Examen Argumentativo

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2022-12-01

Problema 1

Se afirma que la puntuación emitida por la Prueba de inteligencia IQ de Wechsler tiene una media de 100, con distribución normal. A una muestra aleatoria de 13 personas se les aplicó la prueba y se obtuvieron los siguientes resultados:

101, 88, 126, 109, 118, 93, 144, 96, 93, 102, 102, 140, 117

Haz una estimación por intervalo de la verdadera media de la puntuación de la prueba con un nivel de confianza del 91%. Escribe tu respuesta redondeada a 2 decimales. Separa la cota inferior de la superior con una coma y emite tu respuesta entre corchetes.

```
mediaPersonas = c(101,88, 126, 109, 118, 93, 144, 96, 93, 102, 102, 140, 117)
media = mean(mediaPersonas);
varianza = var(mediaPersonas);
std = sqrt(varianza);
```

```
qnorm(pnorm(0.045), mean = media, sd = std)
```

```
## [1] 110.7336
```

```
qnorm(pnorm(1-0.045), mean = media, sd = std)
```

```
## [1] 127.124
```

¿Es factible suponer que la media de la puntuación es correcta? No ¿Por qué? No esta dentro de los limites

Problema 2

Los datos se refieren al consumo de combustible del ciclo urbano en millas por galón (mpg) y 8 atributos (variables) de los automóviles. Los datos son los siguientes

V1. mpg: millas por galón
V2. cilindros: número de cilindros
V3. mileage: número de millas recorridas
V4. horsepower: caballos de fuerza
V5. weight: peso en libras
V6. acceleration: aceleración
V7. model_year
V8. origin: nacional, extranjero, desconocido
V9. car name: marca, tipo

