RWorksheet_6

Catherine Geraldoy BSIT 2-B

2023-12-14

```r
##1. Create a data frame for the table below. Show your solution.

students_data <- data.frame (
  Students = c(1,2,3,4,5,6,7,8,9,10),
  preTest =  c(55,54,47,57,51,61,57,54,63,58),
  postTest = c(61,60,56,63,56,63,59,56,62,61)
)

#a. Compute the descriptive statistics using different packages (Hmisc and pastecs).Write the codes and

#install.packages("Hmisc")
library(Hmisc)
```

```
##
## Attaching package: 'Hmisc'

## The following objects are masked from 'package:base':
##
##     format.pval, units
```

```r
#install.packages("pastecs")
library(pastecs)

stats_hmisc<-describe(students_data)
stats_pastics <- stat.desc(students_data)

#2. The Department of Agriculture was studying the effects of several levels of a fertilizer on the gro

#a. Write the codes and describe the result.
data_fertilize <- c(10,10,10, 20,20,50,10,20,10,50,20,50,20,10)
ordered(data_fertilize)
```

```
##  [1] 10 10 10 20 20 50 10 20 10 50 20 50 20 10
## Levels: 10 < 20 < 50
```

```r
# The result of the 'ordered' function applied to the 'data_fertilize' vector indicates that the fertil


#3. Abdul Hassan, president of Floor Coverings Unlimited, has asked you to study the ex-ercise levels u

# a. What is the best way to represent this in R?

exe_levels <- c("l", "n", "n", "i", "l", "l", "n", "n", "i", "l")
exercise_factor <- factor(exe_levels, levels = c("n", "l", "i"), labels = c("none", "light", "intense"))
```

```r
exercise_factor
```

```
##  [1] light   none    none    intense light   light   none    none    intense
## [10] light
## Levels: none light intense
```

```r
# 4. Sample of 30 tax accountants from all the states and territories of Australia and their individual


tax_accountants <- c("tas", "sa", "qld", "nsw", "nsw", "nt", "wa", "wa", "qld",
           "vic", "nsw", "vic", "qld", "qld", "sa", "tas", "sa", "nt",
           "wa", "vic", "qld", "nsw", "nsw", "wa", "sa", "act", "nsw",
           "vic", "vic", "act")

factor_level <-factor(tax_accountants, levels = c("act", "nsw", "nt", "qld", "sa", "tas", "vic", "wa") )
factor_level
```

```
##  [1] tas sa  qld nsw nsw nt  wa  wa  qld vic nsw vic qld qld sa  tas sa  nt  wa
## [20] vic qld nsw nsw wa  sa  act nsw vic vic act
## Levels: act nsw nt qld sa tas vic wa
```

```r
#the factor_level variable result is factor with level.

# 5. From #4 - continuation:
# • Suppose we have the incomes of the same tax accountants in another vector (in suitably large units

incomes <- c(60, 49, 40, 61, 64, 60, 59, 54,
             62, 69, 70, 42, 56, 61, 61, 61, 58, 51, 48,
             65, 49, 49, 41, 48, 52, 46, 59, 46, 58, 43)

# a. Calculate the sample mean income for each state we can now use the special function tapply():

mean_income <- tapply(incomes, factor_level, mean)

mean_income
```

```
##      act      nsw       nt      qld       sa      tas      vic       wa
## 44.50000 57.33333 55.50000 53.60000 55.00000 60.50000 56.00000 52.25000
```

```r
# b. Copy the results and interpret.
#The result has the means of each states that has factor with levels
# act      nsw       nt      qld       sa      tas      vic       wa
#50000 57.33333 55.50000 53.60000 55.00000 60.50000 56.00000 52.25000

#6. Calculate the standard errors of the state income means (refer again to number 3)
#stdError <- function(x) sqrt(var(x)/length(x)) Note: After this assignment, the standard errors are ca

#a. What is the standard error? Write the codes.
stdError <- function(x) sqrt(var(x)/length(x))
incster <- tapply(incomes, factor_level, stdError)
incster
```

```
##      act      nsw       nt      qld       sa      tas      vic       wa
## 1.500000 4.310195 4.500000 4.106093 2.738613 0.500000 5.244044 2.657536
```

```r
#b. Interpret the result.
#answer. The outcome presents the computed standard errors associated with the mean incomes of differen
```

```r
#7. Use the titanic dataset.

#a. subset the titatic dataset of those who survived and not survived. Show the codes and its result.
library(datasets)
data(Titanic)

Titanic<-as.data.frame(Titanic)

survived<-subset(Titanic, Survived=="Yes")
survived
```

```
##    Class    Sex   Age Survived Freq
## 17   1st   Male Child      Yes    5
## 18   2nd   Male Child      Yes   11
## 19   3rd   Male Child      Yes   13
## 20  Crew   Male Child      Yes    0
## 21   1st Female Child      Yes    1
## 22   2nd Female Child      Yes   13
## 23   3rd Female Child      Yes   14
## 24  Crew Female Child      Yes    0
## 25   1st   Male Adult      Yes   57
## 26   2nd   Male Adult      Yes   14
## 27   3rd   Male Adult      Yes   75
## 28  Crew   Male Adult      Yes  192
## 29   1st Female Adult      Yes  140
## 30   2nd Female Adult      Yes   80
## 31   3rd Female Adult      Yes   76
## 32  Crew Female Adult      Yes   20
```

```r
not_survived <- subset(Titanic, Survived == "No")
not_survived
```

```
##    Class    Sex   Age Survived Freq
## 1    1st   Male Child       No    0
## 2    2nd   Male Child       No    0
## 3    3rd   Male Child       No   35
## 4   Crew   Male Child       No    0
## 5    1st Female Child       No    0
## 6    2nd Female Child       No    0
## 7    3rd Female Child       No   17
## 8   Crew Female Child       No    0
## 9    1st   Male Adult       No  118
## 10   2nd   Male Adult       No  154
## 11   3rd   Male Adult       No  387
## 12  Crew   Male Adult       No  670
## 13   1st Female Adult       No    4
## 14   2nd Female Adult       No   13
## 15   3rd Female Adult       No   89
## 16  Crew Female Adult       No    3
```

```r
#8. The data sets are about the breast cancer Wisconsin. The samples arrive periodically as Dr. Wolberg
library(readr)
csv.file<-"breastcancer_wisconsin.csv"
breastcancer_wisconsin<-read.csv("breastcancer_wisconsin.csv")
breastcancer_wisconsin
```

```
##          id clump_thickness size_uniformity shape_uniformity marginal_adhesion
## 1   1000025               5               1                1                 1
## 2   1002945               5               4                4                 5
## 3   1015425               3               1                1                 1
## 4   1016277               6               8                8                 1
## 5   1017023               4               1                1                 3
## 6   1017122               8              10               10                 8
## 7   1018099               1               1                1                 1
## 8   1018561               2               1                2                 1
## 9   1033078               2               1                1                 1
## 10  1033078               4               2                1                 1
## 11  1035283               1               1                1                 1
## 12  1036172               2               1                1                 1
## 13  1041801               5               3                3                 3
## 14  1043999               1               1                1                 1
## 15  1044572               8               7                5                10
## 16  1047630               7               4                6                 4
## 17  1048672               4               1                1                 1
## 18  1049815               4               1                1                 1
## 19  1050670              10               7                7                 6
## 20  1050718               6               1                1                 1
## 21  1054590               7               3                2                10
## 22  1054593              10               5                5                 3
## 23  1056784               3               1                1                 1
## 24  1057013               8               4                5                 1
## 25  1059552               1               1                1                 1
## 26  1065726               5               2                3                 4
## 27  1066373               3               2                1                 1
## 28  1066979               5               1                1                 1
## 29  1067444               2               1                1                 1
## 30  1070935               1               1                3                 1
## 31  1070935               3               1                1                 1
## 32  1071760               2               1                1                 1
## 33  1072179              10               7                7                 3
## 34  1074610               2               1                1                 2
## 35  1075123               3               1                2                 1
## 36  1079304               2               1                1                 1
## 37  1080185              10              10               10                 8
## 38  1081791               6               2                1                 1
## 39  1084584               5               4                4                 9
## 40  1091262               2               5                3                 3
## 41  1096800               6               6                6                 9
## 42  1099510              10               4                3                 1
## 43  1100524               6              10               10                 2
## 44  1102573               5               6                5                 6
## 45  1103608              10              10               10                 4
## 46  1103722               1               1                1                 1
## 47  1105257               3               7                7                 4
## 48  1105524               1               1                1                 1
## 49  1106095               4               1                1                 3
## 50  1106829               7               8                7                 2
## 51  1108370               9               5                8                 1
## 52  1108449               5               3                3                 4
## 53  1110102              10               3                6                 2
```

```
## 54   1110503        5         5         5         8
## 55   1110524       10         5         5         6
## 56   1111249       10         6         6         3
## 57   1112209        8        10        10         1
## 58   1113038        8         2         4         1
## 59   1113483        5         2         3         1
## 60   1113906        9         5         5         2
## 61   1115282        5         3         5         5
## 62   1115293        1         1         1         1
## 63   1116116        9        10        10         1
## 64   1116132        6         3         4         1
## 65   1116192        1         1         1         1
## 66   1116998       10         4         2         1
## 67   1117152        4         1         1         1
## 68   1118039        5         3         4         1
## 69   1120559        8         3         8         3
## 70   1121732        1         1         1         1
## 71   1121919        5         1         3         1
## 72   1123061        6        10         2         8
## 73   1124651        1         3         3         2
## 74   1125035        9         4         5        10
## 75   1126417       10         6         4         1
## 76   1131294        1         1         2         1
## 77   1132347        1         1         4         1
## 78   1133041        5         3         1         2
## 79   1133136        3         1         1         1
## 80   1136142        2         1         1         1
## 81   1137156        2         2         2         1
## 82   1143978        4         1         1         2
## 83   1143978        5         2         1         1
## 84   1147044        3         1         1         1
## 85   1147699        3         5         7         8
## 86   1147748        5        10         6         1
## 87   1148278        3         3         6         4
## 88   1148873        3         6         6         6
## 89   1152331        4         1         1         1
## 90   1155546        2         1         1         2
## 91   1156272        1         1         1         1
## 92   1156948        3         1         1         2
## 93   1157734        4         1         1         1
## 94   1158247        1         1         1         1
## 95   1160476        2         1         1         1
## 96   1164066        1         1         1         1
## 97   1165297        2         1         1         2
## 98   1165790        5         1         1         1
## 99   1165926        9         6         9         2
## 100  1166630        7         5         6        10
## 101  1166654       10         3         5         1
## 102  1167439        2         3         4         4
## 103  1167471        4         1         2         1
## 104  1168359        8         2         3         1
## 105  1168736       10        10        10        10
## 106  1169049        7         3         4         4
## 107  1170419       10        10        10         8
```

