -0.73936872   66.0950
## 2270  0.326358750 -0.93375450   51.3700
## 2272 -0.876087208  0.42694598  212.6100
## 2273           NA -1.51691185        NA
## 2276 -0.876087208  1.39887489  670.1075
## 2277 -0.876087208 -1.12814028   21.8250
## 2278 -0.642278272 -0.54498293   56.8550
## 2279 -0.876087208  1.01010333  360.9225
## 2280  1.361798324  0.03817441  577.5575
## 2281  2.664448112 -0.73936872   66.3750
## 2283 -0.608876995 -0.35059715  139.0350
## 2284  1.595607261 -0.15621137  214.8250
## 2285  0.393161303 -0.73936872  107.5300
## 2286 -0.876087208  1.98203224 1527.8400
## 2287 -0.876087208  0.42694598  317.8250
## 2288 -0.642278272 -0.54498293  148.3350
## 2290 -0.876087208 -0.54498293  125.2650
## 2291 -0.642278272  1.01010333  296.9825
## 2292  0.727174069 -1.12814028   58.4200
## 2293 -0.876087208  0.42694598  388.4550
## 2294  0.226154920  0.23256020  238.3275
## 2296 -0.642278272  1.78764646 1052.4275
## 2297  0.459963856 -0.73936872   78.8350
## 2298 -0.876087208  0.62133176  332.1775
## 2299 -0.876087208  0.42694598  412.4125
## 2300 -0.642278272 -0.35059715  185.9500
## 2301  1.395199601 -0.54498293   83.2825
## 2302  0.226154920 -1.12814028   22.0125
## 2303 -0.642278272  0.23256020  160.8825
## 2305  1.361798324 -0.73936872  115.5425
## 2306 -0.876087208 -0.93375450   46.0875
## 2308 -0.876087208  2.37080381  996.7175
## 2309  0.626970239  0.62133176  261.8600
## 2310  0.560167686 -0.73936872   79.0500
## 2311  0.593568963 -1.12814028  141.9825
## 2312 -0.642278272 -0.73936872   46.2400
## 2313           NA -1.51691185        NA
## 2314 -0.876087208  4.12027585 1841.7600
```

```
## 2315 -0.642278272  0.03817441  134.8500
## 2316 -0.642278272 -0.15621137  175.9850
## 2317 -0.308265506 -0.93375450  114.6500
## 2318 -0.876087208  1.01010333  639.4375
## 2319  0.560167686  0.42694598  295.3375
## 2320 -0.876087208 -0.54498293  111.2200
## 2321 -0.642278272 -0.54498293  118.4500
## 2322 -0.876087208  0.03817441  218.0775
## 2324 -0.208061676 -0.93375450   39.8625
## 2325 -0.642278272 -0.54498293  291.9250
## 2326 -0.876087208  2.17641802  739.6600
## 2328  0.493365133  0.23256020  294.1175
## 2329 -0.642278272 -0.93375450   53.8600
## 2330  1.629008537 -0.93375450   64.2400
## 2331  0.326358750 -0.35059715  182.3075
## 2332 -0.508673165  1.01010333 1060.5025
## 2334 -0.642278272 -0.35059715  129.1125
## 2335 -0.642278272 -0.73936872   92.2450
## 2336 -0.107857846 -1.12814028   36.7200
## 2337  0.593568963 -0.93375450   68.1750
## 2338 -0.642278272  0.81571754  494.8775
## 2340  0.526766409 -0.54498293   66.6950
## 2341  0.359760026  1.01010333  549.4625
## 2342 -0.876087208 -0.15621137  112.5775
## 2343 -0.642278272  1.20448911  517.1825
## 2344 -0.608876995  0.23256020   99.7850
## 2345 -0.608876995 -0.73936872   26.3500
## 2347  2.430639176 -0.93375450   23.8125
## 2349 -0.876087208 -0.15621137  169.7175
## 2351  0.560167686  1.78764646  801.8675
## 2352 -0.876087208  1.78764646  488.6175
## 2353  1.528804707 -0.93375450   83.6000
## 2354 -0.642278272  0.42694598  184.5875
## 2355 -0.775883378 -0.35059715  171.2375
## 2357 -0.876087208 -0.35059715  154.9875
## 2358  0.560167686 -0.15621137  191.5225
## 2359 -0.608876995 -0.73936872  102.0725
## 2360  2.063225133 -1.12814028   15.6250
## 2362 -0.876087208  1.01010333  600.0475
## 2363 -0.876087208 -0.54498293   85.9400
## 2364 -0.842685931  1.01010333  457.3100
## 2365 -0.876087208  1.39887489 1214.3300
## 2366 -0.375068059  0.23256020  144.7525
## 2367 -0.876087208  1.01010333  617.8900
## 2368  1.228193218 -0.93375450   75.1875
## 2369 -0.876087208  0.23256020  157.7550
## 2370  0.326358750  0.81571754  525.6850
## 2372 -0.876087208 -0.35059715  160.4475
## 2373 -0.642278272  0.03817441  180.2275
## 2374  0.393161303 -0.15621137  281.6425
## 2375 -0.141259123 -1.12814028   44.0850
## 2376 -0.642278272  1.20448911  495.2275
## 2379 -0.876087208  1.01010333  996.8925
## 2380 -0.876087208 -0.54498293  112.9100
```

```
## 2381 -0.876087208 -0.73936872   45.3950
## 2382 -0.876087208 -0.15621137  121.6975
## 2385 -0.876087208  1.01010333  455.3950
## 2386 -0.876087208  0.62133176  280.3550
## 2387 -0.642278272  0.42694598  275.6150
## 2388  0.560167686 -0.35059715   81.4225
## 2389           NA -1.51691185        NA
## 2391  1.528804707 -0.54498293   47.7900
## 2393           NA -1.51691185        NA
## 2395 -0.876087208  1.20448911  728.2975
## 2396 -0.608876995 -0.93375450   90.0100
## 2399  0.459963856 -0.54498293  110.1300
## 2401 -0.876087208  1.59326068  676.9450
## 2402  0.292957473  0.03817441  187.4175
## 2403 -0.542074442  2.17641802  995.3200
## 2404  1.161390665  0.03817441  522.9975
## 2405  0.359760026  1.01010333  646.8200
## 2406 -0.608876995 -0.35059715  157.6775
## 2407 -0.775883378  0.03817441  234.7300
## 2408 -0.742482101  0.03817441  269.1400
## 2409 -0.107857846  0.23256020  163.4400
## 2411  1.428600878 -1.12814028   36.1950
## 2412 -0.642278272  1.20448911 1087.4750
## 2413 -0.608876995 -0.93375450   56.9625
## 2414 -0.876087208  0.62133176  191.0700
## 2415  0.560167686 -0.93375450   47.9800
## 2416 -0.876087208 -1.12814028   73.1500
## 2417 -0.876087208  0.42694598  589.8650
## 2418 -0.642278272 -0.15621137  161.4250
## 2419  2.297034069 -0.35059715  181.0175
## 2420 -0.608876995  0.42694598  734.1475
## 2422 -0.642278272  0.42694598  174.0100
## 2425  0.426562580  1.59326068  851.5825
## 2426           NA -1.51691185        NA
## 2427 -0.876087208  0.42694598  274.2150
## 2428 -0.642278272  0.03817441  352.5350
## 2429 -0.876087208  0.03817441  646.7100
## 2431 -0.876087208  0.81571754  303.7625
## 2432 -0.876087208  2.17641802  943.7350
## 2433 -0.876087208 -0.54498293  111.4725
## 2435  1.328397048 -0.15621137  150.8725
## 2436 -0.876087208  0.81571754  349.3975
## 2437 -0.876087208  0.23256020  154.2675
## 2438  0.827377899  0.03817441  245.8400
## 2439 -0.709080825 -0.54498293   89.0475
## 2441  0.660371516 -0.54498293  135.7750
## 2442 -0.876087208 -0.35059715   68.8575
## 2443  0.393161303  0.23256020  150.5675
## 2444  1.027785558 -1.12814028   52.3500
## 2445  0.426562580 -0.15621137  105.2775
## 2447  0.560167686 -0.93375450   73.5375
## 2449 -0.608876995 -0.54498293   80.7875
## 2450 -0.642278272  1.39887489  610.8375
## 2451 -0.441870612  0.62133176  411.7200
```

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## 2452 -0.876087208  0.03817441   95.1275
## 2453  1.328397048  0.03817441  317.6050
## 2454  2.196830239 -0.15621137  286.9425
## 2455  0.192753643 -0.54498293   67.9750
## 2457 -0.642278272 -0.93375450  136.3350
## 2458  1.294995771  1.01010333  661.4825
## 2459 -0.608876995 -0.93375450   67.6750
## 2460  0.393161303 -0.15621137  408.7075
## 2461 -0.642278272  1.78764646  453.2425
## 2462 -0.876087208 -0.93375450   51.3250
## 2463 -0.876087208  1.01010333  279.9425
## 2465  1.495403431 -0.73936872  155.8825
## 2466 -0.642278272  1.78764646  350.5975
## 2468           NA -1.51691185        NA
## 2471 -0.642278272 -0.93375450  153.7350
## 2472 -0.876087208 -1.12814028  153.5950
## 2473 -0.876087208  0.42694598  211.2025
## 2474 -0.876087208  1.59326068  774.6750
## 2475 -0.876087208  0.62133176  170.5550
## 2476 -0.809284655  0.42694598  217.4425
## 2477 -0.876087208  1.20448911  801.3750
## 2478  0.459963856 -0.15621137  151.3925
## 2479  0.626970239  0.03817441  260.2000
## 2480  1.528804707 -1.12814028   55.3875
## 2481  0.593568963 -0.93375450   87.3250
## 2482 -0.642278272  0.23256020  210.7650
## 2483  0.393161303 -0.54498293  171.4850
## 2485 -0.608876995 -0.35059715  166.9125
## 2486 -0.876087208 -0.54498293  114.1575
## 2487 -0.608876995  0.03817441  277.0250
## 2488 -0.876087208  1.78764646  712.4750
## 2489  1.328397048 -1.32252606    6.2250
## 2490 -0.642278272  1.01010333  300.9975
## 2491           NA -1.51691185        NA
## 2493 -0.842685931  1.98203224  580.0875
## 2494  2.430639176 -1.32252606   38.7550
## 2495  1.528804707 -0.15621137  136.2975
## 2496 -0.876087208  2.17641802  526.2250
## 2497 -0.876087208  1.01010333  760.0425
## 2498 -0.876087208  1.59326068  418.1450
## 2499           NA -1.51691185        NA
## 2500  1.094588112 -0.35059715  150.8650
## 2501  2.564244282 -1.12814028   55.5750
## 2502 -0.642278272 -0.35059715  135.7125
## 2503 -0.876087208  0.42694598  314.1575
## 2505 -0.876087208 -0.73936872   99.0625
## 2506 -0.876087208  0.62133176  332.4250
## 2507  1.328397048 -0.73936872   51.2050
## 2508  0.393161303 -0.73936872   98.2550
## 2509  0.560167686 -0.73936872  678.4325
## 2510 -0.375068059 -0.35059715  117.6850
## 2511  2.297034069 -1.12814028   56.9500
## 2512 -0.876087208 -0.35059715   65.6000
## 2513 -0.876087208  1.39887489  477.9725
```