1. Lea los datos y asegúrese que estén limpios.

```
library(ggplot2)
M = read.csv("data2.1-3.csv")
M
```

```
##       V1 V2    V3  V4   V5   V6 V7 V8                               V9
## 1   18.0  8 307.0 130 3504 12.0 70  1            chevrolet chevelle malibu
## 2   15.0  8 350.0 165 3693 11.5 70  1                    buick skylark 320
## 3   18.0  8 318.0 150 3436 11.0 70  1                   plymouth satellite
## 4   16.0  8 304.0 150 3433 12.0 70  1                        amc rebel sst
## 5   17.0  8 302.0 140 3449 10.5 70  1                          ford torino
## 6   15.0  8 429.0 198 4341 10.0 70  1                     ford galaxie 500
## 7   14.0  8 454.0 220 4354  9.0 70  1                     chevrolet impala
## 8   14.0  8 440.0 215 4312  8.5 70  1                    plymouth fury iii
## 9   14.0  8 455.0 225 4425 10.0 70  1                     pontiac catalina
## 10  15.0  8 390.0 190 3850  8.5 70  1                   amc ambassador dpl
## 11    NA  4 133.0 115 3090 17.5 70  2                  citroen ds-21 pallas
## 12    NA  8 350.0 165 4142 11.5 70  1     chevrolet chevelle concours (sw)
## 13    NA  8 351.0 153 4034 11.0 70  1                   ford torino (sw)
## 14    NA  8 383.0 175 4166 10.5 70  1              plymouth satellite (sw)
## 15    NA  8 360.0 175 3850 11.0 70  1                   amc rebel sst (sw)
## 16  15.0  8 383.0 170 3563 10.0 70  1                  dodge challenger se
## 17  14.0  8 340.0 160 3609  8.0 70  1                   plymouth 'cuda 340
## 18    NA  8 302.0 140 3353  8.0 70  1                ford mustang boss 302
## 19  15.0  8 400.0 150 3761  9.5 70  1                chevrolet monte carlo
## 20  14.0  8 455.0 225 3086 10.0 70  1              buick estate wagon (sw)
## 21  24.0  4 113.0  95 2372 15.0 70  2                toyota corona mark ii
## 22  22.0  6 198.0  95 2833 15.5 70  1                     plymouth duster
## 23  18.0  6 199.0  97 2774 15.5 70  1                          amc hornet
## 24  21.0  6 200.0  85 2587 16.0 70  1                       ford maverick
## 25  27.0  4  97.0  88 2130 14.5 70  2                        datsun pl510
## 26  26.0  4  97.0  46 1835 20.5 70  2          volkswagen 1131 deluxe sedan
## 27  25.0  4 110.0  87 2672 17.5 70  2                         peugeot 504
## 28  24.0  4 107.0  90 2430 14.5 70  2                         audi 100 ls
## 29  25.0  4 104.0  95 2375 17.5 70  2                            saab 99e
## 30  26.0  4 121.0 113 2234 12.5 70  2                            bmw 2002
## 31  21.0  6 199.0  90 2648 15.0 70  1                         amc gremlin
## 32  10.0  8 360.0 215 4615 14.0 70  1                           ford f250
## 33  10.0  8 307.0 200 4376 15.0 70  1                           chevy c20
## 34  11.0  8 318.0 210 4382 13.5 70  1                          dodge d200
## 35   9.0  8 304.0 193 4732 18.5 70  1                            hi 1200d
## 36  27.0  4  97.0  88 2130 14.5 71  2                        datsun pl510
## 37  28.0  4 140.0  90 2264 15.5 71  1                  chevrolet vega 2300
## 38  25.0  4 113.0  95 2228 14.0 71  2                        toyota corona
## 39  25.0  4  98.0  NA 2046 19.0 71  1                           ford pinto
## 40    NA  4  97.0  48 1978 20.0 71  2           volkswagen super beetle 117
## 41  19.0  6 232.0 100 2634 13.0 71  1                         amc gremlin
## 42  16.0  6 225.0 105 3439 15.5 71  1              plymouth satellite custom
## 43  17.0  6 250.0 100 3329 15.5 71  1              chevrolet chevelle malibu
## 44  19.0  6 250.0  88 3302 15.5 71  1                        ford torino 500
## 45  18.0  6 232.0 100 3288 15.5 71  1                         amc matador
## 46  14.0  8 350.0 165 4209 12.0 71  1                     chevrolet impala
## 47  14.0  8 400.0 175 4464 11.5 71  1              pontiac catalina brougham
## 48  14.0  8 351.0 153 4154 13.5 71  1                        ford galaxie 500
## 49  14.0  8 318.0 150 4096 13.0 71  1                       plymouth fury iii
## 50  12.0  8 383.0 180 4955 11.5 71  1                       dodge monaco (sw)
## 51  13.0  8 400.0 170 4746 12.0 71  1              ford country squire (sw)
## 52  13.0  8 400.0 175 5140 12.0 71  1                    pontiac safari (sw)
## 53  18.0  6 258.0 110 2962 13.5 71  1             amc hornet sportabout (sw)
## 54  22.0  4 140.0  72 2408 19.0 71  1                     chevrolet vega (sw)
## 55  19.0  6 250.0 100 3282 15.0 71  1                        pontiac firebird
## 56  18.0  6 250.0  88 3139 14.5 71  1                            ford mustang
## 57  23.0  4 122.0  86 2220 14.0 71  1                    mercury capri 2000
## 58  28.0  4 116.0  90 2123 14.0 71  2                             opel 1900
## 59  30.0  4  79.0  70 2074 19.5 71  2                         peugeot 304
## 60  30.0  4  88.0  76 2065 14.5 71  2                           fiat 124b
## 61  31.0  4  71.0  65 1773 19.0 71  2                  toyota corolla 1200
## 62  35.0  4  72.0  69 1613 18.0 71  2                         datsun 1200
## 63  27.0  4  97.0  60 1834 19.0 71  2                volkswagen model 111
```

```
## 64  26.0  4  91.0  70 1955 20.5 71  1                    plymouth cricket
## 65  24.0  4 113.0  95 2278 15.5 72  2                toyota corona hardtop
## 66  25.0  4  97.5  80 2126 17.0 72  1                   dodge colt hardtop
## 67  23.0  4  97.0  54 2254 23.5 72  2                   volkswagen type 3
## 68  20.0  4 140.0  90 2408 19.5 72  1                      chevrolet vega
## 69  21.0  4 122.0  86 2226 16.5 72  1                  ford pinto runabout
## 70  13.0  8 350.0 165 4274 12.0 72  1                     chevrolet impala
## 71  14.0  8 400.0 175 4385 12.0 72  1                     pontiac catalina
## 72  15.0  8 318.0 150 4135 13.5 72  1                    plymouth fury iii
## 73  14.0  8 351.0 153 4129 13.0 72  1                     ford galaxie 500
## 74  17.0  8 304.0 150 3672 11.5 72  1                   amc ambassador sst
## 75  11.0  8 429.0 208 4633 11.0 72  1                      mercury marquis
## 76  13.0  8 350.0 155 4502 13.5 72  1                buick lesabre custom
## 77  12.0  8 350.0 160 4456 13.5 72  1           oldsmobile delta 88 royale
## 78  13.0  8 400.0 190 4422 12.5 72  1              chrysler newport royal
## 79  19.0  3  70.0  97 2330 13.5 72  2                      mazda rx2 coupe
## 80  15.0  8 304.0 150 3892 12.5 72  1                     amc matador (sw)
## 81  13.0  8 307.0 130 4098 14.0 72  1     chevrolet chevelle concours (sw)
## 82  13.0  8 302.0 140 4294 16.0 72  1               ford gran torino (sw)
## 83  14.0  8 318.0 150 4077 14.0 72  1       plymouth satellite custom (sw)
## 84  18.0  4 121.0 112 2933 14.5 72  2                      volvo 145e (sw)
## 85  22.0  4 121.0  76 2511 18.0 72  2                  volkswagen 411 (sw)
## 86  21.0  4 120.0  87 2979 19.5 72  2                     peugeot 504 (sw)
## 87  26.0  4  96.0  69 2189 18.0 72  2                      renault 12 (sw)
## 88  22.0  4 122.0  86 2395 16.0 72  1                      ford pinto (sw)
## 89  28.0  4  97.0  92 2288 17.0 72  2                      datsun 510 (sw)
## 90  23.0  4 120.0  97 2506 14.5 72  2          toyouta corona mark ii (sw)
## 91  28.0  4  98.0  80 2164 15.0 72  1                      dodge colt (sw)
## 92  27.0  4  97.0  88 2100 16.5 72  2             toyota corolla 1600 (sw)
## 93  13.0  8 350.0 175 4100 13.0 73  1                    buick century 350
## 94  14.0  8 304.0 150 3672 11.5 73  1                         amc matador
## 95  13.0  8 350.0 145 3988 13.0 73  1                     chevrolet malibu
## 96  14.0  8 302.0 137 4042 14.5 73  1                     ford gran torino
## 97  15.0  8 318.0 150 3777 12.5 73  1                dodge coronet custom
## 98  12.0  8 429.0 198 4952 11.5 73  1               mercury marquis brougham
## 99  13.0  8 400.0 150 4464 12.0 73  1              chevrolet caprice classic
## 100 13.0  8 351.0 158 4363 13.0 73  1                          ford ltd
## 101 14.0  8 318.0 150 4237 14.5 73  1             plymouth fury gran sedan
## 102 13.0  8 440.0 215 4735 11.0 73  1          chrysler new yorker brougham
## 103 12.0  8 455.0 225 4951 11.0 73  1              buick electra 225 custom
## 104 13.0  8 360.0 175 3821 11.0 73  1               amc ambassador brougham
## 105 18.0  6 225.0 105 3121 16.5 73  1                      plymouth valiant
## 106 16.0  6 250.0 100 3278 18.0 73  1                 chevrolet nova custom
## 107 18.0  6 232.0 100 2945 16.0 73  1                        amc hornet
## 108 18.0  6 250.0  88 3021 16.5 73  1                     ford maverick
## 109 23.0  6 198.0  95 2904 16.0 73  1                    plymouth duster
## 110 26.0  4  97.0  46 1950 21.0 73  2              volkswagen super beetle
## 111 11.0  8 400.0 150 4997 14.0 73  1                      chevrolet impala
## 112 12.0  8 400.0 167 4906 12.5 73  1                         ford country
## 113 13.0  8 360.0 170 4654 13.0 73  1               plymouth custom suburb
## 114 12.0  8 350.0 180 4499 12.5 73  1              oldsmobile vista cruiser
## 115 18.0  6 232.0 100 2789 15.0 73  1                          amc gremlin
## 116 20.0  4  97.0  88 2279 19.0 73  2                       toyota carina
## 117 21.0  4 140.0  72 2401 19.5 73  1                      chevrolet vega
## 118 22.0  4 108.0  94 2379 16.5 73  2                          datsun 610
## 119 18.0  3  70.0  90 2124 13.5 73  2                           maxda rx3
## 120 19.0  4 122.0  85 2310 18.5 73  1                          ford pinto
## 121 21.0  6 155.0 107 2472 14.0 73  1                     mercury capri v6
## 122 26.0  4  98.0  90 2265 15.5 73  2                 fiat 124 sport coupe
## 123 15.0  8 350.0 145 4082 13.0 73  1               chevrolet monte carlo s
## 124 16.0  8 400.0 230 4278  9.5 73  1                    pontiac grand prix
## 125 29.0  4  68.0  49 1867 19.5 73  2                             fiat 128
## 126 24.0  4 116.0  75 2158 15.5 73  2                         opel manta
## 127 20.0  4 114.0  91 2582 14.0 73  2                         audi 100ls
```

```
## 128 19.0  4 121.0 112 2868 15.5 73  2                       volvo 144ea
## 129 15.0  8 318.0 150 3399 11.0 73  1                   dodge dart custom
## 130 24.0  4 121.0 110 2660 14.0 73  2                           saab 99le
## 131 20.0  6 156.0 122 2807 13.5 73  2                      toyota mark ii
## 132 11.0  8 350.0 180 3664 11.0 73  1                    oldsmobile omega
## 133 20.0  6 198.0  95 3102 16.5 74  1                    plymouth duster
## 134 21.0  6 200.0  NA 2875 17.0 74  1                      ford maverick
## 135 19.0  6 232.0 100 2901 16.0 74  1                         amc hornet
## 136 15.0  6 250.0 100 3336 17.0 74  1                     chevrolet nova
## 137 31.0  4  79.0  67 1950 19.0 74  2                        datsun b210
## 138 26.0  4 122.0  80 2451 16.5 74  1                         ford pinto
## 139 32.0  4  71.0  65 1836 21.0 74  2                 toyota corolla 1200
## 140 25.0  4 140.0  75 2542 17.0 74  1                      chevrolet vega
## 141 16.0  6 250.0 100 3781 17.0 74  1    chevrolet chevelle malibu classic
## 142 16.0  6 258.0 110 3632 18.0 74  1                       amc matador
## 143 18.0  6 225.0 105 3613 16.5 74  1           plymouth satellite sebring
## 144 16.0  8 302.0 140 4141 14.0 74  1                   ford gran torino
## 145 13.0  8 350.0 150 4699 14.5 74  1             buick century luxus (sw)
## 146 14.0  8 318.0 150 4457 13.5 74  1            dodge coronet custom (sw)
## 147 14.0  8 302.0 140 4638 16.0 74  1                ford gran torino (sw)
## 148 14.0  8 304.0 150 4257 15.5 74  1                     amc matador (sw)
## 149 29.0  4  98.0  83 2219 16.5 74  2                           audi fox
## 150 26.0  4  79.0  67 1963 15.5 74  2                   volkswagen dasher
## 151 26.0  4  97.0  78 2300 14.5 74  2                          opel manta
## 152 31.0  4  76.0  52 1649 16.5 74  2                      toyota corona
## 153 32.0  4  83.0  61 2003 19.0 74  2                         datsun 710
## 154 28.0  4  90.0  75 2125 14.5 74  1                         dodge colt
## 155 24.0  4  90.0  75 2108 15.5 74  2                           fiat 128
## 156 26.0  4 116.0  75 2246 14.0 74  2                       fiat 124 tc
## 157 24.0  4 120.0  97 2489 15.0 74  2                       honda civic
## 158 26.0  4 108.0  93 2391 15.5 74  2                            subaru
## 159 31.0  4  79.0  67 2000 16.0 74  2                         fiat x1.9
## 160 19.0  6 225.0  95 3264 16.0 75  1              plymouth valiant custom
## 161 18.0  6 250.0 105 3459 16.0 75  1                     chevrolet nova
## 162 15.0  6 250.0  72 3432 21.0 75  1                    mercury monarch
## 163 15.0  6 250.0  72 3158 19.5 75  1                      ford maverick
## 164 16.0  8 400.0 170 4668 11.5 75  1                    pontiac catalina
## 165 15.0  8 350.0 145 4440 14.0 75  1                   chevrolet bel air
## 166 16.0  8 318.0 150 4498 14.5 75  1                 plymouth grand fury
## 167 14.0  8 351.0 148 4657 13.5 75  1                           ford ltd
## 168 17.0  6 231.0 110 3907 21.0 75  1                      buick century
## 169 16.0  6 250.0 105 3897 18.5 75  1            chevroelt chevelle malibu
## 170 15.0  6 258.0 110 3730 19.0 75  1                       amc matador
## 171 18.0  6 225.0  95 3785 19.0 75  1                      plymouth fury
## 172 21.0  6 231.0 110 3039 15.0 75  1                      buick skyhawk
## 173 20.0  8 262.0 110 3221 13.5 75  1                 chevrolet monza 2+2
## 174 13.0  8 302.0 129 3169 12.0 75  1                     ford mustang ii
## 175 29.0  4  97.0  75 2171 16.0 75  2                     toyota corolla
## 176 23.0  4 140.0  83 2639 17.0 75  1                         ford pinto
## 177 20.0  6 232.0 100 2914 16.0 75  1                       amc gremlin
## 178 23.0  4 140.0  78 2592 18.5 75  1                     pontiac astro
## 179 24.0  4 134.0  96 2702 13.5 75  2                     toyota corona
## 180 25.0  4  90.0  71 2223 16.5 75  2                   volkswagen dasher
## 181 24.0  4 119.0  97 2545 17.0 75  2                          datsun 710
## 182 18.0  6 171.0  97 2984 14.5 75  1                         ford pinto
## 183 29.0  4  90.0  70 1937 14.0 75  2                   volkswagen rabbit
## 184 19.0  6 232.0  90 3211 17.0 75  1                           amc pacer
## 185 23.0  4 115.0  95 2694 15.0 75  2                          audi 100ls
## 186 23.0  4 120.0  88 2957 17.0 75  2                        peugeot 504
## 187 22.0  4 121.0  98 2945 14.5 75  2                        volvo 244dl
## 188 25.0  4 121.0 115 2671 13.5 75  2                           saab 99le
## 189 33.0  4  91.0  53 1795 17.5 75  2                    honda civic cvcc
## 190 28.0  4 107.0  86 2464 15.5 76  2                           fiat 131
## 191 25.0  4 116.0  81 2220 16.9 76  2                          opel 1900
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## 192 25.0  4 140.0  92 2572 14.9 76  1                          capri ii
## 193 26.0  4  98.0  79 2255 17.7 76  1                     dodge colt
## 194 27.0  4 101.0  83 2202 15.3 76  2                    renault 12tl
## 195 17.5  8 305.0 140 4215 13.0 76  1    chevrolet chevelle malibu classic
## 196 16.0  8 318.0 150 4190 13.0 76  1            dodge coronet brougham
## 197 15.5  8 304.0 120 3962 13.9 76  1                       amc matador
## 198 14.5  8 351.0 152 4215 12.8 76  1                 ford gran torino
## 199 22.0  6 225.0 100 3233 15.4 76  1                 plymouth valiant
## 200 22.0  6 250.0 105 3353 14.5 76  1                   chevrolet nova
## 201 24.0  6 200.0  81 3012 17.6 76  1                    ford maverick
## 202 22.5  6 232.0  90 3085 17.6 76  1                       amc hornet
## 203 29.0  4  85.0  52 2035 22.2 76  1                chevrolet chevette
## 204 24.5  4  98.0  60 2164 22.1 76  1                   chevrolet woody
## 205 29.0  4  90.0  70 1937 14.2 76  2                         vw rabbit
## 206 33.0  4  91.0  53 1795 17.4 76  2                     honda civic
## 207 20.0  6 225.0 100 3651 17.7 76  1                  dodge aspen se
## 208 18.0  6 250.0  78 3574 21.0 76  1                ford granada ghia
## 209 18.5  6 250.0 110 3645 16.2 76  1                pontiac ventura sj
## 210 17.5  6 258.0  95 3193 17.8 76  1                     amc pacer d/l
## 211 29.5  4  97.0  71 1825 12.2 76  2                volkswagen rabbit
## 212 32.0  4  85.0  70 1990 17.0 76  2                     datsun b-210
## 213 28.0  4  97.0  75 2155 16.4 76  2                   toyota corolla
## 214 26.5  4 140.0  72 2565 13.6 76  1                       ford pinto
## 215 20.0  4 130.0 102 3150 15.7 76  2                        volvo 245
## 216 13.0  8 318.0 150 3940 13.2 76  1          plymouth volare premier v8
## 217 19.0  4 120.0  88 3270 21.9 76  2                     peugeot 504
## 218 19.0  6 156.0 108 2930 15.5 76  2                   toyota mark ii
## 219 16.5  6 168.0 120 3820 16.7 76  2                mercedes-benz 280s
## 220 16.5  8 350.0 180 4380 12.1 76  1                  cadillac seville
## 221 13.0  8 350.0 145 4055 12.0 76  1                         chevy c10
## 222 13.0  8 302.0 130 3870 15.0 76  1                         ford f108
## 223 13.0  8 318.0 150 3755 14.0 76  1                        dodge d100
## 224 31.5  4  98.0  68 2045 18.5 77  2                honda accord cvcc
## 225 30.0  4 111.0  80 2155 14.8 77  1            buick opel isuzu deluxe
## 226 36.0  4  79.0  58 1825 18.6 77  2                      renault 5 gtl
## 227 25.5  4 122.0  96 2300 15.5 77  1                plymouth arrow gs
## 228 33.5  4  85.0  70 1945 16.8 77  2              datsun f-10 hatchback
## 229 17.5  8 305.0 145 3880 12.5 77  1          chevrolet caprice classic
## 230 17.0  8 260.0 110 4060 19.0 77  1          oldsmobile cutlass supreme
## 231 15.5  8 318.0 145 4140 13.7 77  1              dodge monaco brougham
## 232 15.0  8 302.0 130 4295 14.9 77  1             mercury cougar brougham
## 233 17.5  6 250.0 110 3520 16.4 77  1                  chevrolet concours
## 234 20.5  6 231.0 105 3425 16.9 77  1                       buick skylark
## 235 19.0  6 225.0 100 3630 17.7 77  1               plymouth volare custom
## 236 18.5  6 250.0  98 3525 19.0 77  1                        ford granada
## 237 16.0  8 400.0 180 4220 11.1 77  1                pontiac grand prix lj
## 238 15.5  8 350.0 170 4165 11.4 77  1         chevrolet monte carlo landau
## 239 15.5  8 400.0 190 4325 12.2 77  1                chrysler cordoba
## 240 16.0  8 351.0 149 4335 14.5 77  1                ford thunderbird
## 241 29.0  4  97.0  78 1940 14.5 77  2             volkswagen rabbit custom
## 242 24.5  4 151.0  88 2740 16.0 77  1                pontiac sunbird coupe
## 243 26.0  4  97.0  75 2265 18.2 77  2               toyota corolla liftback
## 244 25.5  4 140.0  89 2755 15.8 77  1                   ford mustang ii 2+2
## 245 30.5  4  98.0  63 2051 17.0 77  1                chevrolet chevette
## 246 33.5  4  98.0  83 2075 15.9 77  1                    dodge colt m/m
## 247 30.0  4  97.0  67 1985 16.4 77  2                         subaru dl
## 248 30.5  4  97.0  78 2190 14.1 77  2                volkswagen dasher
## 249 22.0  6 146.0  97 2815 14.5 77  2                        datsun 810
## 250 21.5  4 121.0 110 2600 12.8 77  2                          bmw 320i
## 251 21.5  3  80.0 110 2720 13.5 77  2                      mazda rx-4
## 252 43.1  4  90.0  48 1985 21.5 78  2      volkswagen rabbit custom diesel
## 253 36.1  4  98.0  66 1800 14.4 78  1                      ford fiesta
## 254 32.8  4  78.0  52 1985 19.4 78  2                  mazda glc deluxe
## 255 39.4  4  85.0  70 2070 18.6 78  2                    datsun b210 gx
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## 256 36.1  4  91.0  60 1800 16.4 78  2                    honda civic cvcc
## 257 19.9  8 260.0 110 3365 15.5 78  1    oldsmobile cutlass salon brougham
## 258 19.4  8 318.0 140 3735 13.2 78  1                      dodge diplomat
## 259 20.2  8 302.0 139 3570 12.8 78  1                 mercury monarch ghia
## 260 19.2  6 231.0 105 3535 19.2 78  1                   pontiac phoenix lj
## 261 20.5  6 200.0  95 3155 18.2 78  1                     chevrolet malibu
## 262 20.2  6 200.0  85 2965 15.8 78  1                  ford fairmont (auto)
## 263 25.1  4 140.0  88 2720 15.4 78  1                  ford fairmont (man)
## 264 20.5  6 225.0 100 3430 17.2 78  1                      plymouth volare
## 265 19.4  6 232.0  90 3210 17.2 78  1                         amc concord
## 266 20.6  6 231.0 105 3380 15.8 78  1                buick century special
## 267 20.8  6 200.0  85 3070 16.7 78  1                       mercury zephyr
## 268 18.6  6 225.0 110 3620 18.7 78  1                          dodge aspen
## 269 18.1  6 258.0 120 3410 15.1 78  1                      amc concord d/l
## 270 19.2  8 305.0 145 3425 13.2 78  1         chevrolet monte carlo landau
## 271 17.7  6 231.0 165 3445 13.4 78  1      buick regal sport coupe (turbo)
## 272 18.1  8 302.0 139 3205 11.2 78  1                        ford futura
## 273 17.5  8 318.0 140 4080 13.7 78  1                     dodge magnum xe
## 274 30.0  4  98.0  68 2155 16.5 78  1                  chevrolet chevette
## 275 27.5  4 134.0  95 2560 14.2 78  2                      toyota corona
## 276 27.2  4 119.0  97 2300 14.7 78  2                         datsun 510
## 277 30.9  4 105.0  75 2230 14.5 78  1                         dodge omni
## 278 21.1  4 134.0  95 2515 14.8 78  2            toyota celica gt liftback
## 279 23.2  4 156.0 105 2745 16.7 78  1                    plymouth sapporo
## 280 23.8  4 151.0  85 2855 17.6 78  1               oldsmobile starfire sx
## 281 23.9  4 119.0  97 2405 14.9 78  2                      datsun 200-sx
## 282 20.3  5 131.0 103 2830 15.9 78  2                          audi 5000
## 283 17.0  6 163.0 125 3140 13.6 78  2                        volvo 264gl
## 284 21.6  4 121.0 115 2795 15.7 78  2                         saab 99gle
## 285 16.2  6 163.0 133 3410 15.8 78  2                     peugeot 604sl
## 286 31.5  4  89.0  71 1990 14.9 78  2                 volkswagen scirocco
## 287 29.5  4  98.0  68 2135 16.6 78  2                     honda accord lx
## 288 21.5  6 231.0 115 3245 15.4 79  1                   pontiac lemans v6
## 289 19.8  6 200.0  85 2990 18.2 79  1                    mercury zephyr 6
## 290 22.3  4 140.0  88 2890 17.3 79  1                     ford fairmont 4
## 291 20.2  6 232.0  90 3265 18.2 79  1                    amc concord dl 6
## 292 20.6  6 225.0 110 3360 16.6 79  1                       dodge aspen 6
## 293 17.0  8 305.0 130 3840 15.4 79  1            chevrolet caprice classic
## 294 17.6  8 302.0 129 3725 13.4 79  1                      ford ltd landau
## 295 16.5  8 351.0 138 3955 13.2 79  1                mercury grand marquis
## 296 18.2  8 318.0 135 3830 15.2 79  1                      dodge st. regis
## 297 16.9  8 350.0 155 4360 14.9 79  1               buick estate wagon (sw)
## 298 15.5  8 351.0 142 4054 14.3 79  1              ford country squire (sw)
## 299 19.2  8 267.0 125 3605 15.0 79  1        chevrolet malibu classic (sw)
## 300 18.5  8 360.0 150 3940 13.0 79  1 chrysler lebaron town @ country (sw)
## 301 31.9  4  89.0  71 1925 14.0 79  2                      vw rabbit custom
## 302 34.1  4  86.0  65 1975 15.2 79  2                     maxda glc deluxe
## 303 35.7  4  98.0  80 1915 14.4 79  1          dodge colt hatchback custom
## 304 27.4  4 121.0  80 2670 15.0 79  1                       amc spirit dl
## 305 25.4  5 183.0  77 3530 20.1 79  2                   mercedes benz 300d
## 306 23.0  8 350.0 125 3900 17.4 79  1                   cadillac eldorado
## 307 27.2  4 141.0  71 3190 24.8 79  2                        peugeot 504
## 308 23.9  8 260.0  90 3420 22.2 79  1    oldsmobile cutlass salon brougham
## 309 34.2  4 105.0  70 2200 13.2 79  1                     plymouth horizon
## 310 34.5  4 105.0  70 2150 14.9 79  1                plymouth horizon tc3
## 311 31.8  4  85.0  65 2020 19.2 79  2                          datsun 210
## 312 37.3  4  91.0  69 2130 14.7 79  2                   fiat strada custom
## 313 28.4  4 151.0  90 2670 16.0 79  1                buick skylark limited
## 314 28.8  6 173.0 115 2595 11.3 79  1                   chevrolet citation
## 315 26.8  6 173.0 115 2700 12.9 79  1            oldsmobile omega brougham
## 316 33.5  4 151.0  90 2556 13.2 79  1                      pontiac phoenix
## 317 41.5  4  98.0  76 2144 14.7 80  2                            vw rabbit
## 318 38.1  4  89.0  60 1968 18.8 80  2                toyota corolla tercel
## 319 32.1  4  98.0  70 2120 15.5 80  1                   chevrolet chevette
```

```
## 320 37.2  4  86.0  65 2019 16.4 80  2                      datsun 310
## 321 28.0  4 151.0  90 2678 16.5 80  1                chevrolet citation
## 322 26.4  4 140.0  88 2870 18.1 80  1                     ford fairmont
## 323 24.3  4 151.0  90 3003 20.1 80  1                       amc concord
## 324 19.1  6 225.0  90 3381 18.7 80  1                       dodge aspen
## 325 34.3  4  97.0  78 2188 15.8 80  2                        audi 4000
## 326 29.8  4 134.0  90 2711 15.5 80  2             toyota corona liftback
## 327 31.3  4 120.0  75 2542 17.5 80  2                         mazda 626
## 328 37.0  4 119.0  92 2434 15.0 80  2               datsun 510 hatchback
## 329 32.2  4 108.0  75 2265 15.2 80  2                     toyota corolla
## 330 46.6  4  86.0  65 2110 17.9 80  2                          mazda glc
## 331 27.9  4 156.0 105 2800 14.4 80  1                         dodge colt
## 332 40.8  4  85.0  65 2110 19.2 80  2                         datsun 210
## 333 44.3  4  90.0  48 2085 21.7 80  2               vw rabbit c (diesel)
## 334 43.4  4  90.0  48 2335 23.7 80  2                 vw dasher (diesel)
## 335 36.4  5 121.0  67 2950 19.9 80  2                audi 5000s (diesel)
## 336 30.0  4 146.0  67 3250 21.8 80  2                mercedes-benz 240d
## 337 44.6  4  91.0  67 1850 13.8 80  2                 honda civic 1500 gl
## 338 40.9  4  85.0  NA 1835 17.3 80  2               renault lecar deluxe
## 339 33.8  4  97.0  67 2145 18.0 80  2                          subaru dl
## 340 29.8  4  89.0  62 1845 15.3 80  2                   vokswagen rabbit
## 341 32.7  6 168.0 132 2910 11.4 80  2                      datsun 280-zx
## 342 23.7  3  70.0 100 2420 12.5 80  2                      mazda rx-7 gs
## 343 35.0  4 122.0  88 2500 15.1 80  2                  triumph tr7 coupe
## 344 23.6  4 140.0  NA 2905 14.3 80  1                ford mustang cobra
## 345 32.4  4 107.0  72 2290 17.0 80  2                       honda accord
## 346 27.2  4 135.0  84 2490 15.7 81  1                  plymouth reliant
## 347 26.6  4 151.0  84 2635 16.4 81  1                     buick skylark
## 348 25.8  4 156.0  92 2620 14.4 81  1               dodge aries wagon (sw)
## 349 23.5  6 173.0 110 2725 12.6 81  1                chevrolet citation
## 350 30.0  4 135.0  84 2385 12.9 81  1                  plymouth reliant
## 351 39.1  4  79.0  58 1755 16.9 81  2                    toyota starlet
## 352 39.0  4  86.0  64 1875 16.4 81  1                    plymouth champ
## 353 35.1  4  81.0  60 1760 16.1 81  2                  honda civic 1300
## 354 32.3  4  97.0  67 2065 17.8 81  2                            subaru
## 355 37.0  4  85.0  65 1975 19.4 81  2                    datsun 210 mpg
## 356 37.7  4  89.0  62 2050 17.3 81  2                     toyota tercel
## 357 34.1  4  91.0  68 1985 16.0 81  2                       mazda glc 4
## 358 34.7  4 105.0  63 2215 14.9 81  1                plymouth horizon 4
## 359 34.4  4  98.0  65 2045 16.2 81  1                    ford escort 4w
## 360 29.9  4  98.0  65 2380 20.7 81  1                    ford escort 2h
## 361 33.0  4 105.0  74 2190 14.2 81  2                  volkswagen jetta
## 362 34.5  4 100.0  NA 2320 15.8 81  2                       renault 18i
## 363 33.7  4 107.0  75 2210 14.4 81  2                     honda prelude
## 364 32.4  4 108.0  75 2350 16.8 81  2                    toyota corolla
## 365 32.9  4 119.0 100 2615 14.8 81  2                      datsun 200sx
## 366 31.6  4 120.0  74 2635 18.3 81  2                         mazda 626
## 367 28.1  4 141.0  80 3230 20.4 81  2          peugeot 505s turbo diesel
## 368   NA  4 121.0 110 2800 15.4 81  2                         saab 900s
## 369 30.7  6 145.0  76 3160 19.6 81  2                       volvo diesel
## 370 25.4  6 168.0 116 2900 12.6 81  2                   toyota cressida
## 371 24.2  6 146.0 120 2930 13.8 81  2                  datsun 810 maxima
## 372 22.4  6 231.0 110 3415 15.8 81  1                     buick century
## 373 26.6  8 350.0 105 3725 19.0 81  1                oldsmobile cutlass ls
## 374 20.2  6 200.0  88 3060 17.1 81  1                      ford granada gl
## 375 17.6  6 225.0  85 3465 16.6 81  1                chrysler lebaron salon
## 376 28.0  4 112.0  88 2605 19.6 82  1                    chevrolet cavalier
## 377 27.0  4 112.0  88 2640 18.6 82  1              chevrolet cavalier wagon
## 378 34.0  4 112.0  88 2395 18.0 82  1              chevrolet cavalier 2-door
## 379 31.0  4 112.0  85 2575 16.2 82  1            pontiac j2000 se hatchback
## 380 29.0  4 135.0  84 2525 16.0 82  1                   dodge aries se
## 381 27.0  4 151.0  90 2735 18.0 82  1                  pontiac phoenix
## 382 24.0  4 140.0  92 2865 16.4 82  1                ford fairmont futura
## 383 23.0  4 151.0  NA 3035 20.5 82  1                      amc concord dl
```

```
## 384 36.0  4 105.0  74 1980 15.3 82  2                 volkswagen rabbit l
## 385 37.0  4  91.0  68 2025 18.2 82  2                  mazda glc custom l
## 386 31.0  4  91.0  68 1970 17.6 82  2                    mazda glc custom
## 387 38.0  4 105.0  63 2125 14.7 82  1               plymouth horizon miser
## 388 36.0  4  98.0  70 2125 17.3 82  1                      mercury lynx l
## 389 36.0  4 120.0  88 2160 14.5 82  2                    nissan stanza xe
## 390 36.0  4 107.0  75 2205 14.5 82  2                        honda accord
## 391 34.0  4 108.0  70 2245 16.9 82  2                      toyota corolla
## 392 38.0  4  91.0  67 1965 15.0 82  2                         honda civic
## 393 32.0  4  91.0  67 1965 15.7 82  2                   honda civic (auto)
## 394 38.0  4  91.0  67 1995 16.2 82  2                        datsun 310 gx
## 395 25.0  6 181.0 110 2945 16.4 82  1                buick century limited
## 396 38.0  6 262.0  85 3015 17.0 82  1    oldsmobile cutlass ciera (diesel)
## 397 26.0  4 156.0  92 2585 14.5 82  1           chrysler lebaron medallion
## 398 22.0  6 232.0 112 2835 14.7 82  1                       ford granada l
## 399 32.0  4 144.0  96 2665 13.9 82  2                     toyota celica gt
## 400 36.0  4 135.0  84 2370 13.0 82  1                   dodge charger 2.2
## 401 27.0  4 151.0  90 2950 17.3 82  1                    chevrolet camaro
## 402 27.0  4 140.0  86 2790 15.6 82  1                     ford mustang gl
## 403 44.0  4  97.0  52 2130 24.6 82  2                           vw pickup
## 404 32.0  4 135.0  84 2295 11.6 82  1                       dodge rampage
## 405 28.0  4 120.0  79 2625 18.6 82  1                         ford ranger
## 406 31.0  4 119.0  82 2720 19.4 82  1                          chevy s-10
```

```
sum(is.na(M))
```

```
## [1] 14
```

```
nrow(M)
```

```
## [1] 406
```

```
M = na.omit(M)
nrow(M)
```

```
## [1] 392
```

```
sum(is.na(M))
```