```
## 108  1170420          1          6          8         10
## 109  1171710          1          1          1          1
## 110  1171710          6          5          4          4
## 111  1171795          1          3          1          2
## 112  1171845          8          6          4          3
## 113  1172152         10          3          3         10
## 114  1173216         10         10         10          3
## 115  1173235          3          3          2          1
## 116  1173347          1          1          1          1
## 117  1173347          8          3          3          1
## 118  1173509          4          5          5         10
## 119  1173514          1          1          1          1
## 120  1173681          3          2          1          1
## 121  1174057          1          1          2          2
## 122  1174057          4          2          1          1
## 123  1174131         10         10         10          2
## 124  1174428          5          3          5          1
## 125  1175937          5          4          6          7
## 126  1176406          1          1          1          1
## 127  1176881          7          5          3          7
## 128  1177027          3          1          1          1
## 129  1177399          8          3          5          4
## 130  1177512          1          1          1          1
## 131  1178580          5          1          3          1
## 132  1179818          2          1          1          1
## 133  1180194          5         10          8         10
## 134  1180523          3          1          1          1
## 135  1180831          3          1          1          1
## 136  1181356          5          1          1          1
## 137  1182404          4          1          1          1
## 138  1182410          3          1          1          1
## 139  1183240          4          1          2          1
## 140  1183246          1          1          1          1
## 141  1183516          3          1          1          1
## 142  1183911          2          1          1          1
## 143  1183983          9          5          5          4
## 144  1184184          1          1          1          1
## 145  1184241          2          1          1          1
## 146  1184840          1          1          3          1
## 147  1185609          3          4          5          2
## 148  1185610          1          1          1          1
## 149  1187457          3          1          1          3
## 150  1187805          8          8          7          4
## 151  1188472          1          1          1          1
## 152  1189266          7          2          4          1
## 153  1189286         10         10          8          6
## 154  1190394          4          1          1          1
## 155  1190485          1          1          1          1
## 156  1192325          5          5          5          6
## 157  1193091          1          2          2          1
## 158  1193210          2          1          1          1
## 159  1193683          1          1          2          1
## 160  1196295          9          9         10          3
## 161  1196915         10          7          7          4
```

```
## 162  1197080         4         1         1         1
## 163  1197270         3         1         1         1
## 164  1197440         1         1         1         2
## 165  1197510         5         1         1         1
## 166  1197979         4         1         1         1
## 167  1197993         5         6         7         8
## 168  1198128        10         8        10        10
## 169  1198641         3         1         1         1
## 170  1199219         1         1         1         2
## 171  1199731         3         1         1         1
## 172  1199983         1         1         1         1
## 173  1200772         1         1         1         1
## 174  1200847         6        10        10        10
## 175  1200892         8         6         5         4
## 176  1200952         5         8         7         7
## 177  1201834         2         1         1         1
## 178  1201936         5        10        10         3
## 179  1202125         4         1         1         1
## 180  1202812         5         3         3         3
## 181  1203096         1         1         1         1
## 182  1204242         1         1         1         1
## 183  1204898         6         1         1         1
## 184  1205138         5         8         8         8
## 185  1205579         8         7         6         4
## 186  1206089         2         1         1         1
## 187  1206695         1         5         8         6
## 188  1206841        10         5         6        10
## 189  1207986         5         8         4        10
## 190  1208301         1         2         3         1
## 191  1210963        10        10        10         8
## 192  1211202         7         5        10        10
## 193  1212232         5         1         1         1
## 194  1212251         1         1         1         1
## 195  1212422         3         1         1         1
## 196  1212422         4         1         1         1
## 197  1213375         8         4         4         5
## 198  1213383         5         1         1         4
## 199  1214092         1         1         1         1
## 200  1214556         3         1         1         1
## 201  1214966         9         7         7         5
## 202  1216694        10         8         8         4
## 203  1216947         1         1         1         1
## 204  1217051         5         1         1         1
## 205  1217264         1         1         1         1
## 206  1218105         5        10        10         9
## 207  1218741        10        10         9         3
## 208  1218860         1         1         1         1
## 209  1218860         1         1         1         1
## 210  1219406         5         1         1         1
## 211  1219525         8        10        10        10
## 212  1219859         8        10         8         8
## 213  1220330         1         1         1         1
## 214  1221863        10        10        10        10
## 215  1222047        10        10        10        10
```

```
## 216  1222936        8         7         8         7
## 217  1223282        1         1         1         1
## 218  1223426        1         1         1         1
## 219  1223793        6        10         7         7
## 220  1223967        6         1         3         1
## 221  1224329        1         1         1         2
## 222  1225799       10         6         4         3
## 223  1226012        4         1         1         3
## 224  1226612        7         5         6         3
## 225  1227210       10         5         5         6
## 226  1227244        1         1         1         1
## 227  1227481       10         5         7         4
## 228  1228152        8         9         9         5
## 229  1228311        1         1         1         1
## 230  1230175       10        10        10         3
## 231  1230688        7         4         7         4
## 232  1231387        6         8         7         5
## 233  1231706        8         4         6         3
## 234  1232225       10         4         5         5
## 235  1236043        3         3         2         1
## 236  1241232        3         1         4         1
## 237  1241559       10         8         8         2
## 238  1241679        9         8         8         5
## 239  1242364        8        10        10         8
## 240  1243256       10         4         3         2
## 241  1270479        5         1         3         3
## 242  1276091        3         1         1         3
## 243  1277018        2         1         1         1
## 244   128059        1         1         1         1
## 245  1285531        1         1         1         1
## 246  1287775        5         1         1         2
## 247   144888        8        10        10         8
## 248   145447        8         4         4         1
## 249   167528        4         1         1         1
## 250   169356        3         1         1         1
## 251   183913        1         2         2         1
## 252   191250       10         4         4        10
## 253  1017023        6         3         3         5
## 254  1100524        6        10        10         2
## 255  1116116        9        10        10         1
## 256  1168736        5         6         6         2
## 257  1182404        3         1         1         1
## 258  1182404        3         1         1         1
## 259  1198641        3         1         1         1
## 260   242970        5         7         7         1
## 261   255644       10         5         8        10
## 262   263538        5        10        10         6
## 263   274137        8         8         9         4
## 264   303213       10         4         4        10
## 265   314428        7         9         4        10
## 266  1182404        5         1         4         1
## 267  1198641       10        10         6         3
## 268   320675        3         3         5         2
## 269   324427       10         8         8         2
```

```
## 270   385103               1              1              1              1
## 271   390840               8              4              7              1
## 272   411453               5              1              1              1
## 273   320675               3              3              5              2
## 274   428903               7              2              4              1
## 275   431495               3              1              1              1
## 276   432809               3              1              3              1
## 277   434518               3              1              1              1
## 278   452264               1              1              1              1
## 279   456282               1              1              1              1
## 280   476903              10              5              7              3
## 281   486283               3              1              1              1
## 282   486662               2              1              1              2
## 283   488173               1              4              3             10
## 284   492268              10              4              6              1
## 285   508234               7              4              5             10
## 286   527363               8             10             10             10
## 287   529329              10             10             10             10
## 288   535331               3              1              1              1
## 289   543558               6              1              3              1
## 290   555977               5              6              6              8
## 291   560680               1              1              1              1
## 292   561477               1              1              1              1
## 293   563649               8              8              8              1
## 294   601265              10              4              4              