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## 2514  1.595607261 -0.54498293  108.9000
## 2516 -0.876087208  1.01010333  533.1525
## 2517 -0.642278272  1.39887489  375.2300
## 2518 -0.642278272  0.23256020  134.4800
## 2520  0.359760026 -0.15621137  125.9550
## 2521  0.292957473  0.42694598  431.3075
## 2522           NA -1.51691185        NA
## 2523 -0.642278272  0.62133176  141.9775
## 2524  0.860779175 -1.12814028   16.7000
## 2525  0.593568963 -0.93375450   79.5050
## 2526  1.595607261 -0.35059715  126.0575
## 2527           NA -1.51691185        NA
## 2528  0.660371516  0.62133176  361.6925
## 2531 -0.642278272 -1.32252606   28.8500
## 2532 -0.608876995 -0.73936872   81.9800
## 2533 -0.642278272  0.23256020  207.3675
## 2534 -0.876087208  0.23256020  506.2500
## 2535  0.626970239  0.42694598  163.0775
## 2536 -0.876087208  0.03817441  212.6025
## 2537  0.626970239 -0.15621137  130.2400
## 2538  0.426562580  0.23256020  218.0925
## 2540  0.493365133  0.03817441  288.3900
## 2541  0.560167686 -0.15621137  412.5375
## 2543 -0.642278272 -0.54498293   83.6650
## 2545  0.626970239 -0.93375450   68.4800
## 2547 -0.642278272 -0.73936872   88.1850
## 2552 -0.775883378  2.75957537  920.8750
## 2553 -0.876087208  1.39887489  541.6700
## 2554  2.697849388 -1.12814028   46.9000
## 2555 -0.876087208  0.81571754  694.7875
## 2557 -0.608876995 -0.54498293  127.8350
## 2558 -0.608876995  0.42694598  254.1925
## 2559  1.495403431 -1.32252606   28.1250
## 2560 -0.642278272  0.42694598  154.6800
## 2561  0.593568963 -1.32252606    9.5875
## 2562 -0.642278272 -0.54498293   88.0875
## 2563  1.328397048 -1.32252606   27.4850
## 2564 -0.041055293 -1.12814028   60.2500
## 2565  2.464040452 -0.93375450   97.5650
## 2567 -0.608876995 -0.15621137   96.8150
## 2569 -0.876087208  0.62133176  218.6425
## 2570 -0.876087208  0.23256020  302.7150
## 2571 -0.608876995  1.01010333  264.6850
## 2572 -0.876087208  0.81571754  247.2100
## 2573  0.326358750  0.23256020  394.3625
## 2574  1.027785558 -0.93375450   36.2350
## 2575 -0.341666782  0.62133176  845.2025
## 2576  1.395199601 -0.15621137  490.1500
## 2578 -0.876087208 -0.35059715  233.8550
## 2579  0.326358750  1.78764646  913.4925
## 2580  0.560167686  0.23256020  408.7925
## 2581 -0.642278272  0.03817441  152.5050
## 2583 -0.876087208  1.39887489  732.7675
## 2584 -0.642278272 -0.35059715  175.1400
```

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## 2585  1.729212367 -0.54498293  443.1500
## 2586 -0.642278272  0.62133176  227.3075
## 2589           NA -1.51691185       NA
## 2590  0.393161303  1.59326068  583.9100
## 2591           NA -1.51691185       NA
## 2592  0.560167686 -0.35059715  114.2775
## 2594 -0.876087208  1.59326068 1605.6550
## 2595 -0.208061676 -0.35059715  204.6425
## 2596  1.528804707  0.23256020  221.4275
## 2598 -0.608876995  1.39887489 1480.8525
## 2599 -0.876087208  1.20448911  847.2775
## 2600 -0.642278272  0.62133176  489.3550
## 2601  0.326358750  0.23256020  213.3150
## 2602 -0.876087208  2.17641802  945.9175
## 2603 -0.542074442  0.03817441  174.2875
## 2604 -0.608876995  0.81571754  298.6650
## 2605  0.426562580 -0.15621137  184.3050
## 2607 -0.876087208  1.98203224  944.1400
## 2608  0.226154920 -0.35059715   58.5250
## 2610 -0.742482101  1.01010333 1036.7150
## 2611 -0.876087208  1.39887489  631.2175
## 2612 -0.876087208 -0.15621137  187.7000
## 2613 -0.642278272 -0.54498293  191.4400
## 2614  0.560167686  0.42694598  252.2550
## 2615 -0.608876995  0.42694598  374.3400
## 2616 -0.608876995 -0.35059715   66.2800
## 2617 -0.876087208 -0.15621137  226.9225
## 2619 -0.642278272  0.23256020  229.6850
## 2620 -0.642278272  0.62133176  218.6875
## 2621 -0.608876995 -0.15621137  133.8375
## 2622 -0.876087208  0.42694598  272.0525
## 2623 -0.876087208  1.59326068  700.0250
## 2625 -0.742482101  0.81571754  277.3350
## 2626  0.693772792 -0.15621137  148.1950
## 2627 -0.608876995 -0.54498293   49.2750
## 2628  0.593568963 -0.93375450   48.4100
## 2629           NA -1.51691185       NA
## 2630           NA -1.51691185       NA
## 2631  0.359760026 -0.15621137  145.3000
## 2632 -0.876087208  0.23256020  148.9150
## 2634 -0.876087208  0.03817441  146.1775
## 2636 -0.876087208  0.23256020  241.2000
## 2637  0.626970239 -0.15621137  338.7150
## 2638 -0.642278272  0.03817441  148.1875
## 2639           NA -1.51691185       NA
## 2641 -0.141259123 -0.54498293   85.2075
## 2642  0.894180452 -1.12814028   70.7225
## 2643  0.793976622 -0.93375450   64.5375
## 2644 -0.642278272  0.03817441  800.1750
## 2645  2.464040452 -0.73936872  326.5450
## 2646  0.393161303 -0.93375450  111.0950
## 2647 -0.608876995 -0.35059715  154.5475
## 2651 -0.876087208 -0.35059715   66.3850
## 2652 -0.608876995 -0.35059715  134.7750
```

```
## 2653 -0.876087208  0.81571754  269.9800
## 2654 -0.642278272  0.03817441  342.7200
## 2655 -0.041055293  0.03817441  178.8475
## 2656 -0.876087208  2.95396115 1372.6750
## 2657  1.862817473 -0.73936872   50.3750
## 2658 -0.876087208 -0.54498293  254.7800
## 2659 -0.642278272  0.03817441  246.7200
## 2660  0.526766409 -0.73936872  117.0375
## 2661 -0.775883378  0.62133176  467.2175
## 2662 -0.608876995 -0.54498293  101.0125
## 2663 -0.375068059 -0.54498293  172.3025
## 2664 -0.575475718 -0.54498293  185.9225
## 2665 -0.642278272  0.62133176  182.8325
## 2666  0.192753643 -0.54498293  304.3500
## 2667  0.526766409  0.62133176  441.9050
## 2668  1.328397048 -0.15621137  246.0100
## 2669 -0.642278272  0.03817441  183.1875
## 2670 -0.876087208 -0.35059715  105.9450
## 2671 -0.876087208  0.23256020  166.5125
## 2672  0.393161303 -0.15621137  118.3725
## 2673  0.259556197 -0.73936872  165.0300
## 2674  0.359760026  0.62133176  494.8450
## 2676  3.031862154 -1.12814028   69.0100
## 2677 -0.608876995 -0.73936872   54.4300
## 2678 -0.876087208  2.37080381 1705.4500
## 2679 -0.642278272 -0.73936872   98.4975
## 2680  0.326358750  0.03817441  366.0250
## 2681 -0.642278272  0.62133176  470.6425
## 2682 -0.876087208  1.59326068  830.2400
## 2683 -0.876087208  0.23256020  139.2525
## 2684  0.226154920 -0.54498293   64.7425
## 2685 -0.876087208  0.03817441  128.0850
## 2686  0.326358750  2.17641802 1260.0225
## 2687 -0.876087208  1.39887489  437.8950
## 2688 -0.642278272 -0.15621137  115.9425
## 2689 -0.642278272  0.42694598  171.5050
## 2690 -0.642278272 -0.15621137  119.6975
## 2691  1.495403431 -1.32252606   18.6000
## 2692  1.528804707 -0.73936872  175.3400
## 2693  0.593568963  0.42694598  218.4125
## 2695  0.359760026  1.98203224  718.9975
## 2698 -0.876087208  0.23256020  207.4775
## 2699 -0.876087208 -0.54498293  148.8500
## 2700  0.526766409 -0.35059715  244.2475
## 2701 -0.642278272 -0.15621137  278.6175
## 2702 -0.608876995  0.42694598  246.9250
## 2704  1.495403431 -0.54498293   72.9550
## 2705           NA -1.51691185        NA
## 2706 -0.876087208 -0.73936872   62.1400
## 2707 -0.608876995 -0.35059715  159.2225
## 2708 -0.074456569 -0.54498293  183.7850
## 2709  1.495403431 -0.73936872  144.5825
## 2710  0.560167686  0.03817441  442.7700
## 2712 -0.876087208 -1.12814028   17.5525
```

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## 2713 -0.508673165  1.20448911  444.0475
## 2715  2.464040452 -0.73936872   69.4850
## 2716           NA -1.51691185        NA
## 2717  0.593568963 -0.73936872   99.2900
## 2719 -0.876087208  1.20448911  631.1575
## 2720  1.328397048 -1.12814028   32.9750
## 2721  0.593568963 -0.73936872   44.4875
## 2722  1.495403431  1.39887489  961.7550
## 2723 -0.642278272 -1.12814028   35.3725
## 2724 -0.842685931  0.42694598  274.5925
## 2725 -0.642278272  0.42694598  144.9350
## 2726 -0.642278272  0.42694598  659.6900
## 2727  0.326358750  1.01010333  619.9575
## 2729 -0.642278272  0.03817441  325.1125
## 2730  0.593568963 -1.12814028   56.8150
## 2731  2.530843005 -1.32252606   38.2000
## 2732 -0.876087208  0.23256020  175.0575
## 2733 -0.642278272  2.95396115 1278.6850
## 2735 -0.642278272  0.62133176  181.4100
## 2738 -0.274864229 -0.73936872  277.3125
## 2743 -0.876087208 -0.15621137  120.3150
## 2744  0.660371516  1.39887489  828.8675
## 2745 -0.642278272  2.37080381 1760.4675
## 2747 -0.709080825  0.42694598  295.6225
## 2748  0.292957473  0.81571754  845.7450
## 2751           NA -1.51691185        NA
## 2752 -0.876087208  1.59326068  877.4225
## 2753 -0.375068059 -1.32252606   56.4250
## 2755  0.526766409 -0.35059715  127.2250
## 2756  2.230231516 -0.93375450   67.3350
## 2757  0.660371516 -0.73936872   68.7250
## 2758  1.294995771 -0.73936872   61.4850
## 2759 -0.876087208  0.23256020  109.8000
## 2760 -0.876087208  3.53711850 1513.3050
## 2761 -0.608876995  0.81571754  775.8425
## 2763  0.393161303 -1.12814028   15.1750
## 2764 -0.876087208  0.42694598  478.7400
## 2766 -0.608876995 -0.35059715   64.3850
## 2767  0.326358750  0.23256020  254.5350
## 2768 -0.876087208  1.01010333  657.5525
## 2769  0.593568963 -0.35059715  237.4975
## 2770 -0.642278272  0.03817441  170.6325
## 2771  2.564244282 -1.12814028  221.2100
## 2772 -0.876087208  0.81571754  451.9900
## 2774 -0.876087208  1.39887489  676.5675
## 2775  0.359760026 -0.35059715   66.5725
## 2776  1.528804707 -0.73936872   83.9000
## 2777 -0.642278272  0.62133176  609.8950
## 2781 -0.876087208  0.42694598  569.7550
## 2782 -0.876087208  0.81571754  261.4550
## 2783 -0.876087208 -0.35059715  145.4900
## 2785  1.762613644 -0.93375450   73.3650
## 2786 -0.642278272 -0.54498293   72.4700
## 2787  1.963021303 -0.73936872   31.5175
```

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## 2788  1.361798324 -1.12814028   44.7100
## 2789 -0.876087208  0.23256020  267.8175
## 2790 -0.876087208 -0.54498293   88.5200
## 2791 -0.642278272  3.14834694 1698.9925
## 2793 -0.876087208  0.42694598  345.5350
## 2794  0.359760026  1.01010333  846.4875
## 2795  1.228193218 -0.93375450   74.0750
## 2797  0.593568963 -0.54498293  160.2525
## 2800 -0.642278272  0.03817441  130.4675
## 2801 -0.876087208 -0.15621137  265.0900
## 2802  1.629008537  0.03817441  205.5375
## 2803  0.793976622 -1.12814028    9.0000
## 2804  0.760575346 -0.15621137  183.5925
## 2806 -0.876087208  1.01010333  830.2850
## 2807 -0.876087208  0.81571754  391.4800
## 2808 -0.876087208  1.20448911  593.7175
## 2810  0.326358750 -0.35059715  148.0850
## 2811 -0.608876995 -0.54498293  185.6975
## 2812  0.426562580  0.81571754  368.5500
## 2813           NA -1.51691185        NA
## 2814 -0.608876995 -0.73936872   99.9700
## 2815 -0.876087208 -0.54498293  253.0275
## 2816  0.526766409 -0.73936872  150.7475
## 2818 -0.608876995 -0.54498293   89.5225
## 2819  1.762613644 -1.12814028   44.2850
## 2820 -0.642278272 -0.35059715  261.2375
## 2821 -0.642278272  1.01010333  693.4800
## 2822  0.326358750  0.62133176  514.1800
## 2825 -0.876087208 -0.35059715   92.4850
## 2826 -0.876087208 -0.54498293  132.6500
## 2827 -0.876087208  0.23256020  440.3075
## 2828 -0.742482101  1.59326068  462.4850
## 2829 -0.876087208  0.23256020  295.8400
## 2830 -0.876087208 -0.93375450   88.2050
## 2831 -0.141259123 -0.93375450   57.6000
## 2832  0.359760026 -0.93375450   31.5825
## 2833 -0.876087208  2.56518959  486.9975
## 2834  0.326358750 -1.12814028   27.8500
## 2835 -0.508673165 -0.35059715  369.5650
## 2836  2.464040452 -0.54498293  135.1600
## 2837  0.660371516  0.03817441  136.5675
## 2838 -0.876087208  1.59326068  354.2650
## 2839 -0.876087208 -0.54498293  166.3350
## 2840  0.326358750  0.42694598  409.0350
## 2841 -0.876087208  1.20448911  821.3550
## 2843  0.359760026 -0.73936872  396.1625
## 2844 -0.642278272 -0.93375450   48.6400
## 2845  0.560167686 -0.35059715  115.1100
## 2847  0.860779175 -0.54498293  127.5775
## 2848 -0.876087208  0.03817441  213.2000
## 2849  1.261594495  0.62133176  760.9875
## 2850 -0.642278272  0.42694598  257.1525
## 2851 -0.876087208 -0.54498293   95.2925
## 2852 -0.608876995 -0.93375450   86.5950
```

```
## 2853  0.560167686 -1.12814028   23.1100
## 2854  0.092549814  0.03817441  231.6450
## 2855 -0.608876995 -0.15621137  162.7925
## 2856 -0.876087208  1.78764646  497.6675
## 2858           NA -1.51691185        NA
## 2859  1.495403431  0.23256020  240.1175
## 2861  0.593568963 -0.15621137  122.8775
## 2862  1.729212367 -0.35059715  118.3275
## 2863 -0.642278272 -1.12814028   42.0600
## 2865 -0.642278272 -0.54498293  115.9075
## 2866 -0.876087208  1.59326068  724.8850
## 2867           NA -1.51691185        NA
## 2868 -0.642278272  0.81571754  332.8750
## 2869 -0.608876995 -0.35059715  208.3450
## 2870  1.094588112 -0.35059715  241.3900
## 2871 -0.642278272  0.81571754  287.7800
## 2872  0.393161303 -0.73936872  124.9775
## 2875  0.593568963 -0.54498293  102.7875
## 2876 -0.876087208  0.03817441  162.5150
## 2878  0.359760026  0.81571754  268.2350
## 2880 -0.709080825  1.59326068  487.1600
## 2881  0.760575346 -1.12814028   27.1850
## 2882 -0.876087208  1.59326068  736.6900
## 2884 -0.876087208 -0.54498293  153.2050
## 2885 -0.876087208  2.95396115 2134.6425
## 2886 -0.642278272  0.62133176 1055.6450
## 2887  1.294995771 -0.73936872   73.4250
## 2888  1.328397048  0.23256020  227.6800
## 2889  1.495403431 -0.35059715  122.9375
## 2891  2.664448112 -0.93375450   46.1100
## 2892 -0.775883378  0.03817441  135.3125
## 2893 -0.642278272 -0.54498293  119.2525
## 2894  1.261594495  0.23256020  585.1975
## 2895 -0.642278272  0.42694598  304.2575
## 2896  0.393161303  0.23256020  216.4125
## 2898           NA -1.51691185        NA
## 2899  1.629008537 -1.32252606   30.5000
## 2901  1.562205984 -0.35059715  495.5975
## 2902 -0.608876995  0.23256020  304.9625
## 2903 -0.341666782  1.78764646  579.5725
## 2904  1.328397048 -0.35059715  200.1150
## 2906  2.497441729 -0.93375450   49.5850
## 2907 -0.876087208  0.23256020  164.0225
## 2908  0.927581729 -0.73936872  177.7650
## 2909 -0.642278272 -0.93375450   39.4500
## 2910  0.426562580  0.62133176  296.8850
## 2912 -0.876087208  0.42694598  285.7675
## 2913 -0.642278272 -0.15621137  125.2125
## 2914 -0.642278272  0.03817441  299.3725
## 2915  1.495403431  0.23256020   95.0625
## 2916  0.326358750  0.81571754  235.1900
## 2917  0.626970239 -0.54498293   52.0225
## 2918 -0.675679548 -0.35059715  151.5900
## 2919 -0.642278272  1.98203224  825.8200
```