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

Tiene 14 valores nulos, se eliminaron y queda un total de 392 muestras.

2. Reduzca la matriz de datos original a otra base sólo de variables numéricas.

```
Num = M[,-9]
```

3. Elija la variable V3 como variable dependiente, determine un modelo adecuado para el análisis y responda a las siguientes preguntas:

```
y = M$V3
modelo <- lm(M$V3~M$V1 + M$V2 + M$V4 + M$V5 + M$V6 + M$V7)
```

a. Determine los coeficientes estimados de todas las variables de tu nueva base de datos construida. (La base que solo tiene variables numéricas)

Observamos que V1, V6 y V7 tienen coeficiente negativo lo que significa que, considerando todas las demás variables constantes.

```
summary(modelo)
```

```
##
## Call:
## lm(formula = M$V3 ~ M$V1 + M$V2 + M$V4 + M$V5 + M$V6 + M$V7)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -80.763 -11.534   0.709  12.027 115.725
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept) -67.786193  33.167911  -2.044   0.0417 *
## M$V1          0.367364   0.352021   1.044   0.2973
## M$V2         30.279858   1.705540  17.754  < 2e-16 ***
## M$V4          0.445570   0.092973   4.792 2.36e-06 ***
## M$V5          0.042524   0.004745   8.961  < 2e-16 ***
## M$V6         -1.565056   0.701893  -2.230   0.0263 *
## M$V7         -0.802170   0.448690  -1.788   0.0746 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 23.76 on 385 degrees of freedom
## Multiple R-squared:  0.9492, Adjusted R-squared:  0.9484
## F-statistic:  1200 on 6 and 385 DF,  p-value: < 2.2e-16
```

b. Utilice el criterio de Akaike para determinar la selección de predictores y búsqueda en ambas direcciones, forward y backward. Describa cuál es la ecuación del nuevo modelo que mejor explica la variable respuesta. ¿Qué puede decir de los p-value individuales?

Se utilizó la función step para encontrar el mejor modelo con busqueda en ambas direcciones. Observando los valores de AIC, se busca el menor, dado a que se busca un modelo multivariado que cumple con esta clausula, las variables a considerar son V1, V6 y V7.

```
step(object = modelo, direction = "both", trace =1)
```

```
## Start:  AIC=2490.69
## M$V3 ~ M$V1 + M$V2 + M$V4 + M$V5 + M$V6 + M$V7
##
##        Df Sum of Sq    RSS    AIC
## - M$V1  1       615 217985 2489.8
## <none>              217370 2490.7
## - M$V7  1      1805 219175 2491.9
## - M$V6  1      2807 220177 2493.7
## - M$V4  1     12968 230338 2511.4
## - M$V5  1     45338 262708 2562.9
## - M$V2  1    177960 395331 2723.2
##
## Step:  AIC=2489.8
## M$V3 ~ M$V2 + M$V4 + M$V5 + M$V6 + M$V7
##
##        Df Sum of Sq    RSS    AIC
## <none>              217985 2489.8
## - M$V7  1      1190 219175 2489.9
## + M$V1  1       615 217370 2490.7
## - M$V6  1      2715 220700 2492.7
## - M$V4  1     13034 231019 2510.6
## - M$V5  1     52571 270556 2572.5
## - M$V2  1    177611 395596 2721.4
```

```
##
## Call:
## lm(formula = M$V3 ~ M$V2 + M$V4 + M$V5 + M$V6 + M$V7)
##
## Coefficients:
## (Intercept)         M$V2         M$V4         M$V5         M$V6         M$V7
##   -73.33278     30.24399      0.44669      0.04014     -1.53807     -0.52690
```

c. Describa los nuevos coeficientes estimados y el error estándar de cada variable después de aplicar el criterio de Akaike para la selección de predictores en la dirección de búsqueda que eligió.

$V3 = -10.62V1 - 9.71V6 + 4.67V7 + 239.6723$

```
modelo2 <- lm(M$V3~M$V1+M$V6+M$V7)
summary(modelo2)
```

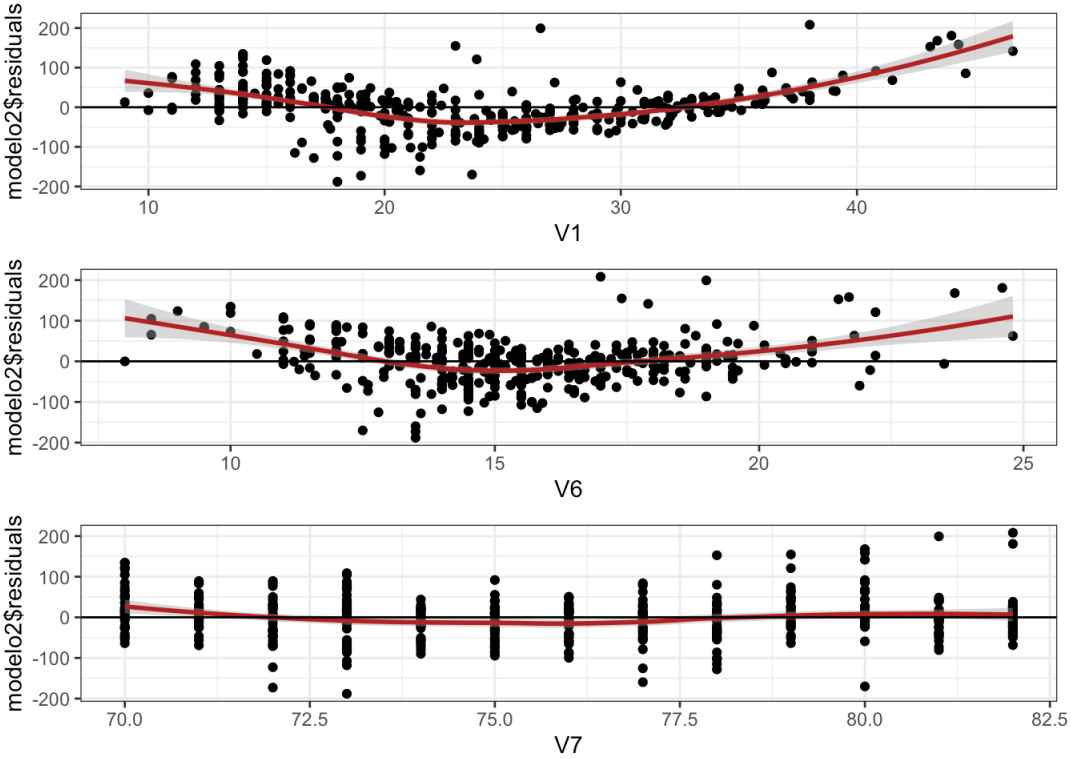
```
##
## Call:
## lm(formula = M$V3 ~ M$V1 + M$V6 + M$V7)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -188.172  -34.149    1.289   26.713  208.214
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept) 239.6723    66.9339   3.581 0.000386 ***
## M$V1        -10.6198     0.4712 -22.538  < 2e-16 ***
## M$V6         -9.7179     1.1342  -8.568 2.52e-16 ***
## M$V7          4.6691     0.9452   4.940 1.16e-06 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 55.96 on 388 degrees of freedom
## Multiple R-squared:  0.7163, Adjusted R-squared:  0.7141
## F-statistic: 326.5 on 3 and 388 DF,  p-value: < 2.2e-16
```

d. Muestre a través de gráficos, los residuales individuales de cada variable en el nuevo modelo. Interprételos.

```
library(ggplot2)
library(gridExtra)

plot1 <- ggplot(data=M, aes(V1, modelo2$residuals))+ geom_point() + geom_smooth(color = "firebrick") + geom_
hline(yintercept=0)+ theme_bw()
plot2 <- ggplot(data=M, aes(V6, modelo2$residuals))+ geom_point() + geom_smooth(color = "firebrick") + geom_
hline(yintercept=0)+ theme_bw()
plot3 <- ggplot(data=M, aes(V7, modelo2$residuals))+ geom_point() + geom_smooth(color = "firebrick") + geom_
hline(yintercept=0)+ theme_bw()
# Se observa la linealidad de los predictores
grid.arrange(plot1,plot2,plot3)
```

```
## `geom_smooth()` using method = 'loess' and formula = 'y ~ x'
## `geom_smooth()` using method = 'loess' and formula = 'y ~ x'
## `geom_smooth()` using method = 'loess' and formula = 'y ~ x'
```



e. Determine la prueba de hipótesis de normalidad en el modelo a través del criterio Shapiro. ¿Se rechaza la hipótesis nula? Justifique porque llegó a esa conclusión en la hipótesis:

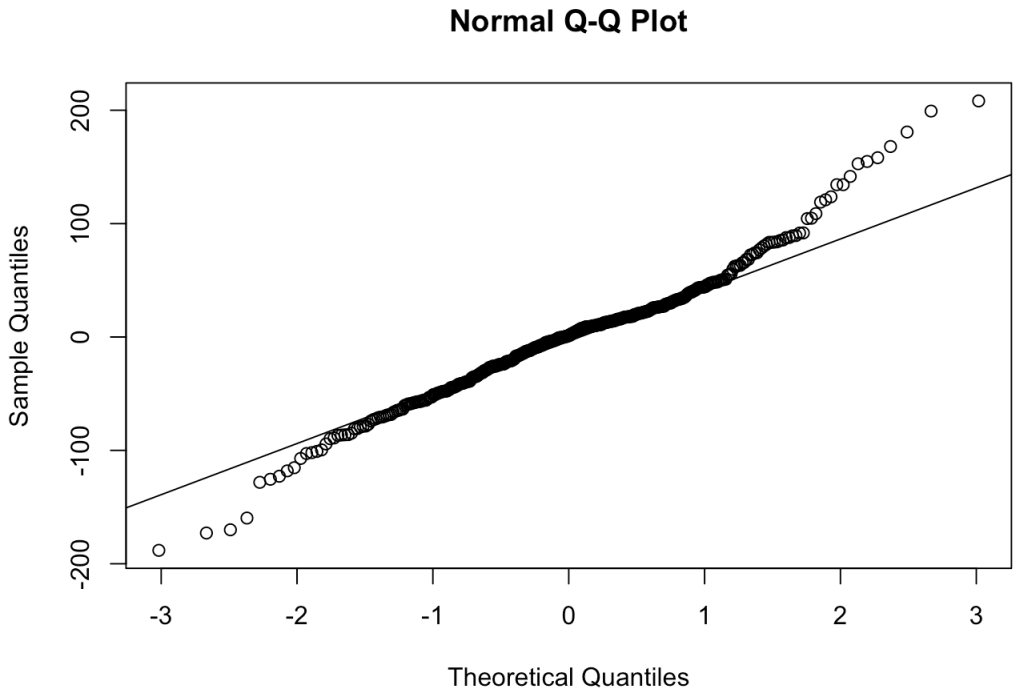
Con la Shapiro test obtenemos la normalidad, donde Ho como normalidad y H1 como un comportamiento no normal y se considera un intervalo de confianza del 95%. p-value < 0.05: se rechaza la Ho.

```
shapiro.test(modelo2$residuals)
```

```
##
##  Shapiro-Wilk normality test
##
## data:  modelo2$residuals
## W = 0.97633, p-value = 5.094e-06
```

f. Agregue algún gráfico de la distribución de residuos del modelo obtenido en el inciso b) e interprete.

```
qqnorm(modelo2$residuals)
qqline(modelo2$residuals)
```



g. Realice una prueba de hipótesis Breusch-Pagan. ¿Se rechaza la hipótesis nula? Justifique porque llegó a esa conclusión en la hipótesis

Con la prueba Breusch-Pagan, nuestra Ho existe homocedasticidad y H1 que no se presenta, con un intervalo de confianza de 95%. Donde el p-value, 0.4102 > 0.05, no se tienen pruebas suficientes para rechazar Ho

```
library(lmtest)
```

```
## Loading required package: zoo
```

```
##
## Attaching package: 'zoo'
```

```
## The following objects are masked from 'package:base':
##
##     as.Date, as.Date.numeric
```

```
bptest(modelo2)
```

```
##
##  studentized Breusch-Pagan test
##
## data:  modelo2
## BP = 2.8821, df = 3, p-value = 0.4102
```

h. ¿Existe multicolinealidad en el modelo? Defina porqué:

No se muestra multicolinealidad ya que los valores calculados de vif son menores a 5 por el intervalo de confianza.

```
library(car)
```

```
## Loading required package: carData
```

```
vif(modelo2)
```

```
##     M$V1     M$V6     M$V7
## 1.688960 1.222795 1.513882
```

i. Realice un ANOVA para el modelo e interprete correctamente los resultados. ¿Cuál es el error estándar residual que arroja? Opine al respecto y redondee a 3 dígitos después del punto decimal:

No se puede realizar ANOVA ya que se rechazo Ho en shapiro, ya que se requiere una normalidad en los datos. Pero el summary nos dio el error estandar residual de 55.96.

Incluya su código y sus cálculos anotando el número de pregunta e inciso al que está respondiendo (no es necesario añadir la redacción del problema) y agregue sus comentarios (si se le solicitan en algún inciso) después de su implementación.

Sugerencias:

Defina las hipótesis nulas como el caso afirmativo de que si se cumple la condición que se pregunta. Utilice un nivel de significancia del 5% para las pruebas de hipótesis.

Problema 3

Los datos se refieren al consumo de combustible del ciclo urbano en millas por galón (mpg) y 8 atributos (variables) de los automóviles. Los datos son los siguientes:

- V1. mpg: millas por galón
- V2. cilindros: número de cilindros
- V3. mileage: número de millas recorridas
- V4. horsepower: caballos de fuerza
- V5. weight: peso en libras
- V6. acceleration: aceleración
- V7. model_year
- V8. origin: nacional, extranjero, desconocido
- V9. car name: marca, tipo

