MATH 3070 Lab Project 5

Prachi Aswani

September 26, 2024

Contents

Problem 1 (Verzani problem 4.7) 1
Problem 2 (Verzani problem 4.10) 2
Problem 3 (Verzani problem 4.11) 2
Problem 4 3

Remember: I expect to see commentary either in the text, in the code with comments created using `#`*, or (preferably) both!* ***Failing to do so may result in lost points!***

Problem 1 (Verzani problem 4.7)

Use the `subset()` *function to return a data frame made from the* `Cars93` *(**MASS**) data frame consisting only of* `non-USA` *cars in origin, with 4 cylinders and a maximum price of $15,000 or less.*

```
library(MASS)

# Subset the Cars93 data frame based on three conditions:
# - Origin should be "non-USA"
# - The car should have 4 cylinders
# - The price should be less than or equal to 15000
non_usa_4cylinders_max15000 <- subset(Cars93,
                                      subset = (Origin == "non-USA" & Cylinders == 4 & Max.Price <= 15.0

# Output the resulting subset data frame
non_usa_4cylinders_max15000
```

```
##    Manufacturer   Model   Type Min.Price Price Max.Price MPG.city MPG.highway
## 40          Geo   Storm Sporty      11.5  12.5      13.5       30          36
## 44      Hyundai   Excel  Small       6.8   8.0       9.2       29          33
## 45      Hyundai Elantra  Small       9.0  10.0      11.0       22          29
## 46      Hyundai  Scoupe Sporty       9.1  10.0      11.0       26          34
## 53        Mazda     323  Small       7.4   8.3       9.1       29          37
## 54        Mazda Protege  Small      10.9  11.6      12.3       28          36
## 62   Mitsubishi  Mirage  Small       7.7  10.3      12.9       29          33
## 64       Nissan  Sentra  Small       8.7  11.8      14.9       29          33
## 81       Subaru  Loyale  Small      10.5  10.9      11.3       25          30
## 84       Toyota  Tercel  Small       7.8   9.8      11.8       32          37
```

```
## 88   Volkswagen     Fox  Small       8.7   9.1       9.5       25          33
##        AirBags DriveTrain Cylinders EngineSize Horsepower  RPM Rev.per.mile
## 40 Driver only      Front         4        1.6         90 5400         3250
## 44        None      Front         4        1.5         81 5500         2710
## 45        None      Front         4        1.8        124 6000         2745
## 46        None      Front         4        1.5         92 5550         2540
## 53        None      Front         4        1.6         82 5000         2370
## 54        None      Front         4        1.8        103 5500         2220
## 62        None      Front         4        1.5         92 6000         2505
## 64 Driver only      Front         4        1.6        110 6000         2435
## 81        None        4WD         4        1.8         90 5200         3375
## 84 Driver only      Front         4        1.5         82 5200         3505
## 88        None      Front         4        1.8         81 5500         2550
##    Man.trans.avail Fuel.tank.capacity Passengers Length Wheelbase Width
## 40             Yes               12.4          4    164        97    67
## 44             Yes               11.9          5    168        94    63
## 45             Yes               13.7          5    172        98    66
## 46             Yes               11.9          4    166        94    64
## 53             Yes               13.2          4    164        97    66
## 54             Yes               14.5          5    172        98    66
## 62             Yes               13.2          5    172        98    67
## 64             Yes               13.2          5    170        96    66
## 81             Yes               15.9          5    175        97    65
## 84             Yes               11.9          5    162        94    65
## 88             Yes               12.4          4    163        93    63
##    Turn.circle Rear.seat.room Luggage.room Weight  Origin              Make
## 40          37           24.5           11   2475 non-USA         Geo Storm
## 44          35           26.0           11   2345 non-USA     Hyundai Excel
## 45          36           28.0           12   2620 non-USA   Hyundai Elantra
## 46          34           23.5            9   2285 non-USA    Hyundai Scoupe
## 53          34           27.0           16   2325 non-USA         Mazda 323
## 54          36           26.5           13   2440 non-USA     Mazda Protege
## 62          36           26.0           11   2295 non-USA Mitsubishi Mirage
## 64          33           26.0           12   2545 non-USA     Nissan Sentra
## 81          35           27.5           15   2490 non-USA     Subaru Loyale
## 84          36           24.0           11   2055 non-USA     Toyota Tercel
## 88          34           26.0           10   2240 non-USA    Volkswagen Fox
```