6
## 295   606140               1              1              1              1
## 296   606722               5              5              7              8
## 297   616240               5              3              4              3
## 298    61634               5              4              3              1
## 299   625201               8              2              1              1
## 300    63375               9              1              2              6
## 301   635844               8              4             10              5
## 302   636130               1              1              1              1
## 303   640744              10             10             10              7
## 304   646904               1              1              1              1
## 305   653777               8              3              4              9
## 306   659642              10              8              4              4
## 307   666090               1              1              1              1
## 308   666942               1              1              1              1
## 309   667204               7              8              7              6
## 310   673637               3              1              1              1
## 311   684955               2              1              1              1
## 312   688033               1              1              1              1
## 313   691628               8              6              4             10
## 314   693702               1              1              1              1
## 315   704097               1              1              1              1
## 316   704168               4              6              5              6
## 317   706426               5              5              5              2
## 318   709287               6              8              7              8
## 319   718641               1              1              1              1
## 320   721482               4              4              4              4
## 321   730881               7              6              3              2
## 322   733639               3              1              1              1
## 323   733639               3              1              1              1
```

```
## 324   733823          5          4          6         10
## 325   740492          1          1          1          1
## 326   743348          3          2          2          1
## 327   752904         10          1          1          1
## 328   756136          1          1          1          1
## 329   760001          8         10          3          2
## 330   760239         10          4          6          4
## 331    76389         10          4          7          2
## 332   764974          5          1          1          1
## 333   770066          5          2          2          2
## 334   785208          5          4          6          6
## 335   785615          8          6          7          3
## 336   792744          1          1          1          1
## 337   797327          6          5          5          8
## 338   798429          1          1          1          1
## 339   704097          1          1          1          1
## 340   806423          8          5          5          5
## 341   809912         10          3          3          1
## 342   810104          1          1          1          1
## 343   814265          2          1          1          1
## 344   814911          1          1          1          1
## 345   822829          7          6          4          8
## 346   826923          1          1          1          1
## 347   830690          5          2          2          2
## 348   831268          1          1          1          1
## 349   832226          3          4          4         10
## 350   832567          4          2          3          5
## 351   836433          5          1          1          3
## 352   837082          2          1          1          1
## 353   846832          3          4          5          3
## 354   850831          2          7         10         10
## 355   855524          1          1          1          1
## 356   857774          4          1          1          1
## 357   859164          5          3          3          1
## 358   859350          8         10         10          7
## 359   866325          8         10          5          3
## 360   873549         10          3          5          4
## 361   877291          6         10         10         10
## 362   877943          3         10          3         10
## 363   888169          3          2          2          1
## 364   888523          4          4          4          2
## 365   896404          2          1          1          1
## 366   897172          2          1          1          1
## 367    95719          6         10         10         10
## 368   160296          5          8          8         10
## 369   342245          1          1          3          1
## 370   428598          1          1          3          1
## 371   492561          4          3          2          1
## 372   493452          1          1          3          1
## 373   493452          4          1          2          1
## 374   521441          5          1          1          2
## 375   560680          3          1          2          1
## 376   636437          1          1          1          1
## 377   640712          1          1          1          1
```

```
## 378  654244        1        1        1        1
## 379  657753        3        1        1        4
## 380  685977        5        3        4        1
## 381  805448        1        1        1        1
## 382  846423       10        6        3        6
## 383 1002504        3        2        2        2
## 384 1022257        2        1        1        1
## 385 1026122        2        1        1        1
## 386 1071084        3        3        2        2
## 387 1080233        7        6        6        3
## 388 1114570        5        3        3        2
## 389 1114570        2        1        1        1
## 390 1116715        5        1        1        1
## 391 1131411        1        1        1        2
## 392 1151734       10        8        7        4
## 393 1156017        3        1        1        1
## 394 1158247        1        1        1        1
## 395 1158405        1        2        3        1
## 396 1168278        3        1        1        1
## 397 1176187        3        1        1        1
## 398 1196263        4        1        1        1
## 399 1196475        3        2        1        1
## 400 1206314        1        2        3        1
## 401 1211265        3       10        8        7
## 402 1213784        3        1        1        1
## 403 1223003        5        3        3        1
## 404 1223306        3        1        1        1
## 405 1223543        1        2        1        3
## 406 1229929        1        1        1        1
## 407 1231853        4        2        2        1
## 408 1234554        1        1        1        1
## 409 1236837        2        3        2        2
## 410 1237674        3        1        2        1
## 411 1238021        1        1        1        1
## 412 1238464        1        1        1        1
## 413 1238633       10       10       10        6
## 414 1238915        5        1        2        1
## 415 1238948        8        5        6        2
## 416 1239232        3        3        2        6
## 417 1239347        8        7        8        5
## 418 1239967        1        1        1        1
## 419 1240337        5        2        2        2
## 420 1253505        2        3        1        1
## 421 1255384        3        2        2        3
## 422 1257200       10       10       10        7
## 423 1257648        4        3        3        1
## 424 1257815        5        1        3        1
## 425 1257938        3        1        1        1
## 426 1258549        9       10       10       10
## 427 1258556        5        3        6        1
## 428 1266154        8        7        8        2
## 429 1272039        1        1        1        1
## 430 1276091        2        1        1        1
## 431 1276091        1        3        1        1
```

```
## 432  1276091                 5                 1                  1                   3
## 433  1277629                 5                 1                  1                   1
## 434  1293439                 3                 2                  2                   3
## 435  1293439                 6                 9                  7                   5
## 436  1294562                10                 8                 10                   1
## 437  1295186                10                10                 10                   1
## 438   527337                 4                 1                  1                   1
## 439   558538                 4                 1                  3                   3
## 440   566509                 5                 1                  1                   1
## 441   608157                10                 4                  3                  10
## 442   677910                 5                 2                  2                   4
## 443   734111                 1                 1                  1                   3
## 444   734111                 1                 1                  1                   1
## 445   780555                 5                 1                  1                   6
## 446   827627                 2                 1                  1                   1
## 447  1049837                 1                 1                  1                   1
## 448  1058849                 5                 1                  1                   1
## 449  1182404                 1                 1                  1                   1
## 450  1193544                 5                 7                  9                   8
## 451  1201870                 4                 1                  1                   3
## 452  1202253                 5                 1                  1                   1
## 453  1227081                 3                 1                  1                   3
## 454  1230994                 4                 5                  5                   8
## 455  1238410                 2                 3                  1                   1
## 456  1246562                10                 2                  2                   1
## 457  1257470                10                 6                  5                   8
## 458  1259008                 8                 8                  9                   6
## 459  1266124                 5                 1                  2                   1
## 460  1267898                 5                 1                  3                   1
## 461  1268313                 5                 1                  1                   3
## 462  1268804                 3                 1                  1                   1
## 463  1276091                 6                 1                  1                   3
## 464  1280258                 4                 1                  1                   1
## 465  1293966                 4                 1                  1                   1
## 466  1296572                10                 9                  8                   7
## 467  1298416                10                 6                  6                   2
## 468  1299596                 6                 6                  6                   5
## 469  1105524                 4                 1                  1                   1
## 470  1181685                 1                 1                  2                   1
## 471  1211594                 3                 1                  1                   1
## 472  1238777                 6                 1                  1                   3
## 473  1257608                 6                 1                  1                   1
## 474  1269574                 4                 1                  1                   1
## 475  1277145                 5                 1                  1                   1
## 476  1287282                 3                 1                  1                   1
## 477  1296025                 4                 1                  2                   1
## 478  1296263                 4                 1                  1                   1
## 479  1296593                 5                 2                  1                   1
## 480  1299161                 4                 8                  7                  10
## 481  1301945                 5                 1                  1                   1
## 482  1302428                 5                 3                  2                   4
## 483  1318169                 9                10                 10                  10
## 484   474162                 8                 7                  8                   5
## 485   787451                 5                 1                  2                   1
```