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## 2920 -0.642278272  0.62133176  215.7700
## 2921  0.326358750 -0.54498293   60.7350
## 2923  2.664448112 -1.32252606   32.4300
## 2924  1.261594495 -0.15621137  483.3150
## 2926  0.393161303 -0.73936872   60.1450
## 2927 -0.876087208 -0.54498293   51.0375
## 2928  1.562205984  0.23256020  568.8825
## 2929  0.493365133 -0.15621137  189.2675
## 2931  0.593568963 -1.12814028   18.5000
## 2932 -0.642278272 -0.15621137  260.1850
## 2933 -0.876087208  0.23256020  284.5050
## 2934  2.196830239 -0.73936872   57.4400
## 2935  0.359760026  1.20448911 1115.0475
## 2936 -0.608876995 -0.15621137  168.0850
## 2937 -0.876087208  0.81571754  352.3225
## 2939 -0.876087208  1.01010333  662.4475
## 2940  1.294995771 -0.93375450   56.3075
## 2941  0.593568963 -0.35059715  158.9125
## 2942  0.259556197  0.03817441  115.4675
## 2945 -0.876087208  1.78764646  833.7525
## 2946  0.493365133  0.03817441  153.1150
## 2947 -0.876087208  1.20448911  331.7775
## 2950 -0.642278272 -0.35059715  132.5825
## 2951 -0.876087208 -0.35059715  154.4050
## 2953  0.359760026 -0.54498293  141.4325
## 2955 -0.608876995  0.62133176  638.9000
## 2956 -0.608876995  0.81571754  651.8450
## 2957 -0.608876995  0.62133176  228.0025
## 2958  0.359760026  0.62133176  379.8675
## 2959  2.664448112 -0.93375450   66.3875
## 2960  1.027785558 -0.15621137   80.3700
## 2961  1.528804707 -0.73936872   64.4100
## 2962 -0.876087208  0.23256020  229.0875
## 2963 -0.608876995 -0.93375450  156.6325
## 2964  0.560167686 -0.73936872   42.9650
## 2965 -0.608876995  0.03817441  156.5775
## 2966 -0.642278272  0.81571754  943.2425
## 2967  0.359760026 -0.15621137  143.6225
## 2968  0.626970239 -0.15621137  169.5950
## 2969  1.528804707 -0.93375450  153.5625
## 2970 -0.441870612 -1.32252606   45.4900
## 2971  2.664448112 -0.73936872   61.2800
## 2972  1.261594495 -0.93375450   86.1175
## 2973 -0.642278272  1.39887489  314.0775
## 2974 -0.876087208  1.01010333  328.6950
## 2976 -0.876087208  1.39887489  642.2575
## 2977 -0.876087208  0.03817441  595.3350
## 2978 -0.608876995  1.01010333  895.2050
## 2979  0.626970239  0.03817441  161.2525
## 2981 -0.876087208 -0.15621137  237.8100
## 2983 -0.542074442  0.23256020  354.2225
## 2984 -0.876087208  0.23256020  106.1250
## 2985  1.729212367 -0.35059715  211.6500
## 2987 -0.876087208  0.81571754  260.2550
```

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## 2988 -0.876087208  0.81571754  406.5975
## 2989  1.294995771 -0.73936872  308.3050
## 2990 -0.642278272  0.81571754  231.7575
## 2991 -0.876087208  0.62133176  294.0000
## 2992 -0.642278272 -0.35059715  279.5475
## 2993 -0.876087208  0.23256020  590.2575
## 2994  0.393161303  1.59326068 1266.9225
## 2996 -0.475271889 -0.93375450   53.5475
## 2998 -0.642278272  0.42694598  462.5525
## 2999 -0.876087208  2.17641802  825.7950
## 3000 -0.876087208  1.01010333  542.5275
## 3001 -0.642278272  1.39887489  353.7575
## 3005 -0.876087208  0.81571754  456.2550
## 3006 -0.876087208 -0.15621137  122.3900
## 3007 -0.642278272  0.03817441  271.2225
## 3008  0.593568963 -0.35059715  365.3500
## 3010  2.497441729 -0.73936872   69.4875
## 3011  0.426562580 -0.35059715   99.4675
## 3012  0.326358750 -0.73936872  119.3725
## 3013  0.493365133  0.42694598  282.9875
## 3014 -0.608876995  0.62133176  488.6850
## 3015 -0.876087208  1.39887489  741.8375
## 3016  0.326358750  1.01010333  822.2800
## 3017 -0.876087208  0.62133176  561.9825
## 3018 -0.876087208  0.81571754  317.5150
## 3019 -0.876087208 -0.54498293   92.3350
## 3020 -0.642278272 -0.35059715  110.7500
## 3021 -0.876087208  0.23256020  252.0800
## 3022 -0.876087208  1.20448911  655.3375
## 3023 -0.876087208  0.42694598  128.1850
## 3024  1.595607261 -0.93375450   64.5350
## 3025  2.664448112 -0.93375450   67.1125
## 3026  0.426562580 -0.35059715   48.7575
## 3027  0.827377899 -0.54498293   89.2200
## 3028  1.762613644 -1.32252606   29.9500
## 3029 -0.876087208  1.39887489  758.9175
## 3030 -0.876087208  1.98203224  792.3975
## 3031 -0.876087208  0.42694598  206.8550
## 3033 -0.642278272  0.81571754  264.6700
## 3034  1.495403431 -0.15621137  134.5375
## 3035 -0.876087208  0.03817441  140.7100
## 3037 -0.775883378 -0.54498293  614.5600
## 3038 -0.876087208  1.39887489  431.3850
## 3039  0.626970239 -0.35059715  177.6950
## 3040  0.626970239  0.42694598  177.5000
## 3041 -0.642278272 -0.54498293  105.8725
## 3042 -0.809284655  1.01010333  797.3900
## 3043 -0.876087208  0.42694598  273.3200
## 3044 -0.876087208  0.03817441  567.0150
## 3047 -0.876087208 -0.15621137  231.9275
## 3048 -0.876087208  3.14834694 1819.5150
## 3049  1.729212367 -1.12814028   37.9250
## 3050 -0.876087208  0.23256020   79.5275
## 3051 -0.876087208  0.81571754  460.2375
```

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## 3052 -0.608876995  0.03817441  138.0600
## 3053 -0.876087208 -0.35059715   81.2750
## 3054 -0.642278272 -0.15621137   52.8250
## 3055  1.729212367 -0.73936872   98.7200
## 3058 -0.642278272  0.81571754  283.7925
## 3060 -0.642278272  0.03817441  311.1600
## 3061  2.330435346 -0.73936872   57.6600
## 3062 -0.876087208  1.01010333  484.6175
## 3063  1.963021303 -0.35059715  258.0925
## 3064  0.393161303  1.01010333  461.1300
## 3065  0.359760026 -0.93375450   95.9250
## 3067  0.326358750 -0.15621137  165.2425
## 3070  1.328397048 -0.15621137  314.4025
## 3071 -0.642278272 -1.12814028   11.0625
## 3073  2.397237899 -0.35059715  131.9975
## 3074 -0.876087208 -1.12814028   43.3375
## 3076 -0.675679548  0.62133176  675.6200
## 3077 -0.642278272 -0.15621137  128.3825
## 3080  0.326358750 -1.12814028   51.8500
## 3081  1.495403431  0.42694598  444.1200
## 3082  1.127989388 -0.35059715   83.5075
## 3083 -0.876087208  1.20448911  860.5450
## 3084  1.495403431  0.03817441  175.2625
## 3085 -0.642278272 -0.35059715  169.9375
## 3086  0.326358750  0.81571754  291.7625
## 3087 -0.876087208  1.01010333  752.4775
## 3088 -0.876087208  1.01010333 1140.3925
## 3089 -0.608876995  0.81571754  462.9125
## 3090 -0.141259123 -0.35059715  208.8950
## 3091 -0.876087208  0.23256020  390.8450
## 3092 -0.608876995 -0.54498293  149.0075
## 3094 -0.876087208 -0.15621137  163.1550
## 3095 -0.876087208 -0.93375450   50.1750
## 3096  1.729212367 -0.93375450   48.5250
## 3097  2.397237899 -0.54498293  218.9450
## 3098  0.793976622 -0.93375450   58.7850
## 3099 -0.642278272  0.81571754  890.7250
## 3100 -0.642278272  0.03817441  299.2825
## 3101  0.326358750  0.42694598  353.3750
## 3102 -0.876087208  0.03817441  326.1750
## 3103 -0.876087208  0.81571754  359.1100
## 3104 -0.876087208  2.75957537 1401.5475
## 3105           NA -1.51691185       NA
## 3107  0.326358750 -0.54498293  146.2900
## 3108 -0.876087208 -0.93375450  102.1825
## 3110 -0.141259123 -0.35059715   97.9950
## 3111 -0.208061676 -0.35059715   88.9925
## 3113 -0.642278272  0.03817441  118.6025
## 3114 -0.876087208  1.20448911  665.8800
## 3116 -0.876087208  2.37080381  837.7550
## 3117 -0.876087208  0.03817441  134.1500
## 3119  0.894180452 -0.54498293   42.8350
## 3120 -0.642278272 -0.54498293   91.3975
## 3121           NA -1.51691185       NA
```

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## 3122  0.125951090 -0.54498293  126.7300
## 3123           NA -1.51691185        NA
## 3124  0.793976622 -0.73936872   98.5000
## 3125 -0.876087208 -0.35059715  161.9400
## 3126 -0.441870612  0.81571754  522.0525
## 3127  1.194791941 -1.12814028   24.2700
## 3129 -0.608876995 -1.32252606   53.3100
## 3130 -0.642278272 -0.35059715   74.6450
## 3131  2.931658325 -1.12814028   30.5450
## 3132  1.495403431 -0.54498293  394.1900
## 3133  1.395199601  0.23256020  321.5275
## 3134 -0.642278272 -1.32252606   15.0000
## 3135  1.294995771  0.62133176  445.4800
## 3136 -0.642278272  1.78764646 1693.8025
## 3137 -0.608876995  0.42694598  208.6050
## 3138 -0.876087208 -0.15621137  197.1825
## 3139  0.359760026 -0.35059715  215.5850
## 3141 -0.608876995  1.01010333  401.6600
## 3142 -0.876087208 -0.35059715  104.1950
## 3143 -0.608876995  0.03817441  153.6650
## 3144 -0.876087208  0.81571754  239.2525
## 3145 -0.575475718 -0.15621137  236.4500
## 3146 -0.876087208 -0.15621137  117.5950
## 3148           NA -1.51691185        NA
## 3150  2.530843005 -0.54498293  144.5650
## 3151  0.493365133  1.20448911 1237.7100
## 3153  1.528804707  0.62133176  301.1475
## 3155           NA -1.51691185        NA
## 3156  1.261594495 -1.32252606   54.0000
## 3157 -0.876087208 -0.15621137  367.4900
## 3158 -0.742482101  1.20448911  884.0100
## 3160  0.393161303 -1.32252606   18.4850
## 3162 -0.709080825  0.62133176  126.8575
## 3163  2.029823856 -0.73936872  181.1500
## 3164  2.063225133 -0.54498293   72.3875
## 3166  0.393161303  0.62133176  276.0575
## 3167 -0.608876995  0.42694598  202.5975
## 3170 -0.876087208 -0.35059715  160.0700
## 3171 -0.642278272  0.03817441   77.7225
## 3173 -0.608876995 -0.73936872  104.7450
## 3174  0.326358750 -0.73936872   32.1975
## 3175  2.697849388 -1.32252606    7.4750
## 3176 -0.642278272  0.62133176  208.8450
## 3177 -0.709080825  0.23256020   94.2625
## 3178  2.430639176 -0.35059715  142.6850
## 3179  0.459963856  0.03817441  163.4575
## 3182 -0.876087208  1.01010333  260.6350
## 3183  2.430639176 -0.73936872  373.9850
## 3185 -0.642278272  0.03817441  198.9025
## 3186 -0.642278272 -0.35059715   58.1900
## 3188  2.664448112 -1.12814028   49.0475
## 3189 -0.608876995  0.81571754  167.7075
## 3190 -0.408469335  0.03817441  405.2750
## 3191 -0.842685931  1.39887489  934.8800
```

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## 3193  2.297034069 -0.54498293  244.3500
## 3195 -0.575475718  1.78764646  427.7525
## 3196 -0.642278272 -0.15621137   72.9525
## 3197  1.729212367 -0.93375450   18.3000
## 3198  2.397237899 -0.73936872  259.9000
## 3199  0.560167686 -0.93375450   76.1025
## 3200  1.261594495 -1.12814028   50.0100
## 3202 -0.608876995 -1.12814028   29.3475
## 3203 -0.007654016  1.01010333  229.2525
## 3204 -0.375068059 -1.12814028   12.4850
## 3205 -0.642278272  0.23256020  180.0200
## 3206  1.328397048 -0.93375450   74.0175
## 3207 -0.341666782 -0.73936872   92.6850
## 3209  0.693772792 -1.12814028   13.7000
## 3212  2.530843005 -0.54498293  168.5800
## 3213 -0.876087208 -0.35059715  195.8175
## 3215 -0.642278272 -0.15621137  227.1500
## 3216 -0.608876995 -0.73936872   84.8100
## 3218 -0.608876995  0.42694598  224.5200
## 3220           NA -1.51691185        NA
## 3221  0.226154920 -0.15621137  253.2200
## 3222 -0.608876995  1.20448911  392.0500
## 3223  0.326358750 -0.54498293  213.9600
## 3224           NA -1.51691185        NA
## 3226  0.326358750  2.17641802  844.6800
## 3228  0.660371516 -0.35059715  171.6250
## 3229 -0.642278272 -0.73936872   23.6575
## 3230  1.261594495 -0.93375450   70.0450
## 3231  1.395199601 -0.35059715  192.9000
## 3232 -0.642278272  0.03817441  168.8400
## 3233 -0.876087208  0.81571754  465.7375
## 3234           NA -1.51691185        NA
## 3235 -0.642278272  1.59326068 1101.9450
## 3236           NA -1.51691185        NA
## 3237 -0.876087208 -0.73936872   90.1950
## 3238  0.393161303 -0.15621137  136.2600
## 3239  1.729212367 -0.93375450  107.3750
## 3240 -0.642278272 -0.93375450  117.6500
## 3241 -0.876087208  0.03817441  213.3300
## 3242  1.261594495  0.42694598  342.8550
## 3243 -0.642278272 -0.54498293   84.8675
## 3245  0.626970239  0.81571754  602.4550
## 3246 -0.675679548  0.23256020  221.7375
## 3247 -0.876087208 -0.35059715  104.3675
## 3248 -0.341666782 -0.73936872   82.6975
## 3249  1.562205984 -1.12814028  103.0600
## 3251  0.459963856 -1.32252606   13.4000
## 3252  0.326358750  2.75957537 1251.9825
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## 3255  1.528804707  0.03817441  362.3225
## 3256 -0.642278272  0.23256020  176.6200
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```