Problem 2 (Verzani problem 4.10)

Find the standard deviation of each variable in the `mtcars` *data set.*

```
# Apply the sapply function to get the standard deviation of each column in mtcars
sapply(mtcars, sd)
```

```
##         mpg         cyl        disp          hp        drat          wt
##   6.0269481   1.7859216 123.9386938  68.5628685   0.5346787   0.9784574
##        qsec          vs          am        gear        carb
##   1.7869432   0.5040161   0.4989909   0.7378041   1.6152000
```

Problem 3 (Verzani problem 4.11)

Find the standard deviation for each numeric variable in `Cars93` *(**MASS**).*

```r
# Subset Cars93 to only numeric variables and calculate the standard deviation
sapply(Cars93[sapply(Cars93, is.numeric)], sd)
```

```
##          Min.Price              Price          Max.Price           MPG.city
##           8.746029           9.659430          11.030457           5.619812
##        MPG.highway         EngineSize         Horsepower                RPM
##           5.331726           1.037363          52.374410         596.731690
##       Rev.per.mile Fuel.tank.capacity         Passengers             Length
##         496.506525           3.279370           1.038979          14.602382
##          Wheelbase              Width        Turn.circle     Rear.seat.room
##           6.819674           3.778986           3.223265                 NA
##       Luggage.room             Weight
##                 NA         589.896510
```

Problem 4

You can find data describing various statistics on 2012 Olympic participating nations such as population and medal counts in the comma-separated value file (olympic-medals2012.csv). Load this dataset into R in a data frame and do the following:

1. *Create a new data frame containing only the country's ISO code (a three-letter code for the country; USA is the United States of America, and DZA Algeria), name, population, and counts for gold, silver, and bronze. This data frame should be called* `olympic2012`.

```r
# Load the olympic-medals2012.csv file
olympic_data <- read.csv("C:/Users/Prachi/OneDrive/Documents/olympic-medals2012.csv")

# Create a new data frame containing selected columns: ISO code, Country name, Population, Gold, Silver
olympic2012 <- olympic_data[, c("ISO", "Country.name", "pop.2010", "Gold", "Silver", "Bronze")]

# Display the olympic2012 data frame
olympic2012
```

```
##     ISO                  Country.name      pop.2010 Gold Silver Bronze
## 1   AFG                   Afghanistan    34,385,000    0      0      1
## 2   ALB                       Albania     3,205,000    0      0      0
## 3   DZA                       Algeria    35,468,000    1      0      0
## 4   ASM                American Samoa        68,420    0      0      0
## 5   AND                       Andorra        84,864    0      0      0
## 6   AGO                        Angola    19,082,000    0      0      0
## 7   ATG          Antigua and Barbuda        88,000    0      0      0
## 8   ARG                     Argentina    40,412,000    1      1      2
## 9   ARM                       Armenia     3,092,000    0      1      2
## 10  ABW                         Aruba       108,000    0      0      0
## 11  AUS                     Australia    22,299,000    7     16     12
## 12  AUT                       Austria     8,390,000    0      0      0
## 13  AZE                    Azerbaijan     9,054,000    2      2      6
## 14  BHS                       Bahamas       343,000    1      0      0
## 15  BHR                       Bahrain     1,262,000    0      0      1
## 16  BGD                    Bangladesh   148,692,000    0      0      0
## 17  BRB                      Barbados       274,000    0      0      0
```

```
## 18  BLR                        Belarus     9,490,000    2      5      5
## 19  BEL                        Belgium    10,896,000    0      1      2
## 20  BLZ                         Belize       345,000    0      0      0
## 21  BEN                          Benin     8,850,000    0      0      0
## 22  BMU                        Bermuda        64,600    0      0      0
## 23  BTN                         Bhutan       726,000    0      0      0
## 24  BOL                        Bolivia     9,929,000    0      0      0
## 25  BIH          Bosnia and Herzegovina     3,760,000    0      0      0
## 26  BWA                       Botswana     2,007,000    0      1      0
## 27  BRA                         Brazil   194,946,000    3      5      9
## 28  VGB          British Virgin Islands        88,000    0      0      0
## 29  BRN                         Brunei       399,000    0      0      0
## 30  BGR                       Bulgaria     7,534,000    0      1      1
## 31  BFA                   Burkina Faso    16,468,000    0      0      0
## 32  MMR                          Burma    47,963,000    0      0      0
## 33  BDI                        Burundi     8,382,000    0      0      0
## 34  KHM                       Cambodia    14,139,000    0      0      0
## 35  CMR                       Cameroon    19,599,000    0      0      0
## 36  CAN                         Canada    34,126,000    1      5     12
## 37  CPV                     Cape Verde       496,000    0      0      0
## 38  CYM                  Cayman Islands        56,230    0      0      0
## 39  CAF        Central African Republic     4,401,000    0      0      0
## 40  TCD                           Chad    11,227,000    0      0      0
## 41  CHL                          Chile    17,113,688    0      0      0
## 42  CHN                          China 1,338,300,000   38     27     23
## 43  COL                       Colombia    46,295,000    1      3      4
## 44  COM                        Comoros       735,000    0      0      0
## 45  COG              Congo-Brazzaville     4,043,000    0      0      0
## 46  COK                   Cook Islands        20,000    0      0      0
## 47  CRI                     Costa Rica     4,659,000    0      0      0
## 48  HRV                        Croatia     4,418,000    3      1      2
## 49  CUB                           Cuba    11,258,000    5      3      6
## 50  CYP                         Cyprus       659,350    0      1      0
## 51  CZE                 Czech Republic    10,520,000    4      3      3
## 52  COD    Democratic Republic of Congo    65,965,000    0      0      0
## 53  DNK                        Denmark     5,547,000    2      4      3
## 54  DJI                       Djibouti       889,000    0      0      0
## 55  DMA                       Dominica        68,000    0      0      0
## 56  DOM             Dominican Republic     9,927,000    1      1      0
## 57  TLS                      East Timor     1,124,000    0      0      0
## 58  ECU                         Ecuador    14,465,000    0      0      0
## 59  EGY                           Egypt    81,121,000    0      2      0
## 60  SLV                     El Salvador     6,193,000    0      0      0
## 61  GNQ               Equatorial Guinea       700,000    0      0      0
## 62  ERI                         Eritrea     5,254,000    0      0      0
## 63  EST                         Estonia     1,340,000    0      1      1
## 64  ETH                        Ethiopia    82,950,000    3      1      3
## 65  FJI                            Fiji       860,000    0      0      0
## 66  FIN                         Finland     5,364,000    0      1      2
## 67  FRA                          France    64,895,000   11     11     12
## 68  GAB                           Gabon     1,505,000    0      1      0
## 69  GMB                          Gambia     1,729,000    0      0      0
## 70  GEO                         Georgia     4,452,000    1      3      3
## 71  DEU                         Germany    81,777,000   11     19     14
```