```
## 486   1002025                1                 1                 1                 3
## 487   1070522                3                 1                 1                 1
## 488   1073960               10                10                10                10
## 489   1076352                3                 6                 4                10
## 490   1084139                6                 3                 2                 1
## 491   1115293                1                 1                 1                 1
## 492   1119189                5                 8                 9                 4
## 493   1133991                4                 1                 1                 1
## 494   1142706                5                10                10                10
## 495   1155967                5                 1                 2                10
## 496   1170945                3                 1                 1                 1
## 497   1181567                1                 1                 1                 1
## 498   1182404                4                 2                 1                 1
## 499   1204558                4                 1                 1                 1
## 500   1217952                4                 1                 1                 1
## 501   1224565                6                 1                 1                 1
## 502   1238186                4                 1                 1                 1
## 503   1253917                4                 1                 1                 2
## 504   1265899                4                 1                 1                 1
## 505   1268766                1                 1                 1                 1
## 506   1277268                3                 3                 1                 1
## 507   1286943                8                10                10                10
## 508   1295508                1                 1                 1                 1
## 509   1297327                5                 1                 1                 1
## 510   1297522                2                 1                 1                 1
## 511   1298360                1                 1                 1                 1
## 512   1299924                5                 1                 1                 1
## 513   1299994                5                 1                 1                 1
## 514   1304595                3                 1                 1                 1
## 515   1306282                6                 6                 7                10
## 516   1313325                4                10                 4                 7
## 517   1320077                1                 1                 1                 1
## 518   1320077                1                 1                 1                 1
## 519   1320304                3                 1                 2                 2
## 520   1330439                4                 7                 8                 3
## 521    333093                1                 1                 1                 1
## 522    369565                4                 1                 1                 1
## 523    412300               10                 4                 5                 4
## 524    672113                7                 5                 6                10
## 525    749653                3                 1                 1                 1
## 526    769612                3                 1                 1                 2
## 527    769612                4                 1                 1                 1
## 528    798429                4                 1                 1                 1
## 529    807657                6                 1                 3                 2
## 530   8233704                4                 1                 1                 1
## 531    837480                7                 4                 4                 3
## 532    867392                4                 2                 2                 1
## 533    869828                1                 1                 1                 1
## 534   1043068                3                 1                 1                 1
## 535   1056171                2                 1                 1                 1
## 536   1061990                1                 1                 3                 2
## 537   1113061                5                 1                 1                 1
## 538   1116192                5                 1                 2                 1
## 539   1135090                4                 1                 1                 1
```

```
## 540  1145420               6               1               1                1
## 541  1158157               5               1               1                1
## 542  1171578               3               1               1                1
## 543  1174841               5               3               1                1
## 544  1184586               4               1               1                1
## 545  1186936               2               1               3                2
## 546  1197527               5               1               1                1
## 547  1222464               6              10              10               10
## 548  1240603               2               1               1                1
## 549  1240603               3               1               1                1
## 550  1241035               7               8               3                7
## 551  1287971               3               1               1                1
## 552  1289391               1               1               1                1
## 553  1299924               3               2               2                2
## 554  1306339               4               4               2                1
## 555  1313658               3               1               1                1
## 556  1313982               4               3               1                1
## 557  1321264               5               2               2                2
## 558  1321321               5               1               1                3
## 559  1321348               2               1               1                1
## 560  1321931               5               1               1                1
## 561  1321942               5               1               1                1
## 562  1321942               5               1               1                1
## 563  1328331               1               1               1                1
## 564  1328755               3               1               1                1
## 565  1331405               4               1               1                1
## 566  1331412               5               7              10               10
## 567  1333104               3               1               2                1
## 568  1334071               4               1               1                1
## 569  1343068               8               4               4                1
## 570  1343374              10              10               8               10
## 571  1344121               8              10               4                4
## 572   142932               7               6              10                5
## 573   183936               3               1               1                1
## 574   324382               1               1               1                1
## 575   378275              10               9               7                3
## 576   385103               5               1               2                1
## 577   690557               5               1               1                1
## 578   695091               1               1               1                1
## 579   695219               1               1               1                1
## 580   824249               1               1               1                1
## 581   871549               5               1               2                1
## 582   878358               5               7              10                6
## 583  1107684               6              10               5                5
## 584  1115762               3               1               1                1
## 585  1217717               5               1               1                6
## 586  1239420               1               1               1                1
## 587  1254538               8              10              10               10
## 588  1261751               5               1               1                1
## 589  1268275               9               8               8                9
## 590  1272166               5               1               1                1
## 591  1294261               4              10               8                5
## 592  1295529               2               5               7                6
## 593  1298484              10               3               4                5
```

```
## 594  1311875       5        1        2        1
## 595  1315506       4        8        6        3
## 596  1320141       5        1        1        1
## 597  1325309       4        1        2        1
## 598  1333063       5        1        3        1
## 599  1333495       3        1        1        1
## 600  1334659       5        2        4        1
## 601  1336798       3        1        1        1
## 602  1344449       1        1        1        1
## 603  1350568       4        1        1        1
## 604  1352663       5        4        6        8
## 605   188336       5        3        2        8
## 606   352431      10        5       10        3
## 607   353098       4        1        1        2
## 608   411453       1        1        1        1
## 609   557583       5       10       10       10
## 610   636375       5        1        1        1
## 611   736150      10        4        3       10
## 612   803531       5       10       10       10
## 613   822829       8       10       10       10
## 614  1016634       2        3        1        1
## 615  1031608       2        1        1        1
## 616  1041043       4        1        3        1
## 617  1042252       3        1        1        1
## 618  1057067       1        1        1        1
## 619  1061990       4        1        1        1
## 620  1073836       5        1        1        1
## 621  1083817       3        1        1        1
## 622  1096352       6        3        3        3
## 623  1140597       7        1        2        3
## 624  1149548       1        1        1        1
## 625  1174009       5        1        1        2
## 626  1183596       3        1        3        1
## 627  1190386       4        6        6        5
## 628  1190546       2        1        1        1
## 629  1213273       2        1        1        1
## 630  1218982       4        1        1        1
## 631  1225382       6        2        3        1
## 632  1235807       5        1        1        1
## 633  1238777       1        1        1        1
## 634  1253955       8        7        4        4
## 635  1257366       3        1        1        1
## 636  1260659       3        1        4        1
## 637  1268952      10       10        7        8
## 638  1275807       4        2        4        3
## 639  1277792       4        1        1        1
## 640  1277792       5        1        1        3
## 641  1285722       4        1        1        3
## 642  1288608       3        1        1        1
## 643  1290203       3        1        1        1
## 644  1294413       1        1        1        1
## 645  1299596       2        1        1        1
## 646  1303489       3        1        1        1
## 647  1311033       1        2        2        1
```