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## 3259  0.459963856  0.23256020  252.4975
## 3260  1.629008537  0.23256020  329.3850
## 3261 -0.876087208 -0.54498293   86.7350
## 3262 -0.775883378  0.03817441  193.7075
## 3263 -0.642278272  0.81571754  345.7450
## 3264 -0.876087208 -0.93375450  399.3550
## 3265 -0.842685931 -0.35059715   81.6025
## 3266 -0.642278272 -0.35059715  144.6250
## 3267 -0.375068059 -0.15621137  282.5500
## 3269           NA -1.51691185        NA
## 3270 -0.876087208 -0.15621137  283.2925
## 3271 -0.876087208  0.23256020  599.0875
## 3272 -0.876087208  0.23256020  313.7825
## 3273  0.359760026  1.20448911 2671.1975
## 3275  0.593568963 -0.93375450   41.0875
## 3277 -0.608876995  0.03817441  379.3900
## 3278 -0.876087208  0.23256020  184.2150
## 3281  0.727174069  0.42694598  269.7050
## 3282 -0.876087208  0.03817441  332.7275
## 3283           NA -1.51691185        NA
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## 3285  1.194791941 -0.93375450   60.6375
## 3286 -0.642278272  0.81571754  332.0350
## 3287 -0.642278272 -0.15621137  166.8500
## 3289 -0.876087208 -0.15621137  164.0750
## 3290  1.328397048 -0.73936872   41.4375
## 3292 -0.876087208  2.56518959  927.1825
## 3294  2.831454495 -1.12814028   19.2125
## 3295 -0.809284655  0.03817441  295.0250
## 3297  0.660371516  0.03817441  161.4075
## 3298  0.359760026 -0.73936872   81.5975
## 3299  0.159352367 -0.35059715  123.0600
## 3300  1.395199601 -0.54498293  216.7800
## 3302 -0.475271889 -1.12814028   17.8100
## 3303 -0.876087208 -0.73936872  276.9375
## 3304  1.294995771 -1.32252606   15.0200
## 3305  1.094588112 -0.73936872   43.0625
## 3306 -0.876087208  0.81571754  494.4100
## 3308 -0.876087208 -0.93375450   75.0500
## 3309 -0.642278272  1.20448911  603.7500
## 3310 -0.041055293 -0.15621137  266.8950
## 3311  1.328397048 -1.12814028   90.2175
## 3312  1.796014920 -1.32252606   12.1600
## 3313 -0.241462952 -0.73936872   80.0875
## 3314 -0.642278272  0.23256020  425.3800
## 3315 -0.876087208  1.78764646  636.4100
## 3317  0.459963856 -0.93375450   71.3775
## 3318 -0.876087208  0.62133176  264.3375
## 3319 -0.642278272  0.81571754  507.8575
## 3320 -0.876087208  0.62133176  316.2650
## 3321 -0.542074442 -0.54498293  135.2525
## 3323  2.664448112 -0.93375450   70.5625
## 3324 -0.775883378 -0.15621137  273.1425
## 3325 -0.642278272  1.39887489  564.3350
```

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## 3326  0.560167686  0.03817441  247.2500
## 3327  1.127989388 -1.32252606   44.9700
## 3328 -0.876087208 -0.54498293  101.7450
## 3329 -0.876087208  1.01010333  283.3625
## 3330 -0.876087208  0.23256020  504.2175
## 3331 -0.742482101 -1.12814028   24.7125
## 3332  0.827377899  0.42694598  636.7525
## 3333 -0.809284655 -0.73936872   73.8500
## 3334 -0.876087208  1.20448911  755.2475
## 3336 -0.642278272  0.23256020  299.1400
## 3340  2.330435346 -0.93375450  104.3450
## 3341 -0.876087208  1.59326068  550.3300
## 3342  0.526766409 -0.35059715  183.9900
## 3343 -0.876087208  0.03817441  146.3450
## 3344  0.593568963  0.23256020  170.0075
## 3346 -0.642278272  0.03817441  168.4600
## 3347 -0.876087208 -0.15621137  135.6450
## 3348 -0.642278272  0.23256020  159.8275
## 3349 -0.876087208  1.59326068  562.6275
## 3350  0.393161303  0.23256020  492.8225
## 3351  2.397237899 -0.15621137  626.2450
## 3352 -0.608876995 -0.35059715   94.2550
## 3353  2.464040452 -0.35059715  462.2700
## 3355 -0.642278272 -0.35059715   49.8200
## 3357  2.798053218 -1.12814028   51.0250
## 3358  0.560167686 -1.12814028   44.9100
## 3359 -0.642278272 -0.73936872  164.7150
## 3360 -0.608876995  0.03817441  148.8950
## 3361  1.695811090 -0.15621137  158.8600
## 3362 -0.876087208  0.23256020  332.6725
## 3363 -0.876087208 -0.35059715  150.2100
## 3365  0.660371516 -0.54498293   87.3950
## 3367  0.459963856 -0.54498293   62.7375
## 3369 -0.876087208  1.98203224 1114.4700
## 3370 -0.642278272 -1.12814028   55.9300
## 3371 -0.642278272 -0.15621137   74.3300
## 3373 -0.642278272  0.62133176  429.7450
## 3377  2.697849388 -0.73936872   89.2050
## 3378 -0.608876995  2.17641802  838.7950
## 3379 -0.642278272  1.01010333  272.2500
## 3380           NA -1.51691185        NA
## 3381  1.762613644 -0.73936872  230.7125
## 3383  0.326358750 -0.54498293  110.2950
## 3384  0.626970239  1.01010333  717.2350
## 3385 -0.675679548  0.62133176  322.6800
## 3386 -0.876087208  0.62133176  494.7600
## 3387 -0.608876995  1.01010333  222.3150
## 3388 -0.775883378  0.42694598  478.2900
## 3391  0.326358750 -0.54498293   74.9750
## 3393 -0.876087208  0.03817441  192.8050
## 3394 -0.642278272  1.01010333  601.0650
## 3395  0.359760026 -1.12814028   42.4175
## 3397  0.459963856 -0.54498293  102.0275
## 3398  2.397237899 -0.54498293  364.6250
```

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## 3399 -0.809284655 -0.73936872   67.5300
## 3400  2.664448112 -0.93375450  100.7550
## 3402  1.528804707 -0.15621137  133.1700
## 3403 -0.642278272  2.56518959  928.5775
## 3404  0.593568963 -0.35059715  313.7125
## 3405  0.560167686 -0.93375450   62.5100
## 3408  1.796014920 -0.73936872   48.7500
## 3409 -0.876087208  1.01010333  281.5200
## 3410 -0.742482101  1.98203224  960.9900
## 3411 -0.341666782 -0.54498293  325.1475
## 3412 -0.876087208  0.23256020  221.1125
## 3413 -0.876087208  0.62133176  735.4225
## 3414 -0.876087208  1.59326068 1409.5500
## 3415  0.493365133  0.42694598  241.9750
## 3416 -0.642278272  1.39887489  553.5775
## 3418  0.793976622 -0.93375450   60.9000
## 3419 -0.876087208 -0.35059715   92.5075
## 3420  0.393161303 -0.73936872   38.8975
## 3421 -0.542074442 -0.54498293  122.6950
## 3422 -0.642278272  1.78764646  760.3700
## 3423  0.393161303 -0.15621137  153.7700
## 3424           NA -1.51691185        NA
## 3425  1.294995771  0.03817441  218.0675
## 3426 -0.642278272  0.42694598  275.9400
## 3428  1.495403431 -1.32252606    9.5875
## 3429 -0.608876995  2.37080381  598.3725
## 3430           NA -1.51691185        NA
## 3431 -0.608876995 -0.15621137   81.5650
## 3432 -0.876087208  0.23256020  552.8400
## 3433 -0.876087208 -0.15621137  122.3800
## 3435 -0.876087208 -0.15621137  484.9875
## 3436 -0.608876995 -0.93375450  209.7825
## 3437 -0.642278272  0.23256020  295.8050
## 3438  0.259556197  0.42694598  385.2800
## 3439           NA -1.51691185        NA
## 3440 -0.709080825 -0.54498293   92.5475
## 3441 -0.876087208  0.42694598  192.5150
## 3442  0.326358750 -0.35059715  179.0250
## 3444  0.593568963  0.42694598 1024.5125
## 3445 -0.608876995  0.62133176  300.6400
## 3446 -0.642278272 -0.35059715  233.9925
## 3447 -0.642278272 -1.12814028   65.8350
## 3448  0.192753643 -0.35059715  303.0700
## 3449  0.793976622 -0.54498293   86.0525
## 3450 -0.441870612 -1.12814028   19.6225
## 3451  0.359760026  0.03817441  442.9425
## 3452 -0.642278272  1.01010333  541.6025
## 3453 -0.508673165  0.23256020  352.7750
## 3454  0.326358750 -0.35059715  223.7650
## 3455  1.562205984 -0.93375450  140.9375
## 3457  1.328397048  0.23256020  239.5800
## 3458  0.326358750 -0.35059715  153.7300
## 3459  2.330435346 -1.12814028   64.9600
## 3460  0.359760026 -0.54498293  119.8000
```

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## 3462  0.359760026  2.56518959 1126.6100
## 3463  0.393161303 -0.35059715  744.4900
## 3464  0.760575346 -0.35059715  139.1125
## 3465 -0.575475718  1.39887489  584.4450
## 3466           NA -1.51691185        NA
## 3467  1.261594495 -0.54498293  196.4900
## 3468 -0.642278272 -0.15621137  253.4225
## 3469           NA -1.51691185        NA
## 3470  0.359760026  0.03817441  219.1425
## 3472  0.560167686  0.23256020  495.0900
## 3473 -0.876087208  2.37080381  984.6975
## 3474 -0.642278272 -0.73936872   59.4375
## 3475  1.495403431 -0.73936872  240.3250
## 3476 -0.876087208  0.03817441  390.7675
## 3477  0.359760026 -0.93375450   57.1675
## 3478  0.827377899 -0.54498293   98.3125
## 3479  2.230231516 -0.73936872   35.0700
## 3480 -0.141259123 -0.73936872   60.5000
## 3481 -0.876087208  1.01010333  451.6750
## 3483 -0.408469335 -0.15621137  210.8325
## 3484           NA -1.51691185        NA
## 3488 -0.608876995 -0.15621137  157.7975
## 3489 -0.876087208  1.39887489 1031.0900
## 3490  2.464040452 -1.12814028   93.1300
## 3492 -0.608876995 -0.15621137  456.2600
## 3494  1.495403431 -0.15621137  140.6325
## 3496  0.326358750 -0.73936872  148.2250
## 3497 -0.642278272 -0.35059715  278.1975
## 3498 -0.876087208  1.01010333  284.8100
## 3499 -0.876087208  0.42694598  212.1950
## 3500  0.359760026 -0.15621137  118.5450
## 3501 -0.642278272  0.23256020  236.8425
## 3502 -0.876087208  2.17641802 1046.6025
## 3503 -0.876087208 -0.73936872   38.5250
## 3504  0.359760026 -0.15621137  619.9250
## 3505  2.898257048 -1.32252606   12.8350
## 3506 -0.876087208  0.81571754  352.6625
## 3507  1.261594495 -0.73936872   53.7200
## 3508  0.493365133  1.01010333  263.5375
## 3509 -0.876087208  0.23256020   93.8300
## 3510 -0.709080825 -0.35059715   80.6300
## 3511  0.326358750  1.01010333  757.7650
## 3512 -0.642278272  0.03817441  354.8725
## 3513  0.560167686 -0.35059715  365.9500
## 3514 -0.876087208  1.01010333  635.2950
## 3515 -0.809284655  2.95396115 1623.8875
## 3516  1.796014920 -0.73936872  121.3500
## 3517  0.359760026 -1.12814028   68.4250
## 3519 -0.876087208  1.98203224  994.6750
## 3520 -0.341666782 -0.35059715   96.7650
## 3521 -0.642278272 -0.35059715  138.7225
## 3522  1.528804707 -0.54498293  110.4375
## 3523  2.931658325 -1.32252606    4.0625
## 3524 -0.876087208 -0.54498293   92.4075
```

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## 3525  0.793976622 -0.54498293  120.8225
## 3526  0.626970239  0.03817441  157.9075
## 3527 -0.876087208  0.23256020  261.6750
## 3529 -0.876087208  0.03817441  148.0025
## 3530  0.560167686 -0.93375450   19.2750
## 3533 -0.876087208  1.01010333  330.9900
## 3534  0.159352367  0.42694598  504.5375
## 3535 -0.742482101  0.62133176  345.3475
## 3537  0.326358750  0.42694598  593.4875
## 3538  3.065263431 -1.12814028   36.4600
## 3542 -0.575475718 -0.73936872  138.5800
## 3543 -0.141259123  0.03817441  140.5200
## 3544 -0.876087208  0.81571754  381.0175
## 3545  2.497441729 -0.73936872  141.7000
## 3546 -0.642278272  1.59326068  351.4475
## 3548 -0.876087208  1.01010333  301.4300
## 3549  2.063225133 -1.12814028   32.2375
## 3551  2.731250665 -0.35059715  592.0875
## 3554 -0.876087208  0.62133176  511.5475
## 3555  0.793976622 -0.15621137  170.3800
## 3557 -0.642278272  4.70343320 3227.5200
## 3558  0.626970239 -0.35059715  226.0300
## 3559 -0.842685931  2.75957537 1698.1150
## 3561 -0.876087208  1.20448911  573.7800
## 3562 -0.876087208  1.78764646 1226.6625
## 3563 -0.608876995 -0.73936872   65.7750
## 3565  0.626970239 -0.93375450   40.9750
## 3567  3.132065984 -1.32252606   12.4500
## 3569 -0.642278272 -0.35059715  127.9825
## 3571 -0.608876995 -0.15621137  117.0900
## 3572 -0.642278272  0.23256020  135.0775
## 3574 -0.642278272  2.95396115 1940.5175
## 3575 -0.876087208  0.23256020  301.4850
## 3578  0.860779175 -1.32252606   24.1100
## 3579 -0.608876995 -0.35059715  124.8150
## 3580  1.328397048  0.42694598  220.6500
## 3581  2.230231516 -0.93375450   23.5700
## 3585 -0.375068059 -0.54498293  139.7300
## 3586  0.326358750 -0.93375450   87.7875
## 3587  1.361798324 -0.73936872   72.0900
## 3588 -0.642278272 -0.54498293  136.7275
## 3590  1.094588112 -1.32252606   45.7500
## 3591 -0.876087208 -0.54498293  124.0625
## 3594 -0.642278272 -0.73936872   31.8325
## 3595  1.695811090 -0.54498293  241.2925
## 3596  0.660371516 -1.32252606   15.0200
## 3598 -0.642278272 -1.32252606   50.7350
## 3599  0.359760026 -0.93375450  169.8200
## 3600 -0.876087208  1.20448911  334.6275
## 3601 -0.642278272  0.23256020  265.7800
## 3602  1.328397048  0.81571754  724.3650
## 3603  1.361798324 -0.35059715  364.9325
## 3604  1.528804707 -0.93375450   50.0500
## 3605  0.359760026 -0.35059715  148.7950
```