1. Lea los datos y asegúrese que estén limpios. Reduzca la matriz de datos original a otra base si es necesario.

```
M2 = read.csv("data2.3.csv")
M2
```

```
##       V1 V2  V3  V4   V5   V6 V7 V8                               V9
## 1   18.0  8 398 215 4209 12.0 70  1            chevrolet chevelle malibu
## 2   15.0  8 492 133 3145 11.5 70  1                    buick skylark 320
## 3   18.0  8 371 139 2332 11.0 70  1                   plymouth satellite
## 4   16.0  8 117  93 3219 12.0 70  1                        amc rebel sst
## 5   17.0  8 200 148 4723 10.5 70  1                          ford torino
## 6   15.0  8 175 140 3311 10.0 70  1                      ford galaxie 500
## 7   14.0  8 243 168 3046  9.0 70  1                      chevrolet impala
## 8   14.0  8 225 149 2842  8.5 70  1                     plymouth fury iii
## 9   14.0  8 400  47 3221 10.0 70  1                      pontiac catalina
## 10  15.0  8 141 149 3750  8.5 70  1                    amc ambassador dpl
## 11    NA  4 469  77 2266 17.5 70  2                  citroen ds-21 pallas
## 12    NA  8  84 192 3298 11.5 70  1     chevrolet chevelle concours (sw)
## 13    NA  8 275 209 2524 11.0 70  1                     ford torino (sw)
## 14    NA  8 298 211 4162 10.5 70  1               plymouth satellite (sw)
## 15    NA  8 413 201 1766 11.0 70  1                    amc rebel sst (sw)
## 16  15.0  8 312 217 4928 10.0 70  1                   dodge challenger se
## 17  14.0  8 141 229 5014  8.0 70  1                    plymouth 'cuda 340
## 18    NA  8 292 211 2073  8.0 70  1                ford mustang boss 302
## 19  15.0  8 479 181 4260  9.5 70  1                chevrolet monte carlo
## 20  14.0  8 193 108 3100 10.0 70  1               buick estate wagon (sw)
## 21  24.0  4 106 141 2883 15.0 70  2                 toyota corona mark ii
## 22  22.0  6 281 109 3394 15.5 70  1                       plymouth duster
## 23  18.0  6 161 199 2473 15.5 70  1                            amc hornet
## 24  21.0  6 476 130 3400 16.0 70  1                          ford maverick
## 25  27.0  4 108 110 2251 14.5 70  2                         datsun pl510
## 26  26.0  4 195  60 1831 20.5 70  2          volkswagen 1131 deluxe sedan
## 27  25.0  4 106 143 2735 17.5 70  2                          peugeot 504
## 28  24.0  4 454 127 2525 14.5 70  2                          audi 100 ls
## 29  25.0  4 258  79 2082 17.5 70  2                             saab 99e
## 30  26.0  4 174  86 3392 12.5 70  2                             bmw 2002
## 31  21.0  6 173 160 4541 15.0 70  1                          amc gremlin
## 32  10.0  8 199  82 4723 14.0 70  1                            ford f250
## 33  10.0  8 484 109 1789 15.0 70  1                            chevy c20
## 34  11.0  8 488  56 4021 13.5 70  1                           dodge d200
## 35   9.0  8  88 123 3958 18.5 70  1                             hi 1200d
## 36  27.0  4 401  73 2946 14.5 71  2                         datsun pl510
## 37  28.0  4 113 229 2773 15.5 71  1                  chevrolet vega 2300
## 38  25.0  4 316  66 3183 14.0 71  2                        toyota corona
## 39  25.0  4 227 111 3617 19.0 71  1                           ford pinto
## 40    NA  4 425 157 3120 20.0 71  2           volkswagen super beetle 117
## 41  19.0  6 399  99 1773 13.0 71  1                          amc gremlin
## 42  16.0  6 278  47 1825 15.5 71  1            plymouth satellite custom
## 43  17.0  6 136 180 2215 15.5 71  1            chevrolet chevelle malibu
## 44  19.0  6 164 187 4778 15.5 71  1                      ford torino 500
## 45  18.0  6 307 150 2730 15.5 71  1                          amc matador
## 46  14.0  8 340  96 5022 12.0 71  1                     chevrolet impala
## 47  14.0  8 485 190 5013 11.5 71  1            pontiac catalina brougham
## 48  14.0  8 214 227 2295 13.5 71  1                      ford galaxie 500
## 49  14.0  8 143 187 1750 13.0 71  1                     plymouth fury iii
## 50  12.0  8 271 224 3659 11.5 71  1                     dodge monaco (sw)
## 51  13.0  8  99  81 2360 12.0 71  1              ford country squire (sw)
## 52  13.0  8 455  79 3242 12.0 71  1                   pontiac safari (sw)
## 53  18.0  6 339 168 4666 13.5 71  1            amc hornet sportabout (sw)
## 54  22.0  4 426  79 4278 19.0 71  1                   chevrolet vega (sw)
## 55  19.0  6 264 182 2040 15.0 71  1                      pontiac firebird
## 56  18.0  6 201 107 4614 14.5 71  1                          ford mustang
## 57  23.0  4 228 168 1616 14.0 71  1                   mercury capri 2000
## 58  28.0  4 407 117 3193 14.0 71  2                            opel 1900
## 59  30.0  4 184 121 4492 19.5 71  2                          peugeot 304
## 60  30.0  4 285  53 3140 14.5 71  2                            fiat 124b
## 61  31.0  4 421 225 3232 19.0 71  2                  toyota corolla 1200
## 62  35.0  4 326 203 3035 18.0 71  2                          datsun 1200
## 63  27.0  4 181 178 4064 19.0 71  2                volkswagen model 111
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## 64  26.0  4 170  60 4837 20.5 71  1                   plymouth cricket
## 65  24.0  4 227 162 4995 15.5 72  2               toyota corona hardtop
## 66  25.0  4 366  68 2311 17.0 72  1                  dodge colt hardtop
## 67  23.0  4 132  70 2298 23.5 72  2                  volkswagen type 3
## 68  20.0  4 464 178 3524 19.5 72  1                     chevrolet vega
## 69  21.0  4 264 131 4560 16.5 72  1                 ford pinto runabout
## 70  13.0  8 206 123 2473 12.0 72  1                    chevrolet impala
## 71  14.0  8 143  80 1899 12.0 72  1                    pontiac catalina
## 72  15.0  8 241 218 3257 13.5 72  1                   plymouth fury iii
## 73  14.0  8 211  53 4782 13.0 72  1                    ford galaxie 500
## 74  17.0  8 121  99 3604 11.5 72  1                  amc ambassador sst
## 75  11.0  8 214  85 3249 11.0 72  1                    mercury marquis
## 76  13.0  8 226 177 3820 13.5 72  1               buick lesabre custom
## 77  12.0  8 168 130 4074 13.5 72  1          oldsmobile delta 88 royale
## 78  13.0  8 356 162 4909 12.5 72  1              chrysler newport royal
## 79  19.0  3 448 211 5053 13.5 72  2                     mazda rx2 coupe
## 80  15.0  8 395 106 2990 12.5 72  1                    amc matador (sw)
## 81  13.0  8 331 227 4139 14.0 72  1    chevrolet chevelle concours (sw)
## 82  13.0  8 190 162 2978 16.0 72  1               ford gran torino (sw)
## 83  14.0  8 403 181 3165 14.0 72  1      plymouth satellite custom (sw)
## 84  18.0  4 188  88 3584 14.5 72  2                     volvo 145e (sw)
## 85  22.0  4 146 228 3676 18.0 72  2                 volkswagen 411 (sw)
## 86  21.0  4 283 166 3282 19.5 72  2                    peugeot 504 (sw)
## 87  26.0  4 316 185 3463 18.0 72  2                     renault 12 (sw)
## 88  22.0  4 367  85 3080 16.0 72  1                     ford pinto (sw)
## 89  28.0  4 452 166 1922 17.0 72  2                     datsun 510 (sw)
## 90  23.0  4 370 118 4388 14.5 72  2         toyouta corona mark ii (sw)
## 91  28.0  4 250 163 2387 15.0 72  1                     dodge colt (sw)
## 92  27.0  4 310 105 4994 16.5 72  2             toyota corolla 1600 (sw)
## 93  13.0  8 319 179 2687 13.0 73  1                   buick century 350
## 94  14.0  8 497 168 2208 11.5 73  1                        amc matador
## 95  13.0  8 435 108 4963 13.0 73  1                    chevrolet malibu
## 96  14.0  8  89 110 2896 14.5 73  1                    ford gran torino
## 97  15.0  8 153 115 2870 12.5 73  1                dodge coronet custom
## 98  12.0  8 208 152 3609 11.5 73  1             mercury marquis brougham
## 99  13.0  8 338 167 4776 12.0 73  1            chevrolet caprice classic
## 100 13.0  8 160 138 1745 13.0 73  1                              ford ltd
## 101 14.0  8 202  81 4853 14.5 73  1             plymouth fury gran sedan
## 102 13.0  8 323 141 5088 11.0 73  1         chrysler new yorker brougham
## 103 12.0  8 471 193 1999 11.0 73  1             buick electra 225 custom
## 104 13.0  8 138 110 2287 11.0 73  1              amc ambassador brougham
## 105 18.0  6 256 204 4950 16.5 73  1                     plymouth valiant
## 106 16.0  6 422 218 2933 18.0 73  1                chevrolet nova custom
## 107 18.0  6 367 205 3176 16.0 73  1                          amc hornet
## 108 18.0  6 187 163 3767 16.5 73  1                       ford maverick
## 109 23.0  6 267 180 4423 16.0 73  1                     plymouth duster
## 110 26.0  4 416 192 2539 21.0 73  2              volkswagen super beetle
## 111 11.0  8 368 116 4807 14.0 73  1                     chevrolet impala
## 112 12.0  8 328 142 3663 12.5 73  1                         ford country
## 113 13.0  8 328 194 4659 13.0 73  1               plymouth custom suburb
## 114 12.0  8 391 114 4823 12.5 73  1             oldsmobile vista cruiser
## 115 18.0  6 128 202 4021 15.0 73  1                          amc gremlin
## 116 20.0  4 331  96 3471 19.0 73  2                       toyota carina
## 117 21.0  4 442 100 2601 19.5 73  1                      chevrolet vega
## 118 22.0  4 435  56 4547 16.5 73  2                          datsun 610
## 119 18.0  3 197 173 2607 13.5 73  2                           maxda rx3
## 120 19.0  4 412  78 5043 18.5 73  1                          ford pinto
## 121 21.0  6 266 188 4467 14.0 73  1                     mercury capri v6
## 122 26.0  4 341 120 4527 15.5 73  2                 fiat 124 sport coupe
## 123 15.0  8 411 218 2693 13.0 73  1              chevrolet monte carlo s
## 124 16.0  8 389 140 4936  9.5 73  1                   pontiac grand prix
## 125 29.0  4 412 109 3659 19.5 73  2                             fiat 128
## 126 24.0  4 416  46 2117 15.5 73  2                          opel manta
## 127 20.0  4 286 229 4575 14.0 73  2                          audi 100ls
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## 128 19.0  4 340 185 4192 15.5 73  2                       volvo 144ea
## 129 15.0  8 229 183 2951 11.0 73  1                   dodge dart custom
## 130 24.0  4 310 216 2635 14.0 73  2                        saab 99le
## 131 20.0  6 402 125 2040 13.5 73  2                     toyota mark ii
## 132 11.0  8 464 217 4855 11.0 73  1                   oldsmobile omega
## 133 20.0  6 409 127 4924 16.5 74  1                    plymouth duster
## 134 21.0  6 364  99 3692 17.0 74  1                      ford maverick
## 135 19.0  6 268 103 4835 16.0 74  1                         amc hornet
## 136 15.0  6 277 132 2735 17.0 74  1                    chevrolet nova
## 137 31.0  4 176  87 1932 19.0 74  2                       datsun b210
## 138 26.0  4 468 101 4946 16.5 74  1                        ford pinto
## 139 32.0  4 495 123 3752 21.0 74  2                toyota corolla 1200
## 140 25.0  4 454 221 2879 17.0 74  1                      chevrolet vega
## 141 16.0  6 163  87 2332 17.0 74  1    chevrolet chevelle malibu classic
## 142 16.0  6 290  50 2823 18.0 74  1                        amc matador
## 143 18.0  6 110 177 3102 16.5 74  1          plymouth satellite sebring
## 144 16.0  8 183 220 3868 14.0 74  1                   ford gran torino
## 145 13.0  8 326 131 4747 14.5 74  1             buick century luxus (sw)
## 146 14.0  8 112 189 2969 13.5 74  1            dodge coronet custom (sw)
## 147 14.0  8 322 192 4128 16.0 74  1                ford gran torino (sw)
## 148 14.0  8 191 173 1927 15.5 74  1                     amc matador (sw)
## 149 29.0  4 373 217 4007 16.5 74  2                          audi fox
## 150 26.0  4 199 154 3780 15.5 74  2                  volkswagen dasher
## 151 26.0  4 267 135 3937 14.5 74  2                        opel manta
## 152 31.0  4 328 173 2260 16.5 74  2                     toyota corona
## 153 32.0  4 197  68 4840 19.0 74  2                       datsun 710
## 154 28.0  4 274  87 2800 14.5 74  1                       dodge colt
## 155 24.0  4 379 230 1722 15.5 74  2                         fiat 128
## 156 26.0  4 238 104 2005 14.0 74  2                      fiat 124 tc
## 157 24.0  4  97 224 3528 15.0 74  2                      honda civic
## 158 26.0  4 134 126 4444 15.5 74  2                           subaru
## 159 31.0  4 189 214 4624 16.0 74  2                       fiat x1.9
## 160 19.0  6 225 131 2012 16.0 75  1             plymouth valiant custom
## 161 18.0  6 355 131 2293 16.0 75  1                    chevrolet nova
## 162 15.0  6 355 225 4958 21.0 75  1                   mercury monarch
## 163 15.0  6 479 191 2263 19.5 75  1                     ford maverick
## 164 16.0  8 168 202 2759 11.5 75  1                   pontiac catalina
## 165 15.0  8 297 111 1781 14.0 75  1                  chevrolet bel air
## 166 16.0  8 353 186 4562 14.5 75  1                plymouth grand fury
## 167 14.0  8 355 178 4119 13.5 75  1                          ford ltd
## 168 17.0  6 340 218 3551 21.0 75  1                     buick century
## 169 16.0  6 222 220 2060 18.5 75  1            chevroelt chevelle malibu
## 170 15.0  6 238 194 2562 19.0 75  1                       amc matador
## 171 18.0  6 242  60 5034 19.0 75  1                     plymouth fury
## 172 21.0  6 114 223 1693 15.0 75  1                     buick skyhawk
## 173 20.0  8 310  61 4915 13.5 75  1                chevrolet monza 2+2
## 174 13.0  8 476 179 3385 12.0 75  1                    ford mustang ii
## 175 29.0  4 175 119 1990 16.0 75  2                    toyota corolla
## 176 23.0  4 395 103 4476 17.0 75  1                        ford pinto
## 177 20.0  6 230 107 1663 16.0 75  1                      amc gremlin
## 178 23.0  4 405 205 3040 18.5 75  1                     pontiac astro
## 179 24.0  4 391 203 3529 13.5 75  2                     toyota corona
## 180 25.0  4 477 106 3069 16.5 75  2                  volkswagen dasher
## 181 24.0  4 419 180 4204 17.0 75  2                       datsun 710
## 182 18.0  6 414 211 4517 14.5 75  1                        ford pinto
## 183 29.0  4 452  86 3253 14.0 75  2                  volkswagen rabbit
## 184 19.0  6 185 130 4723 17.0 75  1                         amc pacer
## 185 23.0  4 383 196 1747 15.0 75  2                       audi 100ls
## 186 23.0  4 346  74 4301 17.0 75  2                     peugeot 504
## 187 22.0  4 319 189 4535 14.5 75  2                     volvo 244dl
## 188 25.0  4 101 139 4452 13.5 75  2                        saab 99le
## 189 33.0  4 246  53 4182 17.5 75  2                   honda civic cvcc
## 190 28.0  4 169 142 3038 15.5 76  2                         fiat 131
## 191 25.0  4 289 158 3200 16.9 76  2                       opel 1900
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## 192 25.0  4 101 135 4221 14.9 76  1                          capri ii
## 193 26.0  4 283 138 2607 17.7 76  1                        dodge colt
## 194 27.0  4 215 206 2367 15.3 76  2                       renault 12tl
## 195 17.5  8 386 166 2234 13.0 76  1    chevrolet chevelle malibu classic
## 196 16.0  8 458 137 2991 13.0 76  1               dodge coronet brougham
## 197 15.5  8 308  70 1942 13.9 76  1                          amc matador
## 198 14.5  8 410 193 4468 12.8 76  1                    ford gran torino
## 199 22.0  6 442  52 1601 15.4 76  1                    plymouth valiant
## 200 22.0  6 160  63 1763 14.5 76  1                      chevrolet nova
## 201 24.0  6 116 201 2985 17.6 76  1                       ford maverick
## 202 22.5  6 246 203 2061 17.6 76  1                          amc hornet
## 203 29.0  4 162 159 4348 22.2 76  1                  chevrolet chevette
## 204 24.5  4 100 204 4648 22.1 76  1                     chevrolet woody
## 205 29.0  4 339  58 4529 14.2 76  2                           vw rabbit
## 206 33.0  4 123 157 4750 17.4 76  2                       honda civic
## 207 20.0  6 203 167 1930 17.7 76  1                      dodge aspen se
## 208 18.0  6 238 147 1792 21.0 76  1                    ford granada ghia
## 209 18.5  6 476 100 3149 16.2 76  1                   pontiac ventura sj
## 210 17.5  6 485  76 3086 17.8 76  1                        amc pacer d/l
## 211 29.5  4 412 133 4120 12.2 76  2                    volkswagen rabbit
## 212 32.0  4 298 180 2620 17.0 76  2                         datsun b-210
## 213 28.0  4 491 208 3676 16.4 76  2                      toyota corolla
## 214 26.5  4 385 113 4912 13.6 76  1                          ford pinto
## 215 20.0  4 249  92 5107 15.7 76  2                           volvo 245
## 216 13.0  8 101 119 2185 13.2 76  1           plymouth volare premier v8
## 217 19.0  4 465 138 2641 21.9 76  2                         peugeot 504
## 218 19.0  6 378 170 3071 15.5 76  2                      toyota mark ii
## 219 16.5  6 491 152 2371 16.7 76  2                  mercedes-benz 280s
## 220 16.5  8 359 151 5111 12.1 76  1                    cadillac seville
## 221 13.0  8 125  73 2486 12.0 76  1                           chevy c10
## 222 13.0  8 390 133 3531 15.0 76  1                           ford f108
## 223 13.0  8 419 157 3019 14.0 76  1                          dodge d100
## 224 31.5  4 201 157 3796 18.5 77  2                  honda accord cvcc
## 225 30.0  4 356 181 3967 14.8 77  1              buick opel isuzu deluxe
## 226 36.0  4 372  78 4659 18.6 77  2                       renault 5 gtl
## 227 25.5  4 217 161 4792 15.5 77  1                    plymouth arrow gs
## 228 33.5  4 443 115 3680 16.8 77  2                 datsun f-10 hatchback
## 229 17.5  8 268 183 2841 12.5 77  1            chevrolet caprice classic
## 230 17.0  8 215  69 1781 19.0 77  1           oldsmobile cutlass supreme
## 231 15.5  8 172 106 2203 13.7 77  1                dodge monaco brougham
## 232 15.0  8 316 212 1629 14.9 77  1               mercury cougar brougham
## 233 17.5  6 492  86 1934 16.4 77  1                    chevrolet concours
## 234 20.5  6 142 139 3936 16.9 77  1                         buick skylark
## 235 19.0  6 126  64 4483 17.7 77  1                plymouth volare custom
## 236 18.5  6 445  67 3942 19.0 77  1                          ford granada
## 237 16.0  8 167 126 2736 11.1 77  1                 pontiac grand prix lj
## 238 15.5  8 421 210 3508 11.4 77  1          chevrolet monte carlo landau
## 239 15.5  8 397 185 4452 12.2 77  1                    chrysler cordoba
## 240 16.0  8 299 162 4761 14.5 77  1                    ford thunderbird
## 241 29.0  4 156  91 2201 14.5 77  2              volkswagen rabbit custom
## 242 24.5  4 193 213 4331 16.0 77  1                 pontiac sunbird coupe
## 243 26.0  4 401  59 4425 18.2 77  2               toyota corolla liftback
## 244 25.5  4  88 126 4896 15.8 77  1                   ford mustang ii 2+2
## 245 30.5  4 227  79 1661 17.0 77  1                  chevrolet chevette
## 246 33.5  4 363 146 2178 15.9 77  1                      dodge colt m/m
## 247 30.0  4 291 179 2869 16.4 77  2                           subaru dl
## 248 30.5  4 365 184 2920 14.1 77  2                    volkswagen dasher
## 249 22.0  6 346 117 1837 14.5 77  2                           datsun 810
## 250 21.5  4 137 219 5072 12.8 77  2                            bmw 320i
## 251 21.5  3 278 114 4598 13.5 77  2                          mazda rx-4
## 252 43.1  4 366 142 4424 21.5 78  2      volkswagen rabbit custom diesel
## 253 36.1  4 316 126 2377 14.4 78  1                          ford fiesta
## 254 32.8  4 395 166 3226 19.4 78  2                     mazda glc deluxe
## 255 39.4  4 298 144 2171 18.6 78  2                       datsun b210 gx
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## 256 36.1  4 407 102 2758 16.4 78  2                    honda civic cvcc
## 257 19.9  8 291 187 3640 15.5 78  1    oldsmobile cutlass salon brougham
## 258 19.4  8 350  97 4894 13.2 78  1                     dodge diplomat
## 259 20.2  8 368  51 4407 12.8 78  1                mercury monarch ghia
## 260 19.2  6 127 147 2110 19.2 78  1                  pontiac phoenix lj
## 261 20.5  6 146 185 3426 18.2 78  1                    chevrolet malibu
## 262 20.2  6 313 124 1672 15.8 78  1                ford fairmont (auto)
## 263 25.1  4 120 144 5089 15.4 78  1                 ford fairmont (man)
## 264 20.5  6 114  61 1661 17.2 78  1                     plymouth volare
## 265 19.4  6 174 166 4915 17.2 78  1                         amc concord
## 266 20.6  6 291 168 2153 15.8 78  1               buick century special
## 267 20.8  6 209 108 5071 16.7 78  1                      mercury zephyr
## 268 18.6  6 454 189 2707 18.7 78  1                         dodge aspen
## 269 18.1  6 374 163 2528 15.1 78  1                    amc concord d/l
## 270 19.2  8 162 226 1805 13.2 78  1        chevrolet monte carlo landau
## 271 17.7  6 376 168 4297 13.4 78  1     buick regal sport coupe (turbo)
## 272 18.1  8 156 183 3314 11.2 78  1                         ford futura
## 273 17.5  8 202 129 3346 13.7 78  1                    dodge magnum xe
## 274 30.0  4 129 212 3295 16.5 78  1                  chevrolet chevette
## 275 27.5  4 223 206 3778 14.2 78  2                       toyota corona
## 276 27.2  4 226 107 4681 14.7 78  2                          datsun 510
## 277 30.9  4 288  81 3227 14.5 78  1                         dodge omni
## 278 21.1  4 117  52 3299 14.8 78  2           toyota celica gt liftback
## 279 23.2  4 176  61 4232 16.7 78  1                     plymouth sapporo
## 280 23.8  4 218 108 2107 17.6 78  1               oldsmobile starfire sx
## 281 23.9  4 194 168 3032 14.9 78  2                      datsun 200-sx
## 282 20.3  5 230 131 3156 15.9 78  2                          audi 5000
## 283 17.0  6 332  91 2541 13.6 78  2                        volvo 264gl
## 284 21.6  4 170 225 3427 15.7 78  2                         saab 99gle
## 285 16.2  6 324 162 3996 15.8 78  2                      peugeot 604sl
## 286 31.5  4 289 112 2454 14.9 78  2                 volkswagen scirocco
## 287 29.5  4 209 202 3761 16.6 78  2                     honda accord lx
## 288 21.5  6 200 156 2433 15.4 79  1                   pontiac lemans v6
## 289 19.8  6 193  66 3661 18.2 79  1                    mercury zephyr 6
## 290 22.3  4 236  54 4229 17.3 79  1                     ford fairmont 4
## 291 20.2  6 373 205 4894 18.2 79  1                    amc concord dl 6
## 292 20.6  6 275  50 4299 16.6 79  1                       dodge aspen 6
## 293 17.0  8 176  67 3902 15.4 79  1           chevrolet caprice classic
## 294 17.6  8  87 186 2350 13.4 79  1                     ford ltd landau
## 295 16.5  8 428 152 4605 13.2 79  1                mercury grand marquis
## 296 18.2  8 482 125 4598 15.2 79  1                     dodge st. regis
## 297 16.9  8 472 228 2595 14.9 79  1              buick estate wagon (sw)
## 298 15.5  8 209  86 3722 14.3 79  1             ford country squire (sw)
## 299 19.2  8 380  65 3120 15.0 79  1        chevrolet malibu classic (sw)
## 300 18.5  8 254 200 5014 13.0 79  1 chrysler lebaron town @ country (sw)
## 301 31.9  4 242 135 2340 14.0 79  2                    vw rabbit custom
## 302 34.1  4 272  86 3845 15.2 79  2                    maxda glc deluxe
## 303 35.7  4 309 188 4639 14.4 79  1          dodge colt hatchback custom
## 304 27.4  4 491 178 4676 15.0 79  1                      amc spirit dl
## 305 25.4  5  96 208 3814 20.1 79  2                  mercedes benz 300d
## 306 23.0  8 103 129 2629 17.4 79  1                   cadillac eldorado
## 307 27.2  4 469 142 3068 24.8 79  2                         peugeot 504
## 308 23.9  8 370 186 2246 22.2 79  1    oldsmobile cutlass salon brougham
## 309 34.2  4  81 129 4297 13.2 79  1                    plymouth horizon
## 310 34.5  4 319  80 2322 14.9 79  1                plymouth horizon tc3
## 311 31.8  4 390  90 3820 19.2 79  2                          datsun 210
## 312 37.3  4 120 140 2501 14.7 79  2                 fiat strada custom
## 313 28.4  4  99 134 3120 16.0 79  1                buick skylark limited
## 314 28.8  6 408 194 2490 11.3 79  1                   chevrolet citation
## 315 26.8  6 325 212 3043 12.9 79  1            oldsmobile omega brougham
## 316 33.5  4 396  77 1776 13.2 79  1                     pontiac phoenix
## 317 41.5  4 429  92 2256 14.7 80  2                           vw rabbit
## 318 38.1  4 237 190 3429 18.8 80  2                toyota corolla tercel
## 319 32.1  4 290  95 1718 15.5 80  1                   chevrolet chevette
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## 320 37.2  4  99  58 4171 16.4 80  2                      datsun 310
## 321 28.0  4 318  81 2881 16.5 80  1                chevrolet citation
## 322 26.4  4 289  60 5079 18.1 80  1                     ford fairmont
## 323 24.3  4 484 153 2042 20.1 80  1                       amc concord
## 324 19.1  6 101 213 2173 18.7 80  1                       dodge aspen
## 325 34.3  4 272 175 2632 15.8 80  2                        audi 4000
## 326 29.8  4 193  85 4068 15.5 80  2             toyota corona liftback
## 327 31.3  4 432  79 4967 17.5 80  2                        mazda 626
## 328 37.0  4 129 201 4799 15.0 80  2              datsun 510 hatchback
## 329 32.2  4 105 121 4116 15.2 80  2                     toyota corolla
## 330 46.6  4 248  97 3982 17.9 80  2                          mazda glc
## 331 27.9  4 143 191 4728 14.4 80  1                       dodge colt
## 332 40.8  4 135 146 3460 19.2 80  2                       datsun 210
## 333 44.3  4 137  73 3151 21.7 80  2              vw rabbit c (diesel)
## 334 43.4  4 198 166 2949 23.7 80  2                vw dasher (diesel)
## 335 36.4  5 432  86 4135 19.9 80  2               audi 5000s (diesel)
## 336 30.0  4 379 219 4792 21.8 80  2               mercedes-benz 240d
## 337 44.6  4  86 225 4521 13.8 80  2               honda civic 1500 gl
## 338 40.9  4 406 193 2600 17.3 80  2              renault lecar deluxe
## 339 33.8  4 446 194 3502 18.0 80  2                        subaru dl
## 340 29.8  4 269 216 2076 15.3 80  2                   vokswagen rabbit
## 341 32.7  6 261 201 2606 11.4 80  2                      datsun 280-zx
## 342 23.7  3 481 225 4814 12.5 80  2                      mazda rx-7 gs
## 343 35.0  4 107 198 3192 15.1 80  2                 triumph tr7 coupe
## 344 23.6  4 163 112 2215 14.3 80  1                ford mustang cobra
## 345 32.4  4 263 221 1685 17.0 80  2                       honda accord
## 346 27.2  4 422 118 3712 15.7 81  1                  plymouth reliant
## 347 26.6  4 322 203 4049 16.4 81  1                      buick skylark
## 348 25.8  4 389 211 3855 14.4 81  1             dodge aries wagon (sw)
## 349 23.5  6 372 120 4410 12.6 81  1                 chevrolet citation
## 350 30.0  4 121 129 2602 12.9 81  1                  plymouth reliant
## 351 39.1  4  81 190 4917 16.9 81  2                    toyota starlet
## 352 39.0  4 300 216 4015 16.4 81  1                    plymouth champ
## 353 35.1  4 124  99 4830 16.1 81  2                  honda civic 1300
## 354 32.3  4 500 119 2938 17.8 81  2                           subaru
## 355 37.0  4 417 228 2205 19.4 81  2                     datsun 210 mpg
## 356 37.7  4 283  65 4144 17.3 81  2                     toyota tercel
## 357 34.1  4 471 218 4532 16.0 81  2                       mazda glc 4
## 358 34.7  4 309 224 1703 14.9 81  1                plymouth horizon 4
## 359 34.4  4 288 210 4807 16.2 81  1                     ford escort 4w
## 360 29.9  4 225 196 2542 20.7 81  1                     ford escort 2h
## 361 33.0  4 241  66 4050 14.2 81  2                  volkswagen jetta
## 362 34.5  4 117 107 2621 15.8 81  2                       renault 18i
## 363 33.7  4 168  59 3348 14.4 81  2                     honda prelude
## 364 32.4  4 400 101 4649 16.8 81  2                     toyota corolla
## 365 32.9  4  90 166 3994 14.8 81  2                       datsun 200sx
## 366 31.6  4 145 229 4608 18.3 81  2                          mazda 626
## 367 28.1  4 194 211 3619 20.4 81  2          peugeot 505s turbo diesel
## 368   NA  4 190 144 3326 15.4 81  2                          saab 900s
## 369 30.7  6 434  57 4095 19.6 81  2                     volvo diesel
## 370 25.4  6 301 230 1656 12.6 81  2                   toyota cressida
## 371 24.2  6 262 148 2305 13.8 81  2                  datsun 810 maxima
## 372 22.4  6 319 117 4996 15.8 81  1                      buick century
## 373 26.6  8 372 183 2435 19.0 81  1                oldsmobile cutlass ls
## 374 20.2  6 435 119 1837 17.1 81  1                       ford granada gl
## 375 17.6  6 442 146 3887 16.6 81  1              chrysler lebaron salon
## 376 28.0  4 244 158 2658 19.6 82  1                  chevrolet cavalier
## 377 27.0  4 201  80 3589 18.6 82  1           chevrolet cavalier wagon
## 378 34.0  4 411 209 2011 18.0 82  1           chevrolet cavalier 2-door
## 379 31.0  4 150 142 3703 16.2 82  1          pontiac j2000 se hatchback
## 380 29.0  4 437 208 3711 16.0 82  1                     dodge aries se
## 381 27.0  4 161  91 4324 18.0 82  1                    pontiac phoenix
## 382 24.0  4 289 198 4896 16.4 82  1               ford fairmont futura
## 383 23.0  4 438  85 2036 20.5 82  1                      amc concord dl
```

```
## 384 36.0  4 487 185 2771 15.3 82  2                 volkswagen rabbit l
## 385 37.0  4 461  84 2329 18.2 82  2                  mazda glc custom l
## 386 31.0  4 243 137 2367 17.6 82  2                    mazda glc custom
## 387 38.0  4 306 204 2746 14.7 82  1               plymouth horizon miser
## 388 36.0  4 224  66 4747 17.3 82  1                       mercury lynx l
## 389 36.0  4 429 131 2836 14.5 82  2                    nissan stanza xe
## 390 36.0  4 198 208 3746 14.5 82  2                        honda accord
## 391 34.0  4 137 138 2438 16.9 82  2                      toyota corolla
## 392 38.0  4 316  74 1758 15.0 82  2                         honda civic
## 393 32.0  4 176 215 3491 15.7 82  2                   honda civic (auto)
## 394 38.0  4 121 217 3481 16.2 82  2                        datsun 310 gx
## 395 25.0  6 250 114 2504 16.4 82  1                 buick century limited
## 396 38.0  6 473 213 1847 17.0 82  1    oldsmobile cutlass ciera (diesel)
## 397 26.0  4 190 180 4448 14.5 82  1           chrysler lebaron medallion
## 398 22.0  6 421  77 1743 14.7 82  1                       ford granada l
## 399 32.0  4 256 148 4837 13.9 82  2                     toyota celica gt
## 400 36.0  4 429 114 1952 13.0 82  1                    dodge charger 2.2
## 401 27.0  4 145 212 2379 17.3 82  1                     chevrolet camaro
## 402 27.0  4 435 217 5118 15.6 82  1                      ford mustang gl
## 403 44.0  4 353 129 2544 24.6 82  2                            vw pickup
## 404 32.0  4 249 159 4955 11.6 82  1                       dodge rampage
## 405 28.0  4 264 119 4640 18.6 82  1                         ford ranger
## 406 31.0  4 367 176 4839 19.4 82  1                          chevy s-10
```

```
sum(is.na(M2))
```

```
## [1] 8
```

```
nrow(M2)
```

```
## [1] 406
```

```
M2= na.omit(M2)
nrow(M2)
```

```
## [1] 398
```

```
sum(is.na(M2))
```