```
## 648  1311108              1               1                1                3
## 649  1315807              5              10               10               10
## 650  1318671              3               1                1                1
## 651  1319609              3               1                1                2
## 652  1323477              1               2                1                3
## 653  1324572              5               1                1                1
## 654  1324681              4               1                1                1
## 655  1325159              3               1                1                1
## 656  1326892              3               1                1                1
## 657  1330361              5               1                1                1
## 658  1333877              5               4                5                1
## 659  1334015              7               8                8                7
## 660  1334667              1               1                1                1
## 661  1339781              1               1                1                1
## 662  1339781              4               1                1                1
## 663 13454352              1               1                3                1
## 664  1345452              1               1                3                1
## 665  1345593              3               1                1                3
## 666  1347749              1               1                1                1
## 667  1347943              5               2                2                2
## 668  1348851              3               1                1                1
## 669  1350319              5               7                4                1
## 670  1350423              5              10               10                8
## 671  1352848              3              10                7                8
## 672  1353092              3               2                1                2
## 673  1354840              2               1                1                1
## 674  1354840              5               3                2                1
## 675  1355260              1               1                1                1
## 676  1365075              4               1                4                1
## 677  1365328              1               1                2                1
## 678  1368267              5               1                1                1
## 679  1368273              1               1                1                1
## 680  1368882              2               1                1                1
## 681  1369821             10              10               10               10
## 682  1371026              5              10               10               10
## 683  1371920              5               1                1                1
## 684   466906              1               1                1                1
## 685   466906              1               1                1                1
## 686   534555              1               1                1                1
## 687   536708              1               1                1                1
## 688   566346              3               1                1                1
## 689   603148              4               1                1                1
## 690   654546              1               1                1                1
## 691   654546              1               1                1                3
## 692   695091              5              10               10                5
## 693   714039              3               1                1                1
## 694   763235              3               1                1                1
## 695   776715              3               1                1                1
## 696   841769              2               1                1                1
## 697   888820              5              10               10                3
## 698   897471              4               8                6                4
## 699   897471              4               8                8                5
##     epithelial_size bare_nucleoli bland_chromatin normal_nucleoli mitoses class
## 1                 2             1               3               1       1     2
```

```
## 2                    7           10             3             2      1    2
## 3                    2            2             3             1      1    2
## 4                    3            4             3             7      1    2
## 5                    2            1             3             1      1    2
## 6                    7           10             9             7      1    4
## 7                    2           10             3             1      1    2
## 8                    2            1             3             1      1    2
## 9                    2            1             1             1      5    2
## 10                   2            1             2             1      1    2
## 11                   1            1             3             1      1    2
## 12                   2            1             2             1      1    2
## 13                   2            3             4             4      1    4
## 14                   2            3             3             1      1    2
## 15                   7            9             5             5      4    4
## 16                   6            1             4             3      1    4
## 17                   2            1             2             1      1    2
## 18                   2            1             3             1      1    2
## 19                   4           10             4             1      2    4
## 20                   2            1             3             1      1    2
## 21                   5           10             5             4      4    4
## 22                   6            7             7            10      1    4
## 23                   2            1             2             1      1    2
## 24                   2         <NA>             7             3      1    4
## 25                   2            1             3             1      1    2
## 26                   2            7             3             6      1    4
## 27                   1            1             2             1      1    2
## 28                   2            1             2             1      1    2
## 29                   2            1             2             1      1    2
## 30                   2            1             1             1      1    2
## 31                   1            1             2             1      1    2
## 32                   2            1             3             1      1    2
## 33                   8            5             7             4      3    4
## 34                   2            1             3             1      1    2
## 35                   2            1             2             1      1    2
## 36                   2            1             2             1      1    2
## 37                   6            1             8             9      1    4
## 38                   1            1             7             1      1    2
## 39                   2           10             5             6      1    4
## 40                   6            7             7             5      1    4
## 41                   6         <NA>             7             8      1    2
## 42                   3            3             6             5      2    4
## 43                   8           10             7             3      3    4
## 44                  10            1             3             1      1    4
## 45                   8            1             8            10      1    4
## 46                   2            1             2             1      2    2
## 47                   4            9             4             8      1    4
## 48                   2            1             2             1      1    2
## 49                   2            1             3             1      1    2
## 50                   4            8             3             8      2    4
## 51                   2            3             2             1      5    4
## 52                   2            4             3             4      1    4
## 53                   3            5             4            10      2    4
## 54                  10            8             7             3      7    4
## 55                   8            8             7             1      1    4
```

```
## 56       4     5     3     6   1   4
## 57       3     6     3     9   1   4
## 58       5     1     5     4   4   4
## 59       6    10     5     1   1   4
## 60       2     2     5     1   1   4
## 61       3     3     4    10   1   4
## 62       2     2     2     1   1   2
## 63      10     8     3     3   1   4
## 64       5     2     3     9   1   4
## 65       2     1     2     1   1   2
## 66       3     2     4     3  10   4
## 67       2     1     3     1   1   2
## 68       8    10     4     9   1   4
## 69       4     9     8     9   8   4
## 70       2     1     3     2   1   2
## 71       2     1     2     1   1   2
## 72      10     2     7     8  10   4
## 73       2     1     7     2   1   2
## 74       6    10     4     8   1   4
## 75       3     4     3     2   3   4
## 76       2     2     4     2   1   2
## 77       2     1     2     1   1   2
## 78       2     1     2     1   1   2
## 79       2     3     3     1   1   2
## 80       3     1     2     1   1   2
## 81       1     1     7     1   1   2
## 82       2     1     2     1   1   2
## 83       2     1     3     1   1   2
## 84       2     2     7     1   1   2
## 85       8     9     7    10   7   4
## 86      10     4     4    10  10   4
## 87       5     8     4     4   1   4
## 88       5    10     6     8   3   4
## 89       2     1     3     1   1   2
## 90       3     1     2     1   1   2
## 91       2     1     3     1   1   2
## 92       2     1     1     1   1   2
## 93       2     1     3     1   1   2
## 94       2     1     2     1   1   2
## 95       2     1     3     1   1   2
## 96       2     1     3     1   1   2
## 97       2     1     1     1   1   2
## 98       2     1     3     1   1   2
## 99      10     6     2     9  10   4
## 100      5    10     7     9   4   4
## 101     10     5     3    10   2   4
## 102      2     5     2     5   1   4
## 103      2     1     3     1   1   2
## 104      6     3     7     1   1   4
## 105     10     1     8     8   8   4
## 106      3     3     3     2   7   4
## 107      2    10     4     1   1   4
## 108      8    10     5     7   1   4
## 109      2     1     2     3   1   2
```

```