```
## 3606 -0.341666782 -0.54498293   90.4900
## 3607 -0.876087208 -0.35059715  132.4375
## 3608  0.593568963 -0.54498293   51.7825
## 3610 -0.608876995  1.01010333  287.2450
## 3611  1.495403431 -0.73936872  114.9225
## 3613  0.693772792  0.42694598  951.1150
## 3615  0.393161303 -0.54498293  105.3225
## 3616  0.326358750 -0.54498293   75.1925
## 3617  0.560167686  0.03817441  161.5125
## 3620 -0.608876995 -0.93375450   21.8500
## 3621  1.395199601 -0.15621137  293.8300
## 3622  0.693772792 -1.32252606   29.9500
## 3623 -0.876087208  0.03817441  160.7400
## 3625 -0.876087208  0.42694598  185.3425
## 3626 -0.876087208  2.56518959  669.6575
## 3627  0.793976622  0.42694598  349.3100
## 3628           NA -1.51691185        NA
## 3629 -0.876087208  0.42694598  251.4875
## 3630 -0.642278272  0.81571754  548.1200
## 3631  0.326358750  1.98203224  959.9450
## 3632  0.459963856  1.59326068 1159.3425
## 3633 -0.775883378  0.62133176  417.7225
## 3634  1.061186835 -1.32252606   66.5125
## 3636  1.829416197 -1.32252606    4.7250
## 3637 -0.876087208  0.03817441  603.6275
## 3638 -0.642278272 -0.15621137  146.9125
## 3640 -0.742482101 -0.73936872  105.6600
## 3642  1.027785558 -0.93375450   57.0400
## 3643  1.695811090 -0.73936872  187.0225
## 3644 -0.642278272  3.34273272 2143.2000
## 3645  0.326358750 -0.73936872   94.2825
## 3646  0.526766409 -0.93375450   55.9250
## 3647  2.430639176 -0.54498293  160.6825
## 3648 -0.642278272  0.42694598  177.6200
## 3649 -0.876087208  0.42694598  433.2525
## 3650           NA -1.51691185        NA
## 3651  0.292957473 -0.35059715  177.8800
## 3652 -0.876087208 -0.54498293  115.2250
## 3653 -0.876087208  1.59326068  559.2600
## 3654 -0.876087208  1.39887489  526.7475
## 3656  0.359760026  0.03817441  315.8200
## 3657  1.261594495 -0.54498293   91.5925
## 3658 -0.642278272 -0.54498293   72.2700
## 3661  0.459963856 -0.54498293  512.8050
## 3662 -0.642278272  2.75957537  760.0175
## 3664  1.629008537 -0.35059715  207.9875
## 3665  0.359760026  0.03817441  174.5825
## 3667 -0.876087208 -0.15621137  182.4475
## 3670 -0.642278272 -0.15621137  200.9175
## 3671 -0.608876995  0.23256020  317.9300
## 3672 -0.876087208  1.59326068  462.0800
## 3673 -0.876087208  0.03817441  254.3425
## 3674 -0.876087208  0.03817441  245.6900
## 3675  1.562205984 -0.35059715  230.3000
```

```
## 3676  2.664448112 -0.73936872   86.0125
## 3677 -0.642278272 -0.15621137  243.3875
## 3678  0.326358750 -1.12814028   47.0000
## 3680 -0.642278272  1.39887489  223.4550
## 3681 -0.742482101  0.23256020  232.5050
## 3683  0.326358750 -1.32252606    6.2250
## 3684  0.359760026  0.23256020  385.3525
## 3687  2.464040452 -0.54498293  148.0725
## 3688  0.393161303 -1.12814028   85.1850
## 3689 -0.876087208  1.98203224  460.5350
## 3690  0.593568963 -0.35059715  164.5600
## 3691 -0.642278272  0.81571754  293.3100
## 3692           NA -1.51691185        NA
## 3693 -0.842685931 -0.15621137  238.9750
## 3694 -0.642278272 -0.35059715   83.2525
## 3695  0.560167686 -0.54498293  119.3075
## 3696  0.359760026  0.42694598  294.1825
## 3698 -0.876087208  0.23256020  225.6850
## 3699  1.562205984 -0.73936872  122.4475
## 3700 -0.876087208 -0.35059715  456.4475
## 3701 -0.642278272 -0.54498293  186.5725
## 3702  0.626970239 -0.54498293  250.9175
## 3703 -0.876087208  1.78764646  626.7025
## 3704 -0.608876995  0.42694598  609.8100
## 3705 -0.876087208  0.23256020  141.1600
## 3707 -0.876087208  1.01010333  406.4750
## 3708 -0.876087208 -0.15621137  242.2250
## 3709  0.860779175 -0.73936872   47.2375
## 3710  0.793976622 -1.32252606   54.2625
## 3711 -0.775883378  1.59326068 1107.9550
## 3712  0.426562580  0.81571754  463.3675
## 3713 -0.876087208  0.62133176  195.8675
## 3714 -0.642278272 -0.35059715  154.9475
## 3715  2.497441729 -0.93375450  105.1050
## 3717  0.359760026  1.59326068  615.5100
## 3718  1.762613644 -1.12814028   51.1400
## 3719 -0.608876995 -0.54498293  118.1250
## 3721  0.560167686  0.42694598  311.3675
## 3722  0.860779175 -1.12814028    9.5625
## 3723 -0.876087208 -0.73936872   45.6725
## 3724 -0.642278272  1.01010333  329.3100
## 3725  0.393161303 -1.12814028   53.2500
## 3726 -0.274864229  0.23256020  299.8600
## 3727 -0.775883378  1.98203224 1233.3550
## 3728 -0.876087208  4.89781898 1666.1975
## 3729 -0.876087208  3.73150428 2202.4800
## 3730 -0.475271889 -0.54498293  231.4550
## 3732 -0.842685931  1.39887489  535.1875
## 3733  1.094588112 -1.32252606   40.1075
## 3734  0.593568963 -1.12814028  128.8100
## 3737  0.560167686  0.23256020  202.5250
## 3739 -0.642278272 -0.15621137  171.6775
## 3740 -0.876087208  0.23256020  320.8600
## 3741 -0.876087208  0.81571754  846.6350
```

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## 3742  0.459963856  0.03817441  179.5625
## 3743 -0.608876995 -0.73936872   96.8250
## 3746  1.361798324 -0.73936872  190.4200
## 3747  0.793976622 -1.12814028   45.7000
## 3748 -0.876087208 -0.93375450  116.0225
## 3749  0.560167686 -0.93375450   62.7375
## 3750 -0.642278272  0.62133176  337.5050
## 3751 -0.876087208  0.81571754  263.7725
## 3753  0.593568963 -0.54498293  230.9325
## 3754           NA -1.51691185       NA
## 3755           NA -1.51691185       NA
## 3756 -0.642278272  0.62133176  230.9625
## 3757 -0.876087208  3.14834694 1715.5525
## 3758  2.063225133 -1.32252606   49.0000
## 3759           NA -1.51691185       NA
## 3760  0.526766409 -0.15621137  113.4875
## 3762 -0.642278272 -0.15621137  136.5000
## 3763 -0.876087208  0.23256020  306.9750
## 3765 -0.608876995  0.81571754  469.9800
## 3766  1.495403431 -0.54498293   92.1975
## 3767 -0.642278272 -0.15621137  115.6200
## 3768  2.464040452 -0.93375450   52.9075
## 3769 -0.876087208  1.39887489  549.1625
## 3770 -0.608876995  1.59326068  664.3725
## 3772 -0.876087208  3.53711850  913.5875
## 3773 -0.842685931  1.78764646  463.6375
## 3774  0.793976622  1.01010333  385.4625
## 3775  0.259556197  0.62133176  269.0125
## 3777  1.261594495 -0.35059715   66.1975
## 3778  1.528804707 -0.73936872   90.8250
## 3779  0.793976622  1.01010333  470.7275
## 3780 -0.675679548  1.78764646 1794.6975
## 3781 -0.642278272 -0.54498293  214.6350
## 3782 -0.642278272  0.81571754  294.0975
## 3783 -0.642278272  0.81571754  201.5625
## 3784  0.827377899 -0.15621137  140.4550
## 3785 -0.642278272 -0.93375450   76.7800
## 3786  0.359760026 -0.35059715   97.0125
## 3790  0.426562580 -0.35059715  140.6600
## 3791  0.259556197  0.23256020  147.0200
## 3792 -0.876087208  1.20448911  374.9175
## 3793 -0.608876995  0.81571754  418.4950
## 3795 -0.876087208  1.01010333  440.8700
## 3797 -0.575475718 -0.54498293  280.4350
## 3798  0.793976622  0.42694598  190.0575
## 3799  0.793976622 -1.32252606    7.9500
## 3802 -0.809284655 -0.54498293  109.0550
## 3804  1.328397048 -0.35059715  362.2850
## 3805           NA -1.51691185       NA
## 3806 -0.876087208 -0.15621137  169.1525
## 3807 -0.608876995 -1.32252606    8.7000
## 3809  0.927581729 -1.12814028   29.5625
## 3811 -0.608876995 -0.93375450   45.6000
## 3812 -0.642278272  0.23256020  197.2950
```

```
## 3813  1.629008537 -0.73936872  111.7400
## 3815 -0.642278272  1.39887489  352.2125
## 3817 -0.876087208  0.23256020  506.6375
## 3818 -0.842685931  1.59326068 1238.3300
## 3819 -0.876087208 -0.15621137  139.8725
## 3820  2.497441729 -0.93375450   95.7000
## 3822  1.261594495  0.23256020  338.1700
## 3823 -0.642278272  0.23256020  250.9525
## 3824  0.560167686 -0.15621137  231.4750
## 3825 -0.241462952  1.39887489 1227.5975
## 3827  0.326358750 -0.54498293   97.2575
## 3828 -0.608876995  0.62133176  312.0675
## 3830  0.326358750 -1.12814028   13.8350
## 3832 -0.642278272 -0.93375450   29.1950
## 3833 -0.241462952  0.42694598  180.4625
## 3834 -0.876087208  0.03817441  621.5975
## 3836  0.660371516 -0.73936872   87.6650
## 3837  2.998460878 -1.32252606    3.5500
## 3838  0.226154920  1.59326068  524.3950
## 3839 -0.876087208 -0.15621137  211.7350
## 3840           NA -1.51691185        NA
## 3842  1.328397048 -0.15621137  253.8425
## 3843 -0.876087208 -0.54498293  158.5050
## 3844  0.226154920  1.98203224 1097.7650
## 3845 -0.642278272  0.62133176  320.4700
## 3846  1.762613644 -1.32252606    9.0250
## 3847           NA -1.51691185        NA
## 3848  0.793976622 -0.35059715  144.7525
## 3849 -0.608876995  1.01010333  820.1650
## 3850 -0.642278272 -0.35059715  272.8675
## 3852 -0.642278272  2.37080381  643.3825
## 3853 -0.876087208  1.20448911  834.7775
## 3854 -0.608876995 -1.12814028   23.4875
## 3855 -0.642278272  0.23256020  357.3125
## 3856 -0.876087208  3.14834694 1510.2150
## 3857 -0.876087208 -0.35059715  125.4000
## 3858 -0.642278272  0.62133176  609.0250
## 3859  0.560167686 -0.15621137  322.4800
## 3860  3.132065984 -1.32252606   37.5750
## 3862  1.495403431 -0.93375450   80.8550
## 3863  0.125951090 -1.32252606   82.7750
## 3865  1.595607261 -0.93375450   39.2250
## 3868  0.560167686  0.42694598  138.3700
## 3871 -0.876087208  0.03817441  239.5775
## 3872  0.493365133 -0.54498293   59.3625
## 3873 -0.876087208  1.39887489  597.8425
## 3874  1.261594495 -0.15621137  265.3650
## 3875 -0.876087208  0.62133176  536.5000
## 3876 -0.775883378 -0.73936872   69.7000
## 3877  0.560167686 -0.93375450   18.5350
## 3878  1.796014920 -0.93375450   54.8000
## 3879 -0.876087208  0.81571754  246.8450
## 3880  0.326358750 -0.35059715   66.0300
## 3881  0.560167686  0.03817441  184.1700
```

```
## 3882 -0.642278272 -0.93375450   54.3450
## 3883  0.326358750 -0.54498293  130.0450
## 3884 -0.608876995  0.42694598  288.6275
## 3885 -0.876087208  1.78764646  969.0275
## 3886  0.092549814 -0.15621137  255.3675
## 3887  0.626970239  0.03817441  461.7900
## 3891 -0.876087208  0.42694598  414.2375
## 3892  0.593568963 -1.32252606   41.4000
## 3894  1.495403431 -1.12814028   18.7875
## 3895 -0.642278272  0.81571754  480.8800
## 3896  0.459963856 -1.32252606   19.9500
## 3897 -0.876087208 -0.54498293  182.1400
## 3898 -0.608876995  0.42694598  193.6200
## 3899 -0.775883378  0.42694598  474.9150
## 3900  1.328397048 -0.15621137  367.0025
## 3901  3.165467261 -1.32252606   16.9900
## 3902  0.326358750  0.81571754  771.5400
## 3903 -0.642278272 -0.35059715  120.0575
## 3904 -0.876087208 -0.93375450   44.9500
## 3905  0.159352367 -0.73936872   85.0825
## 3906 -0.642278272  1.59326068  361.0575
## 3908 -0.876087208 -0.93375450   18.0125
## 3909 -0.642278272  2.17641802  773.2775
## 3910 -0.876087208  2.37080381 1075.4125
## 3911  1.328397048 -0.54498293  172.9625
## 3912 -0.642278272  0.81571754  875.2875
## 3913  1.963021303 -1.32252606   36.2500
## 3914  0.560167686  0.03817441  344.8750
## 3915 -0.642278272  0.23256020  185.4300
## 3916  0.326358750  0.81571754  427.3675
## 3917 -0.575475718 -0.54498293   77.5450
## 3918 -0.608876995 -0.73936872   92.6650
## 3919 -0.876087208  0.23256020  343.2575
## 3920 -0.876087208  0.42694598  289.4700
## 3921 -0.876087208  1.20448911  446.0550
## 3922 -0.709080825  2.17641802  615.7125
## 3923  0.192753643 -1.12814028   23.3100
## 3924  0.359760026  0.23256020  366.7850
## 3925 -0.876087208  1.78764646 1002.4850
## 3926 -0.876087208 -0.15621137  618.4675
## 3927 -0.876087208  1.59326068  487.0750
## 3928  0.259556197  1.78764646  969.3450
## 3931  0.626970239 -0.15621137  162.3275
## 3934 -0.876087208 -0.54498293  141.3450
## 3935  1.261594495  0.03817441  284.9125
## 3936  1.261594495 -0.35059715   92.7725
## 3937  0.626970239  0.03817441  308.9500
## 3939 -0.775883378  0.23256020  398.0675
## 3940  2.363836622 -0.93375450   61.4400
## 3942 -0.876087208  1.20448911  725.4675
## 3943  0.560167686  0.03817441  206.0525
## 3944 -0.642278272 -0.73936872  130.9000
## 3945  1.528804707 -1.12814028   24.0300
## 3946 -0.876087208  0.62133176  217.4675
```

```
## 3947 -0.642278272  0.42694598  254.1575
## 3948 -0.575475718 -1.12814028   20.7450
## 3949 -0.241462952 -0.93375450   92.9250
## 3950           NA -1.51691185        NA
## 3951  0.393161303 -0.15621137  190.0650
## 3953 -0.876087208  1.01010333  493.7675
## 3954 -0.709080825 -0.93375450   63.9800
## 3955 -0.876087208 -0.15621137  172.6250
## 3956  2.464040452 -1.12814028   51.1000
## 3957 -0.608876995  0.62133176  321.9825
## 3958 -0.608876995 -0.54498293  163.0650
## 3959 -0.876087208  0.81571754  346.1400
## 3960  2.230231516 -0.73936872  123.7575
## 3961  0.025747260 -0.93375450   79.8350
## 3962 -0.876087208  1.20448911  411.1250
## 3963  1.495403431 -0.35059715  215.6800
## 3964           NA -1.51691185        NA
## 3965 -0.642278272 -0.15621137  102.0050
## 3966 -0.308265506  1.20448911  386.7875
## 3967  1.395199601  0.62133176  921.0875
## 3968  0.359760026  2.17641802  855.9825
## 3970  0.560167686  0.23256020  211.2725
## 3971 -0.876087208  1.20448911  414.9325
## 3972 -0.876087208  4.31466163 1056.6875
## 3973 -0.775883378 -1.12814028   52.9600
## 3975  0.359760026 -1.32252606   46.2600
## 3976 -0.608876995 -0.54498293  238.1625
## 3979 -0.141259123 -0.54498293   57.1250
## 3980 -0.876087208 -0.54498293  112.8750
## 3981 -0.642278272  0.62133176  446.7075
## 3982 -0.642278272  1.20448911  746.0250
## 3984  0.626970239 -0.73936872   70.8750
## 3985 -0.642278272  0.23256020  226.5300
## 3986  0.560167686 -0.35059715  219.3175
## 3987 -0.876087208  1.98203224  654.6800
## 3988 -0.675679548 -0.15621137  142.6425
## 3989 -0.876087208  0.03817441  373.4075
## 3990  0.593568963 -0.93375450   73.7425
## 3991  1.695811090 -1.12814028   40.2000
## 3994  0.626970239 -0.54498293  138.6625
## 3996 -0.809284655 -0.35059715  266.8475
## 3997 -0.642278272  0.42694598  109.4750
## 3998 -0.876087208  3.14834694 1351.5575
## 4000  0.493365133  0.03817441  137.4625
## 4001 -0.876087208  3.34273272 2023.3800
## 4002  0.359760026  0.03817441  215.3200
## 4003  0.359760026  2.56518959 2308.2525
## 4004           NA -1.51691185        NA
## 4005  0.560167686  2.17641802  710.8250
## 4007 -0.876087208  0.42694598  265.0175
## 4009  0.359760026 -0.93375450   94.7750
## 4010  0.560167686  1.20448911  866.0850
## 4012 -0.608876995  0.81571754  540.6025
## 4013  2.464040452 -0.73936872   46.4175
```