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

```
M2Num = M2[,-9]
```

Existen 8 valores nulos los cuales se eliminaron y nos queda 398 pruebas.

2. Elija la variable V8 como variable dependiente, determine a través de análisis discriminante el análisis y responda a las siguientes preguntas:

a. Realice la implementación del modelo que incluya en principio todas las variables de la base para determinar su variable dependiente.

```
library(klaR)
```

```
## Loading required package: MASS
```

```
greedy.wilks(V8 ~., M2Num)
```

```
## Formula containing included variables:
##
## V8 ~ V2 + V1 + V7
## <environment: 0x7fb9d989d180>
##
##
## Values calculated in each step of the selection procedure:
##
##   vars Wilks.lambda F.statistics.overall p.value.overall F.statistics.diff
## 1   V2    0.6347596            227.85822    5.448672e-41         227.85822
## 2   V1    0.6098922            126.32773    3.867956e-43          16.10552
## 3   V7    0.5756180             96.82724    5.785536e-47          23.46005
##   p.value.diff
## 1 5.448672e-41
## 2 7.164984e-05
## 3 1.834421e-06
```

```
modelo3 <- lda(V8 ~ V2+V1+V7 , data = M)
```

b. Obtenga los valores de la función discriminante utilizando el resultado de los coeficientes en el inciso a).

```
modelo3$scaling
```

```
##           LD1
## V2 -0.4390472
## V1  0.1061919
## V7 -0.1263154
```

c. Considere la función discriminante y los grupos. ¿Cuál es el valor del umbral (criterio de decisión)? Redondee a dos dígitos después del punto decimal:

d. Genere la variable “clase.pred” con el criterio condicional de si los valores de la función discriminante están por encima del valor del inciso c) pertenecen al grupo 1. ¿Cual es la tasa de error del modelo considerando esta clase predicha? Considere los primeros 3 dígitos después del punto decimal:

e. Genere las predicciones del modelo y obtenga las probabilidades a posteriori de los grupos.

```
predicciones = predict(modelo3)
predicciones$posterior
```

```
##              1          2
## 1   0.92864250 0.071357497
## 2   0.95822338 0.041776620
## 3   0.92864250 0.071357497
## 4   0.94997138 0.050028624
## 5   0.94019112 0.059808882
## 6   0.95822338 0.041776620
## 7   0.96516417 0.034835835
## 8   0.96516417 0.034835835
## 9   0.96516417 0.034835835
## 10  0.95822338 0.041776620
## 16  0.95822338 0.041776620
## 17  0.96516417 0.034835835
## 19  0.95822338 0.041776620
## 20  0.96516417 0.034835835
## 21  0.15557176 0.844428238
## 22  0.56176464 0.438235359
## 23  0.73183587 0.268164133
## 24  0.60759985 0.392400153
## 25  0.09463804 0.905361956
## 26  0.11210996 0.887890039
## 27  0.13233603 0.867663975
## 28  0.15557176 0.844428238
## 29  0.13233603 0.867663975
## 30  0.11210996 0.887890039
## 31  0.60759985 0.392400153
## 32  0.98332914 0.016670857
## 33  0.98332914 0.016670857
## 34  0.97993235 0.020067654
## 35  0.98615909 0.013840905
## 36  0.11572314 0.884276858
## 37  0.09775012 0.902249883
## 38  0.16033273 0.839667269
## 41  0.73880277 0.261197233
## 42  0.83292180 0.167078196
## 43  0.80495723 0.195042770
## 44  0.73880277 0.261197233
## 45  0.77358444 0.226415564
## 46  0.97197838 0.028021617
## 47  0.97197838 0.028021617
## 48  0.97197838 0.028021617
## 49  0.97197838 0.028021617
## 50  0.98062435 0.019375649
## 51  0.97668950 0.023310501
## 52  0.97668950 0.023310501
## 53  0.77358444 0.226415564
## 54  0.25180063 0.748199368
## 55  0.73880277 0.261197233
## 56  0.77358444 0.226415564
## 57  0.21790119 0.782098811
## 58  0.09775012 0.902249883
## 59  0.06911962 0.930880383
## 60  0.06911962 0.930880383
## 61  0.05791060 0.942089401
## 62  0.02806325 0.971936752
## 63  0.11572314 0.884276858
## 64  0.13650086 0.863499145
## 65  0.22406349 0.775936508
## 66  0.19293532 0.807064675
## 67  0.25860463 0.741395373
## 68  0.38071582 0.619284183
## 69  0.33728459 0.662715411
## 70  0.98129295 0.018707050
## 71  0.97749076 0.022509238
```

```
## 72  0.97293710 0.027062905
## 73  0.97749076 0.022509238
## 74  0.96099729 0.039002713
## 75  0.98710308 0.012896924
## 76  0.98129295 0.018707050
## 77  0.98446309 0.015536907
## 78  0.98129295 0.018707050
## 79  0.25376428 0.746235719
## 80  0.97293710 0.027062905
## 81  0.98129295 0.018707050
## 82  0.98129295 0.018707050
## 83  0.97749076 0.022509238
## 84  0.47285273 0.527147270
## 85  0.29643628 0.703563717
## 86  0.33728459 0.662715411
## 87  0.16521089 0.834789106
## 88  0.29643628 0.703563717
## 89  0.11943711 0.880562892
## 90  0.25860463 0.741395373
## 91  0.11943711 0.880562892
## 92  0.14077549 0.859224507
## 93  0.98500125 0.014998747
## 94  0.98193890 0.018061098
## 95  0.98500125 0.014998747
## 96  0.98193890 0.018061098
## 97  0.97826509 0.021734906
## 98  0.98755095 0.012449050
## 99  0.98500125 0.014998747
## 100 0.98500125 0.014998747
## 101 0.98193890 0.018061098
## 102 0.98500125 0.014998747
## 103 0.98755095 0.012449050
## 104 0.98500125 0.014998747
## 105 0.84264935 0.157350654
## 106 0.88654134 0.113458659
## 107 0.84264935 0.157350654
## 108 0.84264935 0.157350654
## 109 0.67558083 0.324419166
## 110 0.19857085 0.801429153
## 111 0.98967176 0.010328241
## 112 0.98755095 0.012449050
## 113 0.98500125 0.014998747
## 114 0.98755095 0.012449050
## 115 0.84264935 0.157350654
## 116 0.43491996 0.565080037
## 117 0.38919128 0.610808720
## 118 0.34533234 0.654667657
## 119 0.33961229 0.660387713
## 120 0.48178361 0.518216388
## 121 0.75238099 0.247619013
## 122 0.19857085 0.801429153
## 123 0.97826509 0.021734906
## 124 0.97386389 0.026136111
## 125 0.12325365 0.876746346
## 126 0.26552723 0.734472772
## 127 0.43491996 0.565080037
## 128 0.48178361 0.518216388
## 129 0.97826509 0.021734906
## 130 0.26552723 0.734472772
## 131 0.78587858 0.214121423
## 132 0.98967176 0.010328241
## 133 0.82126840 0.178731598
## 135 0.84733786 0.152662136
## 136 0.92197598 0.078024018
```

```
## 137 0.10763949 0.892360512
## 138 0.23675650 0.763243499
## 139 0.09079303 0.909206966
## 140 0.27256701 0.727432988
## 141 0.90725712 0.092742883
## 142 0.90725712 0.092742883
## 143 0.87020582 0.129794175
## 144 0.97901336 0.020986638
## 145 0.98798346 0.012016540
## 146 0.98552105 0.014478953
## 147 0.98552105 0.014478953
## 148 0.98552105 0.014478953
## 149 0.14966034 0.850339662
## 150 0.23675650 0.763243499
## 151 0.23675650 0.763243499
## 152 0.10763949 0.892360512
## 153 0.09079303 0.909206966
## 154 0.17532326 0.824676741
## 155 0.31158282 0.688417179
## 156 0.23675650 0.763243499
## 157 0.31158282 0.688417179
## 158 0.23675650 0.763243499
## 159 0.10763949 0.892360512
## 160 0.87419584 0.125804162
## 161 0.89354607 0.106453935
## 162 0.93668401 0.063315985
## 163 0.93668401 0.063315985
## 164 0.98316580 0.016834204
## 165 0.98602308 0.013976917
## 166 0.98316580 0.016834204
## 167 0.98840112 0.011598879
## 168 0.91022564 0.089774363
## 169 0.92451258 0.075487421
## 170 0.93668401 0.063315985
## 171 0.89354607 0.106453935
## 172 0.82646280 0.173537203
## 173 0.96482920 0.035170802
## 174 0.99037851 0.009621494
## 175 0.18055944 0.819440564
## 176 0.40633998 0.593660018
## 177 0.85191123 0.148088769
## 178 0.40633998 0.593660018
## 179 0.36169287 0.638307130
## 180 0.31931280 0.680687198
## 181 0.36169287 0.638307130
## 182 0.89354607 0.106453935
## 183 0.18055944 0.819440564
## 184 0.87419584 0.125804162
## 185 0.40633998 0.593660018
## 186 0.40633998 0.593660018
## 187 0.45259059 0.547409411
## 188 0.31931280 0.680687198
## 189 0.09379177 0.906208233
## 190 0.24993694 0.750063056
## 191 0.36999786 0.630002137
## 192 0.36999786 0.630002137
## 193 0.32714342 0.672856578
## 194 0.28699143 0.713008567
## 195 0.98216698 0.017833022
## 196 0.98650795 0.013492050
## 197 0.98770904 0.012290955
## 198 0.98980320 0.010196801
## 199 0.83153720 0.168462803
## 200 0.83153720 0.168462803
```

```
## 201 0.77184279 0.228157212
## 202 0.81788856 0.182111440
## 203 0.21621590 0.783784101
## 204 0.39227194 0.607728065
## 205 0.21621590 0.783784101
## 206 0.11471221 0.885287793
## 207 0.87808038 0.121919622
## 208 0.91310824 0.086891759
## 209 0.90531587 0.094684134
## 210 0.92031576 0.079684240
## 211 0.20063827 0.799361729
## 212 0.13533619 0.864663810
## 213 0.24993694 0.750063056
## 214 0.30670116 0.693298844
## 215 0.60164206 0.398357939
## 216 0.99229991 0.007700090
## 217 0.64593521 0.354064790
## 218 0.89690358 0.103096421
## 219 0.93311493 0.066885073
## 220 0.98519124 0.014808759
## 221 0.99229991 0.007700090
## 222 0.99229991 0.007700090
## 223 0.99229991 0.007700090
## 224 0.17720216 0.822797842
## 225 0.22234409 0.777655908
## 226 0.08428485 0.915715154
## 227 0.40083814 0.599161855
## 228 0.12861792 0.871382081
## 229 0.98570455 0.014295453
## 230 0.98697622 0.013023782
## 231 0.99015824 0.009841760
## 232 0.99103733 0.008962670
## 233 0.93531480 0.064685201
## 234 0.89135219 0.108647810
## 235 0.91590684 0.084093163
## 236 0.92290182 0.077098182
## 237 0.98919387 0.010806134
## 238 0.99015824 0.009841760
## 239 0.99015824 0.009841760
## 240 0.98919387 0.010806134
## 241 0.25670786 0.743292141
## 242 0.44693398 0.553066024
## 243 0.37838051 0.621619490
## 244 0.40083814 0.599161855
## 245 0.20644124 0.793558761
## 246 0.12861792 0.871382081
## 247 0.22234409 0.777655908
## 248 0.20644124 0.793558761
## 249 0.86071806 0.139281942
## 250 0.58750390 0.412496102
## 251 0.39475307 0.605246927
## 252 0.02925421 0.970745790
## 253 0.10158937 0.898410629
## 254 0.17417916 0.825820840
## 255 0.05715779 0.942842208
## 256 0.10158937 0.898410629
## 257 0.98209737 0.017902632
## 258 0.98368461 0.016315390
## 259 0.98107324 0.018926758
## 260 0.92922951 0.070770495
## 261 0.91127749 0.088722513
## 262 0.91575395 0.084246050
## 263 0.47459556 0.525404439
## 264 0.91127749 0.088722513
```

```
## 265 0.92670427 0.073295735
## 266 0.90973824 0.090261760
## 267 0.90658743 0.093412574
## 268 0.93633022 0.063669784
## 269 0.94173443 0.058265574
## 270 0.98428002 0.015719979
## 271 0.94574485 0.054255150
## 272 0.98719177 0.012808231
## 273 0.98854854 0.011451457
## 274 0.26359774 0.736402263
## 275 0.36468582 0.635314182
## 276 0.37791412 0.622085880
## 277 0.23194357 0.768056429
## 278 0.65789437 0.342105629
## 279 0.56395254 0.436047462
## 280 0.53590670 0.464093299
## 281 0.53120532 0.468794681
## 282 0.83006431 0.169935694
## 283 0.95214356 0.047856438
## 284 0.63633015 0.363669853
## 285 0.95857790 0.041422102
## 286 0.21236745 0.787632546
## 287 0.28233704 0.717662964
## 288 0.91412950 0.085870498
## 289 0.93621187 0.063788126
## 290 0.65744784 0.342552161
## 291 0.93154780 0.068452205
## 292 0.92656943 0.073430565
## 293 0.99165142 0.008348579
## 294 0.99065880 0.009341197
## 295 0.99239816 0.007601840
## 296 0.98954941 0.010450590
## 297 0.99180637 0.008193629
## 298 0.99369847 0.006301528
## 299 0.98740380 0.012596203
## 300 0.98894678 0.011053217
## 301 0.23838195 0.761618045
## 302 0.17119700 0.828802998
## 303 0.13245555 0.867544447
## 304 0.42275182 0.577248176
## 305 0.70001311 0.299986887
## 306 0.97451463 0.025485369
## 307 0.43199763 0.568002367
## 308 0.96993357 0.030066433
## 309 0.16853324 0.831466755
## 310 0.16074025 0.839259751
## 311 0.24182862 0.758171384
## 312 0.10140850 0.898591505
## 313 0.37744796 0.622552043
## 314 0.72831827 0.271681732
## 315 0.79639638 0.203603623
## 316 0.18788330 0.812116698
## 317 0.06006532 0.939934675
## 318 0.10831280 0.891687195
## 319 0.27395528 0.726044723
## 320 0.12585947 0.874140534
## 321 0.45013486 0.549865138
## 322 0.52550940 0.474490603
## 323 0.62218483 0.377815169
## 324 0.95448873 0.045511275
## 325 0.19936891 0.800631089
## 326 0.36815050 0.631849496
## 327 0.30501682 0.694983178
## 328 0.13007524 0.869924765
```

```
## 329 0.27021392 0.729786078
## 330 0.02380408 0.976195916
## 331 0.45481485 0.545185153
## 332 0.06797990 0.932020105
## 333 0.03628753 0.963712469
## 334 0.04272518 0.957274817
## 335 0.26777966 0.732220336
## 336 0.35940653 0.640593471
## 337 0.03435691 0.965643087
## 339 0.21487448 0.785125522
## 340 0.36815050 0.631849496
## 341 0.61634736 0.383652642
## 342 0.45788612 0.542113878
## 343 0.17909682 0.820903181
## 345 0.26282847 0.737171533
## 346 0.54381382 0.456186182
## 347 0.57176365 0.428236349
## 348 0.60830108 0.391698918
## 349 0.91958548 0.080414520
## 350 0.41259811 0.587401887
## 351 0.11181902 0.888180980
## 352 0.11370897 0.886291032
## 353 0.21137391 0.788626094
## 354 0.31265789 0.687342110
## 355 0.15768057 0.842319427
## 356 0.14090141 0.859098594
## 357 0.24457544 0.755424564
## 358 0.22424446 0.775755542
## 359 0.23425689 0.765743107
## 360 0.41718393 0.582816071
## 361 0.28496649 0.715033514
## 363 0.25880418 0.741195815
## 364 0.30861265 0.691387352
## 365 0.28883126 0.711168739
## 366 0.34175406 0.658245940
## 367 0.50142228 0.498577721
## 369 0.74584887 0.254151126
## 370 0.88872704 0.111272956
## 371 0.90924846 0.090751539
## 372 0.93367283 0.066327166
## 373 0.96811389 0.031886110
## 374 0.95521756 0.044782435
## 375 0.97211222 0.027887777
## 376 0.56200065 0.437999349
## 377 0.60782841 0.392171594
## 378 0.29231653 0.707683467
## 379 0.42130049 0.578699514
## 380 0.51508993 0.484910074
## 381 0.60782841 0.392171594
## 382 0.73202398 0.267976022
## 384 0.22063413 0.779365866
## 385 0.18986581 0.810134186
## 386 0.42130049 0.578699514
## 387 0.16249366 0.837506341
## 388 0.22063413 0.779365866
## 389 0.22063413 0.779365866
## 390 0.22063413 0.779365866
## 391 0.29231653 0.707683467
## 392 0.16249366 0.837506341
## 393 0.37605083 0.623949171
## 394 0.16249366 0.837506341
## 395 0.91513988 0.084860124
## 396 0.48057841 0.519421586
## 397 0.65183176 0.348168241
```

```
## 398 0.95001692 0.049983080
## 399 0.37605083 0.623949171
## 400 0.22063413 0.779365866
## 401 0.60782841 0.392171594
## 402 0.60782841 0.392171594
## 403 0.05878775 0.941212247
## 404 0.37605083 0.623949171
## 405 0.56200065 0.437999349
## 406 0.42130049 0.578699514
```

f. Utilice nuevamente su modelo final considerando costos distintos de cero para los grupos (determine los que considere adecuados para el ejercicio). Muestre los resultados y matriz de confusión.

g. ¿Se logró segmentar? ¿Es buen discriminante para su predicción?