## 110                   3           9           7           8     3    4
## 111                   2           2           5           3     2    2
## 112                   5           9           3           1     1    4
## 113                   2          10           7           3     3    4
## 114                  10           8           8           1     1    4
## 115                   2           3           3           1     1    2
## 116                   2           5           1           1     1    2
## 117                   2           2           3           2     1    2
## 118                   4          10           7           5     8    4
## 119                   4           3           1           1     1    2
## 120                   2           2           3           1     1    2
## 121                   2           1           3           1     1    2
## 122                   2           2           3           1     1    2
## 123                  10          10           5           3     3    4
## 124                   8          10           5           3     1    4
## 125                   9           7           8          10     1    4
## 126                   2           1           2           1     1    2
## 127                   4          10           7           5     5    4
## 128                   2           1           3           1     1    2
## 129                   5          10           1           6     2    4
## 130                  10           1           1           1     1    2
## 131                   2           1           2           1     1    2
## 132                   2           1           3           1     1    2
## 133                   8          10           3           6     3    4
## 134                   2           1           2           2     1    2
## 135                   3           1           2           1     1    2
## 136                   2           2           3           3     1    2
## 137                   2           1           2           1     1    2
## 138                   2           1           1           1     1    2
## 139                   2           1           2           1     1    2
## 140                   1        <NA>           2           1     1    2
## 141                   2           1           1           1     1    2
## 142                   2           1           1           1     1    2
## 143                   4           5           4           3     3    4
## 144                   2           5           1           1     1    2
## 145                   2           1           2           1     1    2
## 146                   2        <NA>           2           1     1    2
## 147                   6           8           4           1     1    4
## 148                   3           2           2           1     1    2
## 149                   8           1           5           8     1    2
## 150                  10          10           7           8     7    4
## 151                   1           1           3           1     1    2
## 152                   6          10           5           4     3    4
## 153                   4           5           8          10     1    4
## 154                   2           3           1           1     1    2
## 155                   2           1           1           1     1    2
## 156                   3          10           3           1     1    4
## 157                   2           1           2           1     1    2
## 158                   2           1           3           1     1    2
## 159                   3        <NA>           1           1     1    2
## 160                   6          10           7          10     6    4
## 161                   5          10           5           7     2    4
## 162                   2           1           3           2     1    2
## 163                   2           1           3           1     1    2
```

```
## 164                1             3           1          1     7    2
## 165                2          <NA>           3          1     1    2
## 166                2             2           3          2     1    2
## 167                8            10           3         10     3    4
## 168                6             1           3          1    10    4
## 169                2             1           3          1     1    2
## 170                1             1           1          1     1    2
## 171                2             1           1          1     1    2
## 172                2             1           3          1     1    2
## 173                2             1           2          1     1    2
## 174                8            10          10         10     7    4
## 175                3            10           6          1     1    4
## 176               10            10           5          7     1    4
## 177                2             1           3          1     1    2
## 178                8             1           5         10     3    4
## 179                2             1           3          1     1    2
## 180                6            10           3          1     1    4
## 181                1             1           3          1     1    2
## 182                2             1           1          1     1    2
## 183                2             1           3          1     1    2
## 184                5            10           7          8     1    4
## 185                4            10           5          1     1    4
## 186                1             1           3          1     1    2
## 187                5             8           7         10     1    4
## 188                6            10           7          7    10    4
## 189                5             8           9         10     1    4
## 190                2             1           3          1     1    2
## 191                6             8           7         10     1    4
## 192               10            10           4         10     3    4
## 193                2             1           2          1     1    2
## 194                2             1           3          1     1    2
## 195                2             1           3          1     1    2
## 196                2             1           3          1     1    2
## 197                4             7           7          8     2    2
## 198                2             1           3          1     1    2
## 199                2             1           1          1     1    2
## 200                2             1           2          1     1    2
## 201                5            10           7          8     3    4
## 202               10            10           8          1     1    4
## 203                2             1           3          1     1    2
## 204                2             1           3          1     1    2
## 205                2             1           3          1     1    2
## 206                6            10           7         10     5    4
## 207                7             5           3          5     1    4
## 208                1             1           3          1     1    2
## 209                1             1           3          1     1    2
## 210                1             1           3          1     1    2
## 211                5            10           8         10     6    4
## 212                4             8           7          7     1    4
## 213                2             1           3          1     1    2
## 214                7            10           7         10     4    4
## 215                3            10          10          6     1    4
## 216                5             5           5         10     2    4
## 217                2             1           2          1     1    2
```

```
## 218         2     1     3     1     1     2
## 219         6     4     8    10     2     4
## 220         2     1     3     1     1     2
## 221         2     1     3     1     1     2
## 222        10    10     9    10     1     4
## 223         1     5     2     1     1     4
## 224         3     8     7     4     1     4
## 225         3    10     7     9     2     4
## 226         2     1     2     1     1     2
## 227         4    10     8     9     1     4
## 228         3     5     7     7     1     4
## 229         1     1     3     1     1     2
## 230        10    10     9    10     1     4
## 231         3     7     7     6     1     4
## 232         6     8     8     9     2     4
## 233         3     1     4     3     1     2
## 234         5    10     4     1     1     4
## 235         3     1     3     6     1     2
## 236         2  <NA>     3     1     1     2
## 237         8    10     4     8    10     4
## 238         6     2     4    10     4     4
## 239         6     9     3    10    10     4
## 240         3    10     5     3     2     4
## 241         2     2     2     3     1     2
## 242         1     1     3     1     1     2
## 243         2     1     3     1     1     2
## 244         2     5     5     1     1     2
## 245         2     1     3     1     1     2
## 246         2     2     3     1     1     2
## 247         5    10     7     8     1     4
## 248         2     9     3     3     1     4
## 249         2     1     3     6     1     2
## 250         2  <NA>     3     1     1     2
## 251         2     1     1     1     1     2
## 252         2    10     5     3     3     4
## 253         3    10     3     5     3     2
## 254         8    10     7     3     3     4
## 255        10     8     3     3     1     4
## 256         4    10     3     6     1     4
## 257         2     1     1     1     1     2
## 258         2     1     2     1     1     2
## 259         2     1     3     1     1     2
## 260         5     8     3     4     1     2
## 261         3    10     5     1     3     4
## 262        10    10    10     6     5     4
## 263         5    10     7     8     1     4
## 264         6    10     5     5     1     4
## 265        10     3     5     3     3     4
## 266         2     1     3     2     1     2
## 267         3    10     4     3     2     4
## 268         3    10     7     1     1     4
## 269         3     4     8     7     8     4
## 270         2     1     3     1     1     2
## 271         3    10     3     9     2     4
```

```
## 272               2             1               3               1       1     2
## 273               3            10               7               1       1     4
## 274               3             4               3               3       1     4
## 275               2             1               3               2       1     2
## 276               2          <NA>               2               1       1     2
## 277               2             1               2               1       1     2
## 278               2             1               2               1       1     2
## 279               2             1               3               1       1     2
## 280               3             7               3               3       8     4
## 281               2             1               3               1       1     2
## 282               2             1               3               1       1     2
## 283               4            10               5               6       1     4
## 284               2            10               5               3       1     4
## 285               2            10               3               8       2     4
## 286               8            10              10               7       3     4
## 287              10            10               4              10      10     4
## 288               3             1               2               1       1     2
## 289               4             5               5              10       1     4
## 290               6            10               4              10       4     4
## 291               2             1               1               1       1     2
## 292               2             1               3               1       1     2
## 293               2          <NA>               6              10       1     4
## 294               2            10               2               3       1     4
## 295               2          <NA>               2               1       1     2
## 296               6            10               7               4       1     4
## 297               4             5               4               7       1     2
## 298               2          <NA>               2               3       1     2
## 299               5             1               1               1       1     2
## 300               4            10               7               7       2     4
## 301               4             4               7              10       