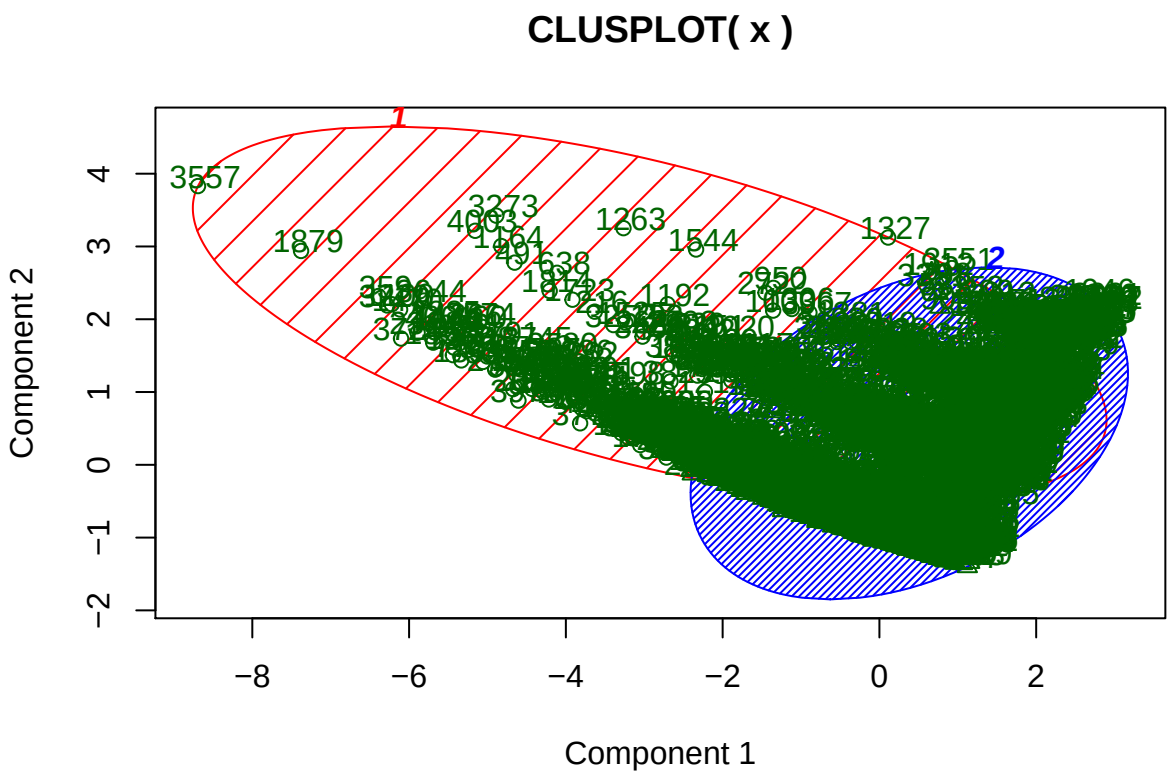
```
## 4014 -0.174660399 -1.12814028   44.9500
## 4015 -0.876087208  3.14834694 1794.2425
## 4016 -0.876087208  2.56518959 1547.1025
## 4017  0.560167686 -0.15621137  207.7450
## 4018 -0.642278272  2.37080381  897.1275
## 4019 -0.876087208  0.42694598  275.6025
## 4020  0.560167686 -0.35059715  138.9750
## 4021  0.593568963 -1.32252606    7.1875
## 4022 -0.876087208  0.42694598  173.5400
## 4023 -0.876087208 -0.73936872  140.7125
## 4027  0.626970239 -1.12814028   79.4750
## 4028           NA -1.51691185        NA
## 4030           NA -1.51691185        NA
## 4031 -0.642278272  0.42694598  508.1950
## 4032  0.326358750 -0.35059715  159.8575
## 4034  0.526766409 -0.73936872  129.7100
## 4035  0.359760026 -0.35059715  136.6500
## 4036 -0.642278272 -0.93375450   43.3300
## 4037  0.326358750 -0.93375450  319.7050
## 4038 -0.608876995 -0.54498293  404.5575
## 4041  1.261594495 -0.73936872  159.8825
## 4042 -0.876087208  0.42694598  167.7925
## 4043 -0.709080825  2.37080381 1382.9750
## 4044  2.764651942 -1.32252606   29.9500
## 4045 -0.608876995  1.01010333  301.8800
## 4047  1.027785558 -1.32252606    5.5625
## 4048  0.560167686 -0.73936872  150.2100
## 4049 -0.642278272  1.59326068  749.7575
## 4050 -0.876087208  0.81571754  193.5875
## 4051 -0.642278272 -0.93375450   70.6000
## 4052 -0.341666782 -0.73936872   71.9000
## 4053  0.326358750  0.62133176  334.7875
## 4054 -0.642278272  1.20448911  698.6275
## 4055 -0.174660399 -0.73936872  125.8275
## 4057  0.426562580 -0.15621137  520.0875
## 4058  1.462002154  0.42694598  229.6225
## 4059           NA -1.51691185        NA
## 4060 -0.642278272  0.03817441  155.0675
## 4061 -0.876087208 -0.93375450  184.5700
## 4062 -0.876087208  2.75957537 1160.2150
## 4063  1.495403431 -0.93375450   65.7575
## 4064  0.560167686 -0.73936872  106.4525
## 4065  0.593568963 -0.93375450   16.1750
## 4066 -0.642278272  0.23256020  255.1250
## 4067 -0.642278272  0.23256020  245.0200
## 4068 -0.876087208  0.03817441  157.2425
## 4069 -0.876087208 -0.54498293   82.7200
```

```
x<-data_cluster[,15:17]
x<-na.omit(x)

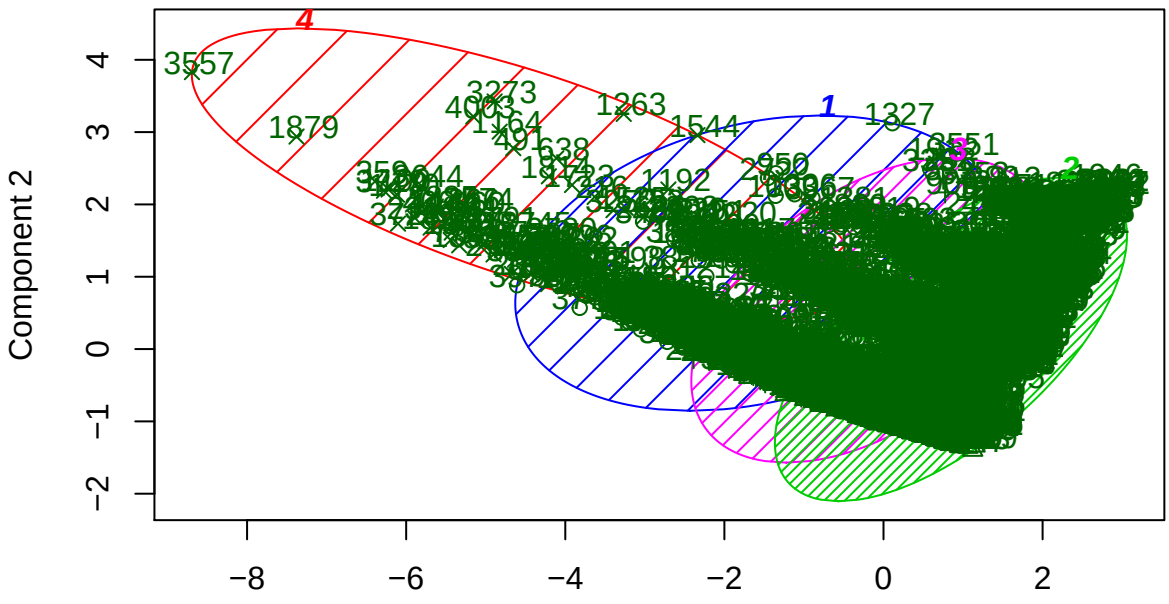
fit2<-kmeans(x,2)
y_cluster2<-fit2$cluster
head(y_cluster2)
```

```
## 1 2 3 4 5 6
## 2 1 1 2 2 2
```

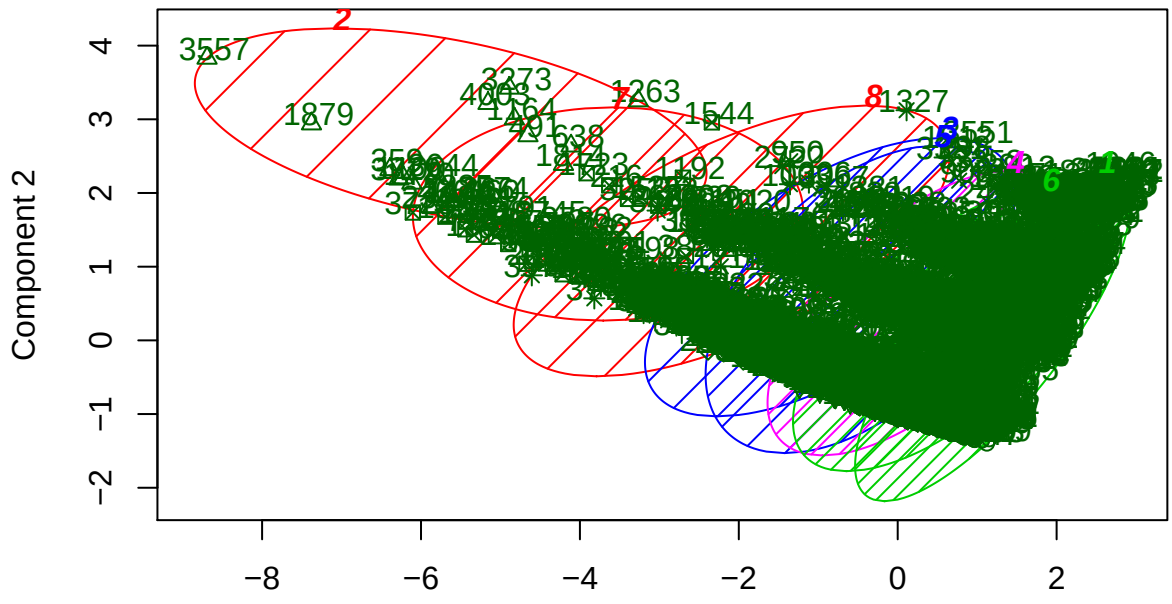
```
clusplot(x,fit2$cluster, color=TRUE, shade=TRUE, labels=2, lines=0)
```




```
fit4<-kmeans(x,4)
y_cluster4<-fit4$cluster
clusplot(x,fit4$cluster, color=TRUE, shade=TRUE, labels=2, lines=0)
```




```
fit8<-kmeans(x,8)
y_cluster8<-fit8$cluster
clusplot(x,fit8$cluster, color=TRUE, shade=TRUE, labels=2, lines=0)
```




```
# Evaluo los modelos de agregación de kmeans mediante el parámetro silhouette width
# Primero utilizo la función daisy() para hallar la matriz de disimilaridad
typeof(x)
```

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

```
x<-as.matrix(x)
typeof(x)
```