Problema 4

Los siguientes datos corresponden a la contaminación del aire de la ciudad de los Ángeles en diferentes días con las siguientes variables:

- X1 = Wind
- X2 = Solar radiation
- X3 = CO
- X4 = NO
- X5 = NO2
- X6 = O3
- X7 = HC (hydrocarbons combustion)

1. Realice un análisis de normalidad de las variables continuas para identificar variables normales por pares y por distribución conjunta (se sugiere utilizar la prueba normalidad de Mardia y con prueba de Anderson Darling). Identifique las variables que resultaron leptocúrticas, platicúrticas y mesocúrticas.

Según la prueba de normalidad de Marbia no pasa la prueba de sesgo, pero si la de kurtosis. Los datos no se deistribuyen normal.

```
library(moments)
pro4 = read.csv("airpollution.csv")
library(MVN)
mvn(data = pro4, mvnTest = "mardia")
```

```
## $multivariateNormality
##              Test        Statistic             p value Result
## 1 Mardia Skewness 129.215412365806 0.00112128950460133     NO
## 2 Mardia Kurtosis 1.14168278514876   0.253585898977204    YES
## 3             MVN             <NA>                <NA>     NO
##
## $univariateNormality
##               Test  Variable Statistic   p value Normality
## 1 Anderson-Darling    X1        0.9891  0.0118      NO
## 2 Anderson-Darling    X2        0.9623  0.0137      NO
## 3 Anderson-Darling    X3        2.3631  <0.001      NO
## 4 Anderson-Darling    X4        2.1283  <0.001      NO
## 5 Anderson-Darling    X5        0.6975  0.0636      YES
## 6 Anderson-Darling    X6        1.2030  0.0034      NO
## 7 Anderson-Darling    X7        3.9150  <0.001      NO
##
## $Descriptives
##     n      Mean    Std.Dev Median Min Max  25th  75th        Skew    Kurtosis
## X1 42  7.500000  1.5811388    8.0   5  10  6.00  8.75  0.03614032 -1.10809524
## X2 42 73.857143 17.3353881   76.5  30 107 68.25 84.75 -0.73323765  0.30901245
## X3 42  4.547619  1.2337209    4.0   2   7  4.00  5.00  0.57793497 -0.25497268
## X4 42  2.190476  1.0873574    2.0   1   5  1.00  3.00  0.62983752 -0.52220171
## X5 42 10.047619  3.3709837    9.5   5  21  8.00 12.00  0.98543943  1.22197318
## X6 42  9.404762  5.5658345    8.5   2  25  6.00 11.00  1.13370267  1.02388767
## X7 42  3.095238  0.6917466    3.0   2   5  3.00  3.00  0.31349052  0.04343283
```

```
kurtosis(pro4)
```

```
##       X1       X2       X3       X4       X5       X6       X7
## 1.985318 3.472396 2.880564 2.600140 4.430435 4.222569 3.193703
```

Todas las variables son leptocúrticas

2. Con el total de datos calcula la distancia de Mahalanobis de cada observación al centroide (vector de medias) con respecto a la matriz de covarianzas. ¿Qué observación está más alejada, según la distancia de Mahalanobis, del centroide? ¿Qué observación está más cercana?

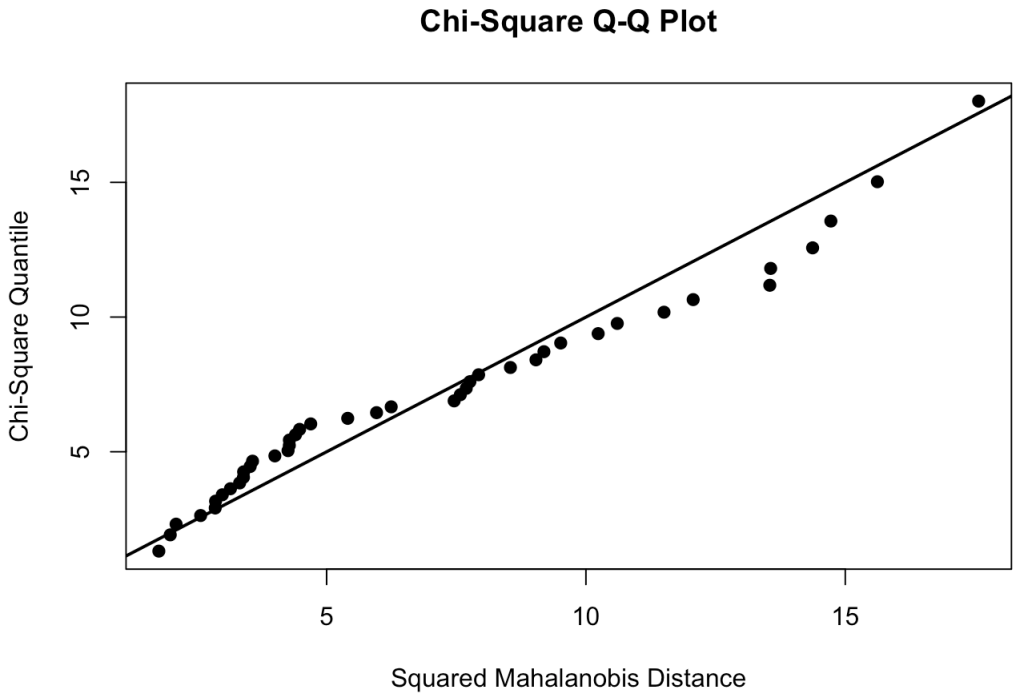
```
vMedia4 = colMeans(pro4)
S4 = cov(pro4)
Dm = mahalanobis(pro4, vMedia4, S4)
gl = ncol(pro4)
for(i in c(0.25, 0.5, 0.75)){
  prop = sum(Dm < qchisq(i,gl))/length(Dm)
  cat("Observado:",prop, "Esperado: ", i*100, "%\n")
}
```

```
## Observado: 0.4047619 Esperado:  25 %
## Observado: 0.547619 Esperado:  50 %
## Observado: 0.7380952 Esperado:  75 %
```

No muy similares, pero son cercanos.

3. Interprete los resultados de su análisis.

```
test4 = mvn(data = pro4, multivariatePlot = "qq")
```



se observan que las distancias de Mahalanobis mayores provocan sesgo nega

Problema 5

Los siguientes datos corresponden a la contaminación del aire de la ciudad de los Ángeles en diferentes días con las siguientes variables:

- X1 = Wind
- X2 = Solar radiation
- X3 = CO
- X4 = NO
- X5 = NO2
- X6 = O3
- X7 = HC (hydrocarbons combustion)

A. Aplicar al total de datos un análisis de componentes principales y con base en al menos tres criterios (por ejemplo, porcentaje de variación acumulada, gráfica de Scree y los valores de las cargas) determinar cuántos componentes son suficientes para explicar razonablemente la mayoría de la variación.

B. Escribir las combinaciones lineales de los Componentes principales en función de las variables y cargas obtenidas de los componentes principales resultantes.

C. Utilizando los dos primeros componentes hacer una gráfica de dispersión de las puntuaciones. Comentar el gráfico en función de la variabilidad.

D. Hacer un gráfico vectorial de las variables e interpretar sus relaciones.

E. Interprete los resultados de su análisis.

Problema 6

A continuación se muestran los records de mujeres en pruebas de velocidad corriendo de varios países.

COUNTRY = país

- X1 = segundos en carrera de 100 metros
- X2 = segundos en carrera de 200 metros
- X3 = segundos en carrera de 400 metros
- X4 = minutos en carrera de 800 metros
- X5 = minutos en carrera de 1500 metros
- X6 = minutos en carrera de 3000 metros
- X7 = minutos en carrera de maratón

A. Justifique por qué es adecuado el uso del Análisis factorial (hacer la prueba de esfericidad de Bartlett y KMO).

B. Justifique el número de factores principales que se utilizarán en el modelo.

C. dentifique las comunalidades de los factores del modelo propuesto, y los errores: interprete si se necesita un nuevo factor.

D. Encuentre con ayuda de un gráfico de variables qué conviene más sin rotación o con rotación varimax. (se puede ayudar con la función **fa** de la librería psych y el gráfico de la función **fa.diagram**)

E. Interprete los resultados de su análisis.

Problema 7

A continuación se muestra las distancias por avión entre las siguientes ciudades:

0					
1068	0				
461	867	0			
549	769	107	0		
805	1819	943	1050	0	
508	941	108	172	882	0

A. Hallar la matriz de ultra-distancias (dendrogram-dist) con el método de aglomeración jerárquica: (1) distancia mínima para nuevo grupo (2) distancia promedio entre individuos. Construir el dendrograma respectivo.

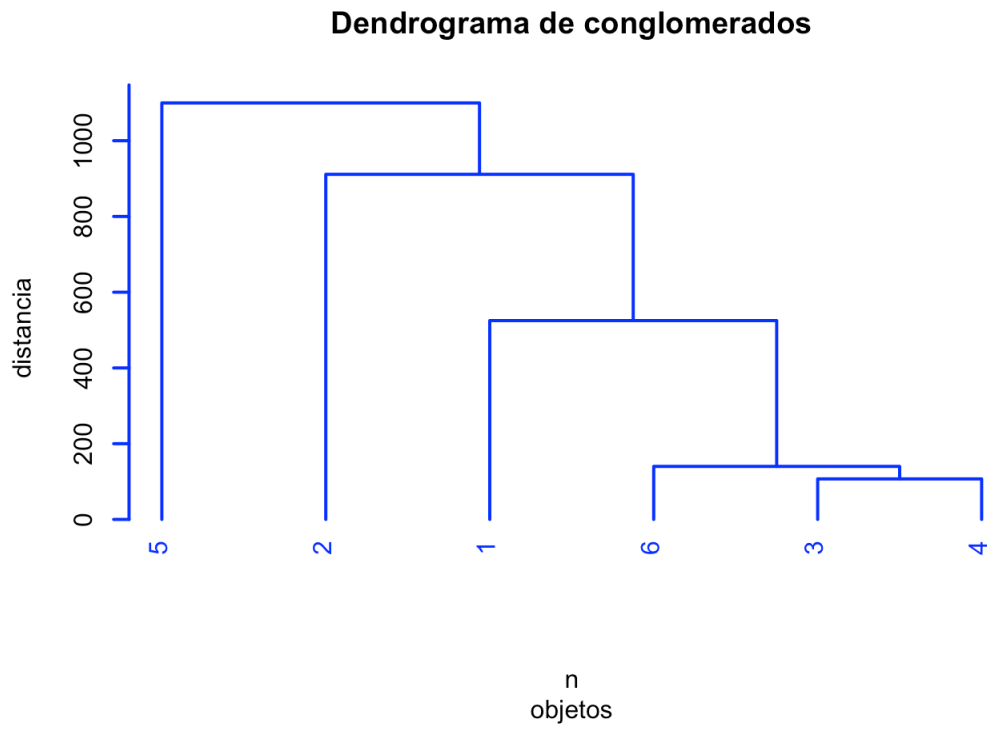
```
library(factoextra)
```

```
## Welcome! Want to learn more? See two factoextra-related books at https://goo.gl/ve3WBa
```

```
Mpre7 = matrix(c(0,1068,606,461,805,508,0,0,867,769,1819,941,0,0,0,107,943,108,0,0,0,0, 1050,172,0,0,0,0,0,8
82,0,0,0,0,0,0), ncol = 6)
M7 = Mpre7 + t(Mpre7); M7
```

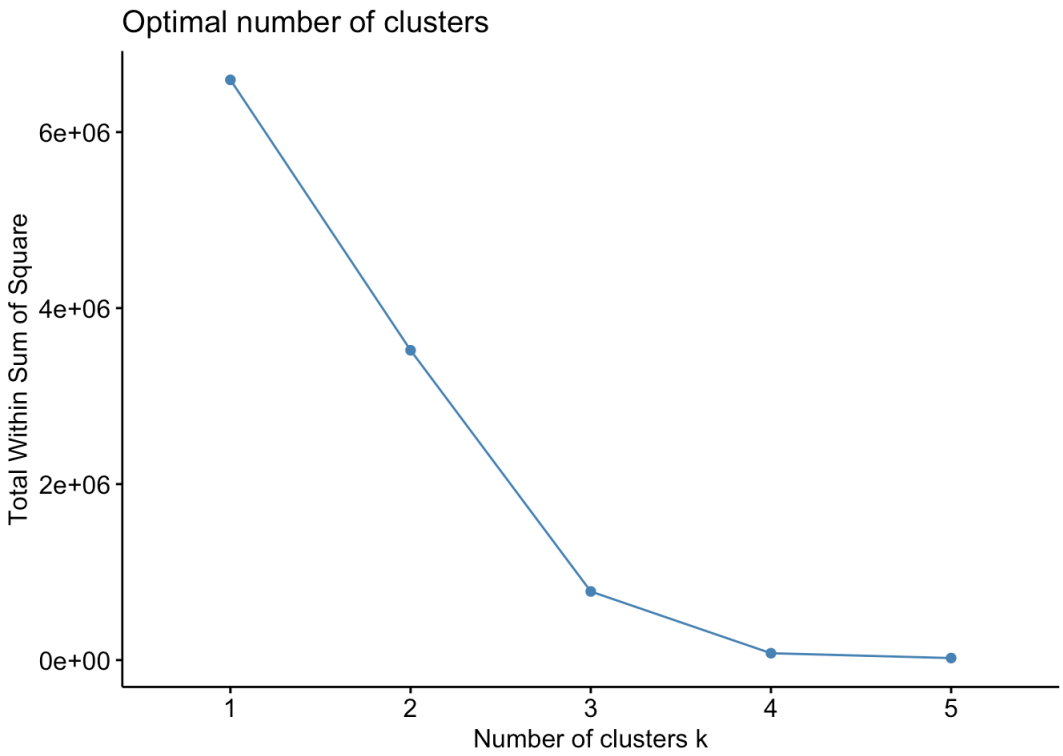
```
##      [,1] [,2] [,3] [,4] [,5] [,6]
## [1,]    0 1068  606  461  805  508
## [2,] 1068    0  867  769 1819  941
## [3,]  606  867    0  107  943  108
## [4,]  461  769  107    0 1050  172
## [5,]  805 1819  943 1050    0  882
## [6,]  508  941  108  172  882    0
```

```
d7 = as.dist(M7)
J = hclust(d7, method = "average")
plot(J, hang = -1, lwd = 2, col = "blue", main = "Dendrograma de conglomerados", sub = "objetos", xlab = "
n",ylab = c("distancia"))
```



B. Interprete los resultados de su análisis.

```
fviz_nbclust(M7, FUNcluster = kmeans, method = "wss", k.max = 5)
```



Al ver la grafica de clusters optimos realizado por el dondograma de conglomerados podemos decir que el numero optimo de clusters para nuestos datos es 4.