1     4
## 302               2             1               3               1       1     2
## 303               9            10               7              10      10     4
## 304               2             1               3               1       1     2
## 305               3            10               3               3       1     4
## 306               4            10               3              10       4     4
## 307               2             1               3               1       1     2
## 308               2             1               3               1       1     2
## 309               4             3               8               8       4     4
## 310               2             5               5               1       1     2
## 311               3             1               2               1       1     2
## 312               2             1               1               1       1     2
## 313              10             1               3               5       1     4
## 314               2             1               1               1       1     2
## 315               1             1               2               1       1     2
## 316               7          <NA>               4               9       1     2
## 317               5            10               4               3       1     4
## 318               6             8               8               9       1     4
## 319               5             1               3               1       1     2
## 320               6             5               7               3       1     2
## 321               5            10               7               4       6     4
## 322               2          <NA>               3               1       1     2
## 323               2             1               3               1       1     2
## 324               2            10               4               1       1     4
## 325               2             1               3               1       1     2
```

```
## 326     2     1    2     3    1    2
## 327     2    10    5     4    1    4
## 328     2     1    2     1    1    2
## 329     6     4    3    10    1    4
## 330     5    10    7     1    1    4
## 331     2     8    6     1    1    4
## 332     2     1    3     1    2    2
## 333     2     1    2     2    1    2
## 334     4    10    4     3    1    4
## 335     3    10    3     4    2    4
## 336     2     1    1     1    1    2
## 337     4    10    3     4    1    4
## 338     2     1    3     1    1    2
## 339     1     1    2     1    1    2
## 340     2    10    4     3    1    4
## 341     2    10    7     6    1    4
## 342     2     1    3     1    1    2
## 343     2     1    1     1    1    2
## 344     2     1    1     1    1    2
## 345    10    10    9     5    3    4
## 346     2     1    1     1    1    2
## 347     3     1    1     3    1    2
## 348     1     1    1     3    1    2
## 349     5     1    3     3    1    4
## 350     3     8    7     6    1    4
## 351     2     1    1     1    1    2
## 352     2     1    3     1    1    2
## 353     7     3    4     6    1    2
## 354     7    10    4     9    4    4
## 355     2     1    2     1    1    2
## 356     3     1    2     2    1    2
## 357     3     3    3     3    3    4
## 358    10    10    7     3    8    4
## 359     8     4    4    10    3    4
## 360     3     7    3     5    3    4
## 361    10    10    8    10   10    4
## 362     6    10    5     1    4    4
## 363     4     3    2     1    1    2
## 364     2     3    2     1    1    2
## 365     2     1    3     1    1    2
## 366     2     1    2     1    1    2
## 367     8    10    7    10    7    4
## 368     5    10    8    10    3    4
## 369     2     1    1     1    1    2
## 370     1     1    2     1    1    2
## 371     3     1    2     1    1    2
## 372     2     1    1     1    1    2
## 373     2     1    2     1    1    2
## 374     2     1    2     1    1    2
## 375     2     1    2     1    1    2
## 376     2     1    1     1    1    2
## 377     2     1    2     1    1    2
## 378     1     1    2     1    1    2
## 379     3     1    2     2    1    2
```

```
## 380           4          1           3           1     1     2
## 381           2          1           1           1     1     2
## 382           4         10           7           8     4     4
## 383           2          1           3           2     1     2
## 384           2          1           1           1     1     2
## 385           2          1           1           1     1     2
## 386           3          1           1           2     3     2
## 387           2         10           7           1     1     4
## 388           3          1           3           1     1     2
## 389           2          1           2           2     1     2
## 390           3          2           2           2     1     2
## 391           2          1           2           1     1     2
## 392           3         10           7           9     1     4
## 393           2          1           2           1     1     2
## 394           1          1           1           1     1     2
## 395           2          1           2           1     1     2
## 396           2          1           2           1     1     2
## 397           2          1           3           1     1     2
## 398           2          1           1           1     1     2
## 399           2          1           2           2     1     2
## 400           2          1           1           1     1     2
## 401           6          9           9           3     8     4
## 402           2          1           1           1     1     2
## 403           2          1           2           1     1     2
## 404           2          4           1           1     1     2
## 405           2          1           1           2     1     2
## 406           2          1           2           1     1     2
## 407           2          1           2           1     1     2
## 408           2          1           2           1     1     2
## 409           2          2           3           1     1     2
## 410           2          1           2           1     1     2
## 411           2          1           2           1     1     2
## 412           1       <NA>           2           1     1     2
## 413           8          4           8           5     1     4
## 414           2          1           3           1     1     2
## 415           3         10           6           6     1     4
## 416           3          3           3           5     1     2
## 417          10         10           7           2     1     4
## 418           2          1           2           1     1     2
## 419           2          2           3           2     2     2
## 420           5          1           1           1     1     2
## 421           2          3           3           1     1     2
## 422          10         10           8           2     1     4
## 423           2          1           3           3     1     2
## 424           2          1           2           1     1     2
## 425           2          1           1           1     1     2
## 426          10         10          10          10     1     4
## 427           2          1           1           1     1     2
## 428           4          2           5          10     1     4
## 429           2          1           2           1     1     2
## 430           2          1           2           1     1     2
## 431           2          1           2           2     1     2
## 432           4          1           3           2     1     2
## 433           2          1           2           2     1     2
```

```
## 434                     2              1                1                1        1      2
## 435                     5              8                4                2        1      2
## 436                     3             10                5                1        1      4
## 437                     6              1                2                8        1      4
## 438                     2              1                1                1        1      2
## 439                     2              1                1                1        1      2
## 440                     2              1                1                1        1      2
## 441                     4             10               10                1        1      4
## 442                     2              4                1                1        1      2
## 443                     2              3                1                1        1      2
## 444                     2              2                1                1        1      2
## 445                     3              1                2                1        1      2
## 446                     2              1                1                1        1      2
## 447                     2              1                1                1        1      2
## 448                     2              1                1                1        1      2
## 449                     1              1                1                1        1      2
## 450                     6             10                8               10        1      4
## 451                     1              1                2                1        1      2
## 452                     2              1                1                1        1      2
## 453                     2              1                1                1        1      2
## 454                     6             10               10                7        1      4
## 455                     3              1                1                1        1      2
## 456                     2              6                1                1        2      4
## 457                     5             10                8                6        1      4
## 458                     6              3               10               10        1      4
## 459                     2              1                1                1        1      2
## 460                     2              1                1                1        1      2
## 461                     2              1                1                1        1      2
## 462                     2              5                1                1        1      2
## 463                     2              1                1                1        1      2
## 464                     2              1                1                2        1      2
## 465                     2              1                1                1        1      2
## 466                     6              4                7               10        3      4
## 467                     4             10                9                7        1      4
## 468                     4             10                7                6        2      4
## 469                     2              1                1                1        1      2
## 470                     2              1                2                1        1      2
## 471                     1              1                2                1        1      2
## 472                     2              1                1                1        1      2
## 473                     1              1                1                1        1      2
## 474                     2              1                1                1        1      2
## 475                     2              1                1                1        1      2
## 476                     2              1                1                1        1      2
## 477                     2              1                1                1        1      2
## 478                     2              1                1                1        1      2
## 479                     2              1                1                1        1      2
## 480                     4             10                7                5        1      4
## 481                     1              1                1                1        1      2
## 482                     2              1                1                1        1      2
## 483                    10              5               10               10       10      4
## 484                     5             10                9               10        1      4
## 485                     2              1                1                1        1      2
## 486                     1              3                1                1        1      2
## 487                     1              1                2                1        1      2
```