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

```
d<-daisy(x)
sk2<-silhouette(y_cluster2,d)
sk4<-silhouette(y_cluster4,d)
sk8<-silhouette(y_cluster8,d)

mean(sk2[,3])
```

```
## [1] 0.7281067
```

```
mean(sk4[,3])
```

```
## [1] 0.5969772
```

```
mean(sk8[,3])
```

```
## [1] 0.5480993
```

```
# Pruebo todo el rango de clusters que va de 2 a 10
resultados<-rep(0,10)
```

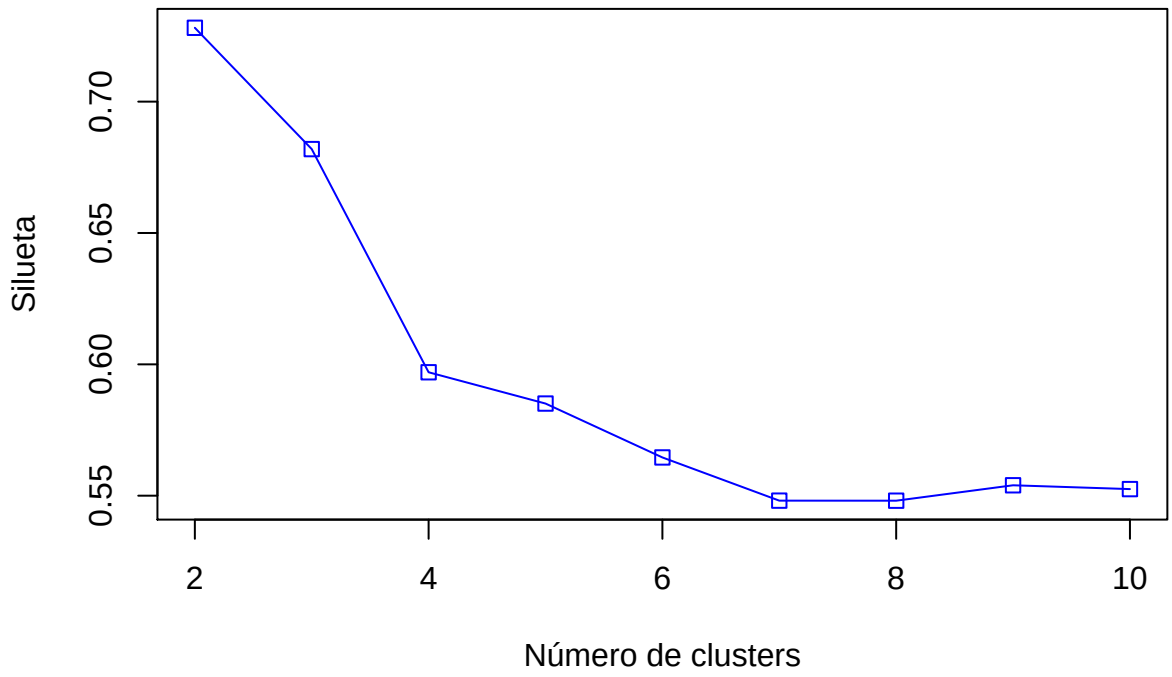
```
resultados
```

```
##  [1] 0 0 0 0 0 0 0 0 0 0
```

```
for (i in c(2,3,4,5,6,7,8,9,10)) {
  fit<-kmeans(x,i)
  y_cluster<-fit$cluster
  sk<-silhouette(y_cluster,d)
  resultados[i]<-mean(sk[,3])
}
resultados
```

```
##  [1] 0.0000000 0.7281067 0.6819366 0.5969772 0.5850718 0.5645577 0.5481148
##  [8] 0.5480993 0.5539619 0.5525104
```

```
plot(2:10, resultados[2:10], type="o", col="blue", pch=0, xlab="Número de clusters", ylab="Silueta")
```




```
# Confirmo el número de clusters óptimo utilizando la función kmeansruns()
library(fpc)
```

```
## Warning: package 'fpc' was built under R version 3.4.4
```

```
fit_ch<-kmeansruns(x, krange=1:10, criterion = "ch")
fit_asw<-kmeansruns(x, krange=1:10, criterion = "asw")
```

```
## Warning: Quick-TRANSfer stage steps exceeded maximum (= 157100)
```

```
## Warning: Quick-TRANSfer stage steps exceeded maximum (= 157100)
```

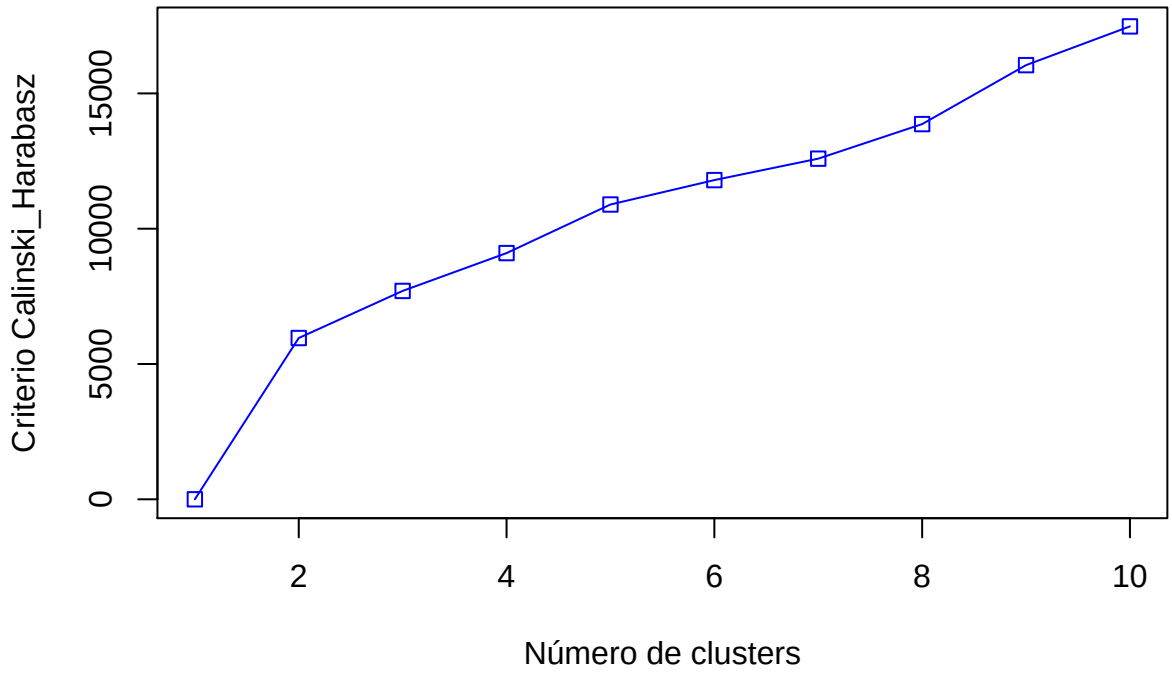
```
fit_ch$bestk
```

```
## [1] 10
```

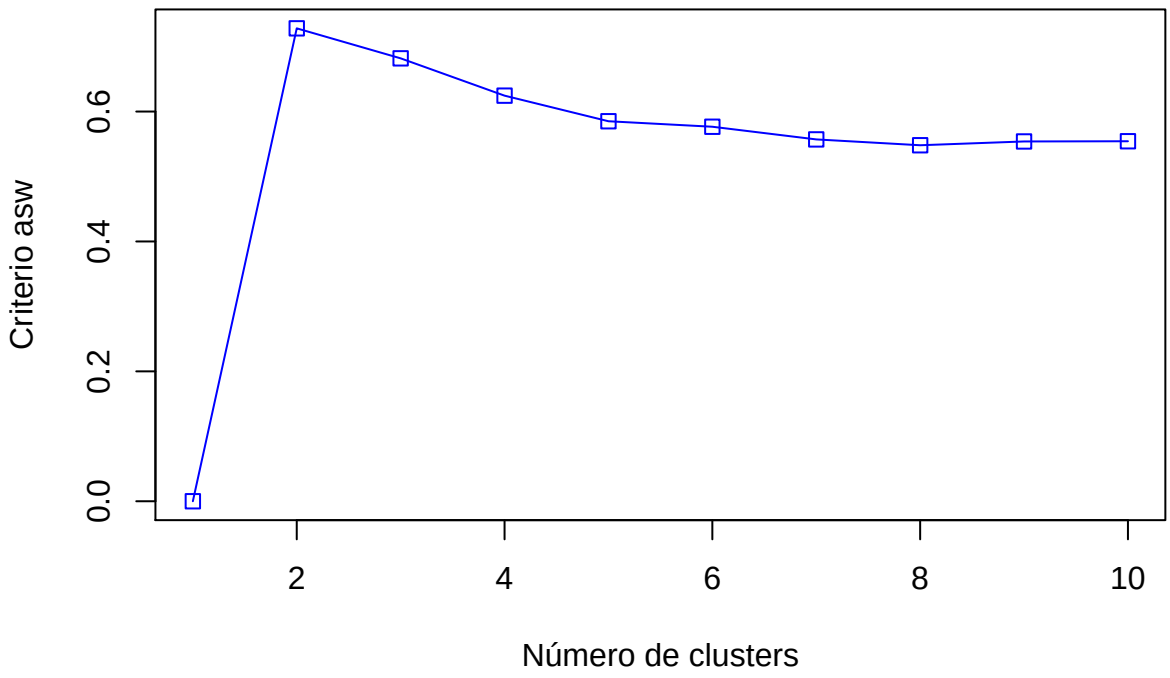
```
fit_asw$bestk
```

```
## [1] 2
```

```
plot(1:10, fit_ch$crit, type="o", col="blue", pch=0, xlab="Número de clusters",
     ylab="Criterio Calinski_Harabasz")
```




```
plot(1:10, fit_asw$crit, type="o", col="blue", pch=0, xlab="Número de clusters",
     ylab="Criterio asw")
```




```
# Partitioning clustering using k-medoids clustering
library(factoextra)
```

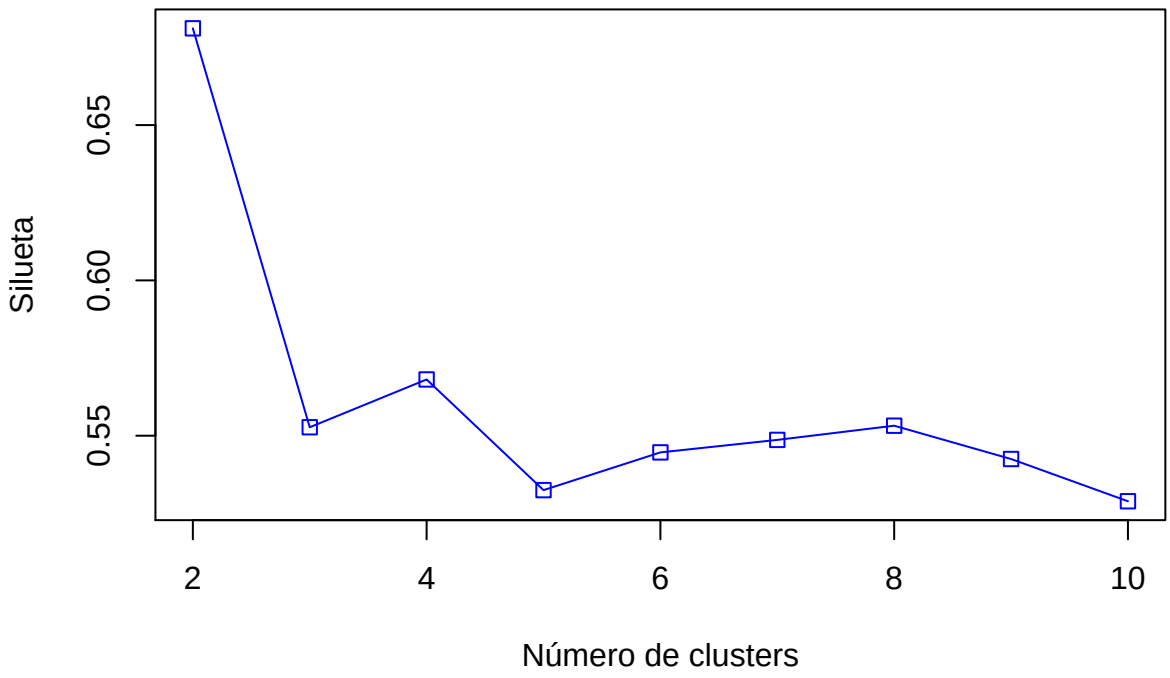
```
## Warning: package 'factoextra' was built under R version 3.4.4
```

```
## Welcome! Related Books: `Practical Guide To Cluster Analysis in R` at https://goo.gl/13EFCZ
```

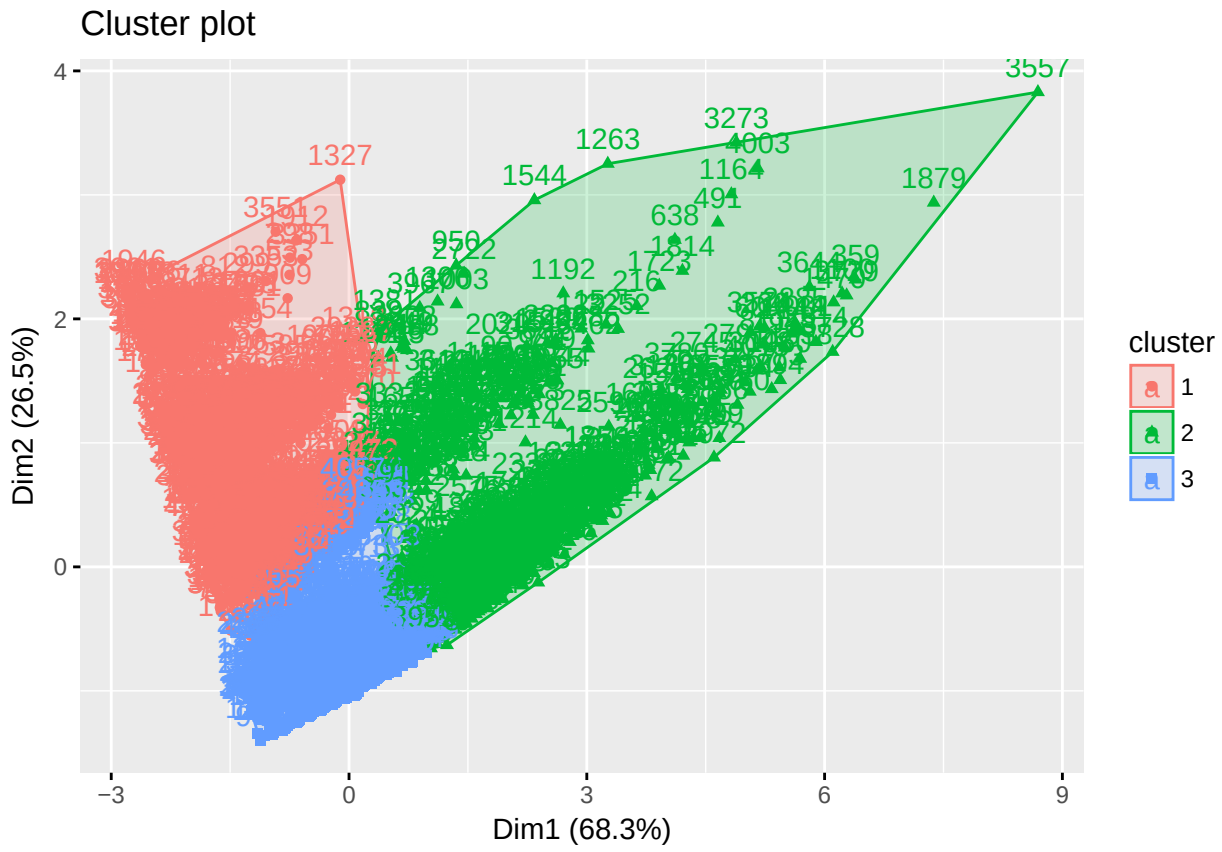
```
for (i in c(2,3,4,5,6,7,8,9,10)) {
  pam.iter <- pam(x, i)
  sk<-silhouette(pam.iter,d)
  resultados[i]<-mean(sk[,3])
}
resultados
```

```
##  [1] 0.0000000 0.6811433 0.5527233 0.5681059 0.5324766 0.5446273 0.5486542
##  [8] 0.5532201 0.5424946 0.5288995
```

```
plot(2:10, resultados[2:10], type="o", col="blue", pch=0, xlab="Número de clusters", ylab="Silueta")
```




```
pam.res<-pam(x,3, stand=TRUE)
fviz_cluster(pam.res)
```




```
clusters<-pam.res$clustering
head(clusters)
```

```
## 1 2 3 4 5 6
## 1 2 2 3 3 1
```

```
d_medoid<-as.data.frame(clusters)
head(d_medoid)
```

```
##   clusters
## 1        1
## 2        2
## 3        2
## 4        3
## 5        3
## 6        1
```