```
## 72  GHA                      Ghana    24,392,000    0      0      0
## 73  GRC                     Greece    11,316,000    0      0      2
## 74  GRD                    Grenada       104,000    1      0      0
## 75  GUM                       Guam       179,000    0      0      0
## 76  GTM                  Guatemala    14,389,000    0      1      0
## 77  GIN                     Guinea     9,982,000    0      0      0
## 78  GNB                Guinea-Bissau     1,515,000    0      0      0
## 79  GUY                     Guyana       755,000    0      0      0
## 80  HTI                      Haiti     9,993,000    0      0      0
## 81  HND                   Honduras     7,600,000    0      0      0
## 82  HKG                  Hong Kong     7,068,000    0      0      1
## 83  HUN                    Hungary    10,000,000    8      4      5
## 84  ISL                    Iceland       318,000    0      0      0
## 85  IND                      India 1,224,615,000    0      2      4
## 86  IDN                  Indonesia   239,870,000    0      1      1
## 87  IRN                       Iran    73,973,000    4      5      3
## 88  IRQ                       Iraq    32,031,000    0      0      0
## 89  IRL                    Ireland     4,475,000    1      1      3
## 90  ISR                     Israel     7,624,000    0      0      0
## 91  ITA                      Italy    60,483,000    8      9     11
## 92  CIV                Ivory Coast    19,738,000    0      0      0
## 93  JAM                    Jamaica     2,702,000    4      4      4
## 94  JPN                      Japan   127,451,000    7     14     17
## 95  JOR                     Jordan     6,047,000    0      0      0
## 96  KAZ                 Kazakhstan    16,323,000    7      1      5
## 97  KEN                      Kenya    40,513,000    2      4      5
## 98  KIR                   Kiribati       100,000    0      0      0
## 99  KWT                     Kuwait     2,736,000    0      0      1
## 100 KGZ                  Kyrgyzstan     5,448,000    0      0      0
## 101 LAO                        Laos     6,201,000    0      0      0
## 102 LVA                      Latvia     2,239,000    1      0      1
## 103 LBN                     Lebanon     4,227,000    0      0      0
## 104 LSO                     Lesotho     2,171,000    0      0      0
## 105 LBR                     Liberia     3,994,000    0      0      0
## 106 LBY                       Libya     6,355,000    0      0      0
## 107 LIE               Liechtenstein        36,032    0      0      0
## 108 LTU                   Lithuania     3,287,000    2      1      2
## 109 LUX                  Luxembourg       507,000    0      0      0
## 110 MKD                   Macedonia     2,060,000    0      0      0
## 111 MDG                  Madagascar    20,714,000    0      0      0
## 112 MWI                      Malawi    14,901,000    0      0      0
## 113 MYS                    Malaysia    28,401,000    0      1      1
## 114 MDV                    Maldives       316,000    0      0      0
## 115 MLI                        Mali    15,370,000    0      0      0
## 116 MLT                       Malta       416,000    0      0      0
## 117 MHL             Marshall Islands        54,038    0      0      0
## 118 MRT                  Mauritania     3,460,000    0      0      0
## 119 MUS                   Mauritius     1,281,000    0      0      0
## 120 MEX                      Mexico   113,423,000    1      3      3
## 121 FSM                  Micronesia       111,000    0      0      0
## 122 MDA                     Moldova     3,562,000    0      0      2
## 123 MCO                      Monaco        35,407    0      0      0
## 124 MNG                    Mongolia     2,756,000    0      2      3
## 125 MNE                  Montenegro       632,000    0      1      0
```

```
## 126 MAR                          Morocco    31,951,000    0      0      1
## 127 MOZ                       Mozambique    23,390,000    0      0      0
## 128 NAM                          Namibia     2,283,000    0      0      0
## 129 NRU                            Nauru        10,372    0      0      0
## 130 NPL                            Nepal    29,959,000    0      0      0
## 131 NLD                      Netherlands    16,616,000    6      6      8
## 132 NZL                      New Zealand     4,368,000    6      2      5
## 133 NIC                        Nicaragua     5,789,000    0      0      0
## 134 NER                            Niger    15,512,000    0      0      0
## 135 NGA                          Nigeria   158,423,000    0      0      0
## 136 PRK                      North Korea    24,589,122    4      0      2
## 137 NOR                           Norway     4,889,000    2      1      1
## 138 OMN                             Oman     2,783,000    0      0      