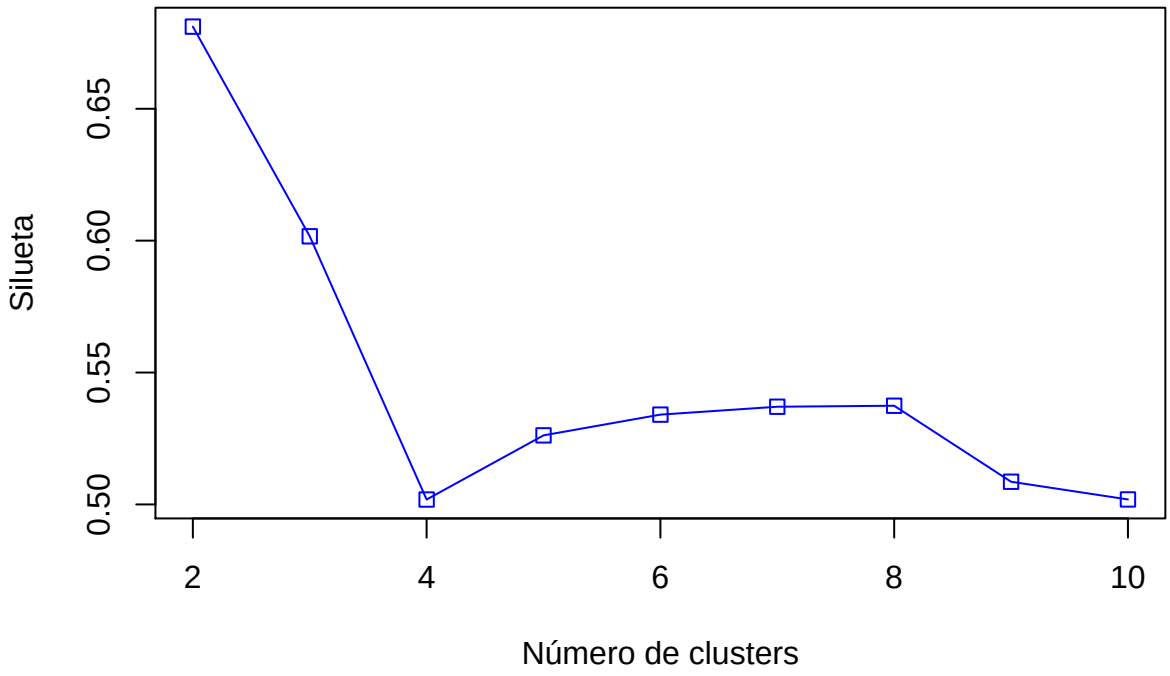
```
# Ward hierarchical clustering
d <- dist(x, method = "euclidean")
fit <- hclust(d, method="ward")
```

```
## The "ward" method has been renamed to "ward.D"; note new "ward.D2"
```

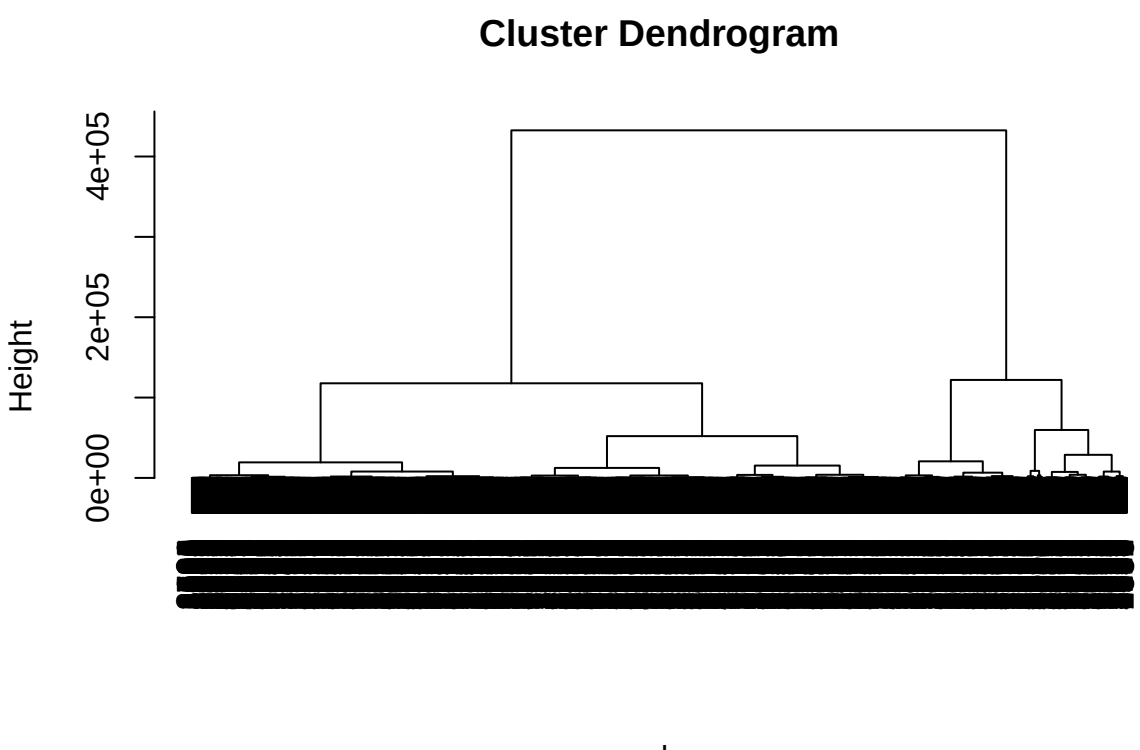
```
for (i in c(2,3,4,5,6,7,8,9,10)) {
  groups <- cutree(fit, i)
  sk<-silhouette(groups,d)
  resultados[i]<-mean(sk[,3])
}
resultados
```

```
##  [1] 0.0000000 0.6811433 0.6016481 0.5018600 0.5261816 0.5340438 0.5370381
##  [8] 0.5374181 0.5086039 0.5018878
```

```
plot(2:10, resultados[2:10], type="o", col="blue", pch=0, xlab="Número de clusters", ylab="Silueta")
```




```
plot(fit)
```




```
clusters<-cutree(fit, k=3)
head(clusters)
```

```
## 1 2 3 4 5 6
## 1 2 2 1 1 1
```

```
# Escojo los resultados de k-medoids con 3 clusters para hacer análisis
#Añado la columna "nom_tienda" a la tabla "clientes_part"
# Creamos una nueva columna "nom_tienda" en la tabla "cliente_part" y añadimos la info
cliente_part$nom_tienda<-datos_cabecera_cod$nom_tienda[match(cliente_part$cod_cliente, datos_cabecera_c
# Añado la info de los clusters a "clientes_part"
cluster_df<-cbind(x, d_medoid)
data_cluster$cluster<-cluster_df$clusters[match(data_cluster$recency, cluster_df$recency)]
cliente_part$cluster<-data_cluster$cluster[match(cliente_part$cod_cliente, data_cluster$cod_cliente)]
cliente_part$cluster<-as.factor(cliente_part$cluster)

# Análisis descriptivo entre clusters

table(cliente_part$cluster)
```

```
##
##    1    2    3
## 1115 1049  978
```

```
table(cliente_part$cluster,cliente_part$nom_tienda)
```

```
##
##     Barcelona  Florencia  Fort Lauderdale  Liverpool  Londres I
```

```
##   1        118         36               31         61        124
##   2         82         37               23         47        139
##   3        106         32               34         49        123
##
##     Londres II Madrid Manhattan I  Manhattan II Miami Beach  Milán  Munich
##   1        123     54          107           42           56    107     78
##   2        105     48          143           32           46     93     80
##   3         84     41          118           40           33     97     61
##
##     París I  París II Roma
##   1       84       25   69
##   2       77       27   70
##   3       80       20   60
```

```
tapply(cliente_part$monetary, cliente_part$cluster, mean)
```

```
##        1        2        3
## 223.5987 419.5666 298.9089
```

```
tapply(cliente_part$recency, cliente_part$cluster, mean)
```

```
##        1        2        3
## 59.61076  7.29552  8.47955
```

```
tapply(cliente_part$frequency, cliente_part$cluster, mean)
```

```
##         1         2         3
##  5.867265 10.270734  8.338446
```

```
aggregate(cliente_part[,15:17], by=list(cliente_part$cluster), mean)
```

```
##   Group.1  recency frequency monetary
## 1       1 59.61076  5.867265 223.5987
## 2       2  7.29552 10.270734 419.5666
## 3       3  8.47955  8.338446 298.9089
```

```
#ggplot(cliente_part, aes(x=cluster, y=monitery)) +
    #geom_boxplot()+
    #scale_y_continuous(labels = comma)

cliente_part<-cliente_part%>%
  group_by(cluster)%>%
  mutate(n = n()/nrow(cliente_part))

g16<-ggplot(cliente_part, aes(x=monetary, fill=cluster)) +
    geom_density(aes(weight=n),col=NA, alpha=0.35)

g17<-ggplot(cliente_part, aes(x=recency, fill=cluster)) +
    geom_density(aes(weight=n),col=NA, alpha=0.35)

g18<-ggplot(cliente_part, aes(x=frequency, fill=cluster)) +
    geom_density(aes(weight=n),col=NA, alpha=0.35)

grid<-grid.arrange(g16, g17, g18, nrow=3, ncol=1, heights=c(10,10,10))
```

```
## Warning: Removed 122 rows containing non-finite values (stat_density).
```

```
## Warning in density.default(x, weights = w, bw = bw, adjust = adjust, kernel
```

```
## = kernel, : sum(weights) != 1 -- will not get true density

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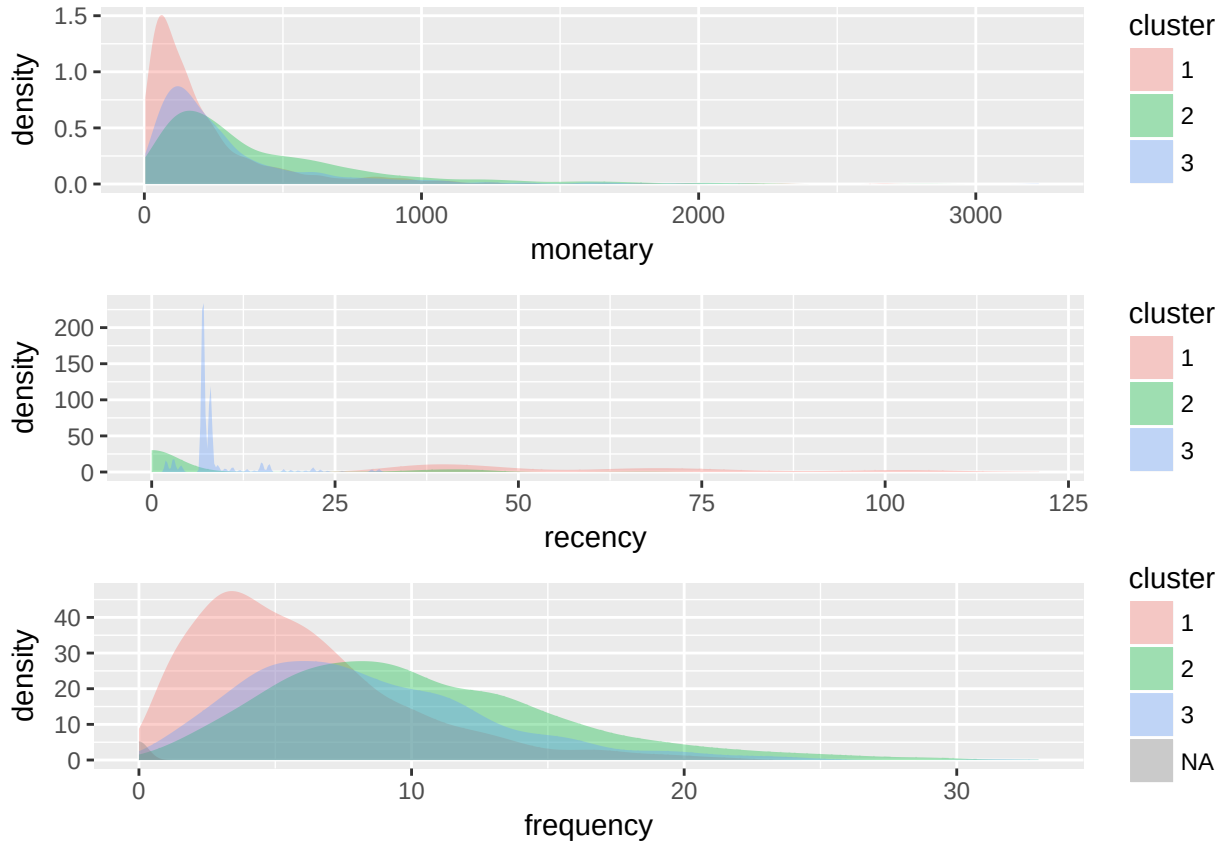

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