0
## 139 PAK                         Pakistan   173,593,000    0      0      0
## 140 PLW                            Palau        20,472    0      0      0
## 141 PSE                        Palestine     4,152,000    0      0      0
## 142 PAN                           Panama     3,517,000    0      0      0
## 143 PNG                 Papua New Guinea     6,858,000    0      0      0
## 144 PRY                         Paraguay     6,454,000    0      0      0
## 145 PER                             Peru    29,076,000    0      0      0
## 146 PHL                      Philippines    93,261,000    0      0      0
## 147 POL                           Poland    38,184,000    2      2      6
## 148 PRT                         Portugal    10,638,000    0      1      0
## 149 PRI                      Puerto Rico     3,978,000    0      1      1
## 150 QAT                            Qatar     1,759,000    0      0      2
## 151 ROU                          Romania    21,438,000    2      5      2
## 152 RUS                           Russia   141,750,000   24     26     32
## 153 RWA                           Rwanda    10,624,000    0      0      0
## 154 KNA            Saint Kitts and Nevis        52,000    0      0      0
## 155 LCA                       Saint Lucia       174,000    0      0      0
## 156 VCT Saint Vincent and the Grenadines       109,000    0      0      0
## 157 WSM                             Samoa       184,000    0      0      0
## 158 SMR                        San Marino        31,534    0      0      0
## 159 STP            Sao Tome and Principe       165,000    0      0      0
## 160 SAU                      Saudi Arabia    27,448,000    0      0      1
## 161 SEN                           Senegal    12,434,000    0      0      0
## 162 SRB                            Serbia     7,291,000    1      1      2
## 163 SYC                        Seychelles        87,000    0      0      0
## 164 SLE                      Sierra Leone     5,867,000    0      0      0
## 165 SGP                         Singapore     5,077,000    0      0      2
## 166 SVK                          Slovakia     5,430,000    0      1      3
## 167 SVN                          Slovenia     2,049,000    1      1      2
## 168 SLB                   Solomon Islands       538,000    0      0      0
## 169 SOM                           Somalia     9,331,000    0      0      0
## 170 ZAF                      South Africa    49,991,000    3      2      1
## 171 KOR                       South Korea    48,875,000   13      8      7
## 172 ESP                             Spain    46,071,000    3     10      4
## 173 LKA                        Sri Lanka    20,860,000    0      0      0
## 174 SDN                             Sudan    43,552,000    0      0      0
## 175 SUR                          Surinam       525,000    0      0      0
## 176 SWZ                        Swaziland     1,056,000    0      0      0
## 177 SWE                           Sweden     9,378,000    1      4      3
## 178 CHE                      Switzerland     7,826,000    2      2      0
## 179 SYR                            Syria    20,447,000    0      0      0
```

```
## 180 TWN                         Taiwan    23,174,528    0      1      1
## 181 TJK                     Tajikistan     6,879,000    0      0      1
## 182 TZA                       Tanzania    44,841,000    0      0      0
## 183 THA                       Thailand    69,122,000    0      2      1
## 184 TGO                           Togo     6,028,000    0      0      0
## 185 TON                         Tonga        104,000    0      0      0
## 186 TTO           Trinidad and Tobago     1,341,000    1      0      3
## 187 TUN                       Tunisia    10,549,000    1      1      1
## 188 TUR                        Turkey    72,752,000    2      2      1
## 189 TKM                  Turkmenistan     5,042,000    0      0      0
## 190 TUV                        Tuvalu         9,827    0      0      0
## 191 UGA                        Uganda    33,424,000    1      0      0
## 192 GBR                            UK    62,232,000   29     17     19
## 193 UKR                       Ukraine    45,871,000    6      5      9
## 194 ARE          United Arab Emirates     7,512,000    0      0      0
## 195 URY                       Uruguay     3,357,000    0      0      0
## 196 USA                            US   309,349,000   46     29     29
## 197 UZB                    Uzbekistan    28,228,000    1      0      3
## 198 VUT                       Vanuatu       240,000    0      0      0
## 199 VEN                     Venezuela    28,834,000    1      0      0
## 200 VNM                       Vietnam    86,928,000    0      0      0
## 201 VIR                Virgin Islands       110,000    0      0      0
## 202 YEM                         Yemen    24,053,000    0      0      0
## 203 ZMB                        Zambia    12,927,000    0      0      0
## 204 ZWE                      Zimbabwe    12,571,000    0      0      0
```

2. *What proportion of countries earned no medals? Answer this using* `olympic2012`.

```r
# Your code here
# Find countries with zero medals
no_medals <- olympic2012$Gold == 0 & olympic2012$Silver == 0 & olympic2012$Bronze == 0

# Calculate the proportion of countries that earned no medals
proportion_no_medals <- sum(no_medals) / nrow(olympic2012)

# Output the proportion
proportion_no_medals
```

```
## [1] 0.5833333
```