```
## 488             6         10          8          1     5     4
## 489             3          3          3          4     1     4
## 490             3          4          4          1     1     4
## 491             2          1          1          1     1     2
## 492             3         10          7          1     1     4
## 493             1          1          2          1     1     2
## 494             6         10          6          5     2     4
## 495             4          5          2          1     1     2
## 496             1          1          2          1     1     2
## 497             1          1          1          1     1     2
## 498             2          1          1          1     1     2
## 499             2          1          2          1     1     2
## 500             2          1          2          1     1     2
## 501             2          1          3          1     1     2
## 502             2          1          2          1     1     2
## 503             2          1          2          1     1     2
## 504             2          1          3          1     1     2
## 505             2          1          1          1     1     2
## 506             2          1          1          1     1     2
## 507             7          5          4          8     7     4
## 508             2          4          1          1     1     2
## 509             2          1          1          1     1     2
## 510             2          1          1          1     1     2
## 511             2          1          1          1     1     2
## 512             2          1          2          1     1     2
## 513             2          1          1          1     1     2
## 514             1          1          2          1     1     2
## 515             3         10          8         10     2     4
## 516             3         10          9         10     1     4
## 517             1          1          1          1     1     2
## 518             1          1          2          1     1     2
## 519             2          1          1          1     1     2
## 520             4         10          9          1     1     4
## 521             3          1          1          1     1     2
## 522             3          1          1          1     1     2
## 523             3          5          7          3     1     4
## 524             4         10          5          3     1     4
## 525             2          1          2          1     1     2
## 526             2          1          1          1     1     2
## 527             2          1          1          1     1     2
## 528             2          1          3          1     1     2
## 529             2          1          1          1     1     2
## 530             1          1          2          1     1     2
## 531             4         10          6          9     1     4
## 532             2          1          2          1     1     2
## 533             1          1          3          1     1     2
## 534             2          1          2          1     1     2
## 535             2          1          2          1     1     2
## 536             2          1          3          1     1     2
## 537             2          1          3          1     1     2
## 538             2          1          3          1     1     2
## 539             2          1          2          1     1     2
## 540             2          1          2          1     1     2
## 541             2          2          2          1     1     2
```

```
## 542                     2              1                1                 1       1      2
## 543                     2              1                1                 1       1      2
## 544                     2              1                2                 1       1      2
## 545                     2              1                2                 1       1      2
## 546                     2              1                2                 1       1      2
## 547                     4             10                7                10       1      4
## 548                     1              1                1                 1       1      2
## 549                     1              1                1                 1       1      2
## 550                     4              5                7                 8       2      4
## 551                     2              1                2                 1       1      2
## 552                     2              1                3                 1       1      2
## 553                     2              1                4                 2       1      2
## 554                     2              5                2                 1       2      2
## 555                     2              1                1                 1       1      2
## 556                     2              1                4                 8       1      2
## 557                     1              1                2                 1       1      2
## 558                     2              1                1                 1       1      2
## 559                     2              1                2                 1       1      2
## 560                     2              1                2                 1       1      2
## 561                     2              1                3                 1       1      2
## 562                     2              1                3                 1       1      2
## 563                     2              1                3                 1       1      2
## 564                     2              1                2                 1       1      2
## 565                     2              1                3                 2       1      2
## 566                     5             10               10                10       1      4
## 567                     2              1                3                 1       1      2
## 568                     2              3                2                 1       1      2
## 569                     6             10                2                 5       2      4
## 570                     6              5               10                 3       1      4
## 571                     8             10                8                 2       1      4
## 572                     3             10                9                10       2      4
## 573                     2              1                2                 1       1      2
## 574                     2              1                2                 1       1      2
## 575                     4              2                7                 7       1      4
## 576                     2              1                3                 1       1      2
## 577                     2              1                2                 1       1      2
## 578                     2              1                2                 1       1      2
## 579                     2              1                2                 1       1      2
## 580                     2              1                3                 1       1      2
## 581                     2              1                2                 1       1      2
## 582                     5             10                7                 5       1      4
## 583                     4             10                6                10       1      4
## 584                     2              1                1                 1       1      2
## 585                     3              1                1                 1       1      2
## 586                     2              1                1                 1       1      2
## 587                     6             10               10                10       1      4
## 588                     2              1                2                 2       1      2
## 589                     6              3                4                 1       1      4
## 590                     2              1                1                 1       1      2
## 591                     4              1               10                 1       1      4
## 592                     4             10                7                 6       1      4
## 593                     3             10                4                 1       1      4
## 594                     2              1                1                 1       1      2
## 595                     4             10                7                 1       1      4
```

```
## 596               2             1                2               1       1     2
## 597               2             1                2               1       1     2
## 598               2             1                3               1       1     2
## 599               2             1                2               1       1     2
## 600               1             1                1               1       1     2
## 601               2             1                2               1       1     2
## 602               1             1                2               1       1     2
## 603               2             1                2               1       1     2
## 604               4             1                8              10       1     4
## 605               5            10                8               1       2     4
## 606               5             8                7               8       3     4
## 607               2             1                1               1       1     2
## 608               2             1                1               1       1     2
## 609              10            10               10               1       1     4
## 610               2             1                1               1       1     2
## 611               3            10                7               1       2     4
## 612               5             2                8               5       1     4
## 613               6            10               10              10      10     4
## 614               2             1                2               1       1     2
## 615               1             1                2               1       1     2
## 616               2             1                2               1       1     2
## 617               2             1                2               1       1     2
## 618               1             ?                1               1       1     2
## 619               2             1                2               1       1     2
## 620               2             1                2               1       1     2
## 621               2             1                2               1       1     2
## 622               3             2                6               1       1     2
## 623               2             1                2               1       1     2
## 624               2             1                1               1       1     2
## 625               1             1                2               1       1     2
## 626               3             4                1               1       1     2
## 627               7             6                7               7       3     4
## 628               2             5                1               1       1     2
## 629               2             1                1               1       1     2
## 630               2             1                1               1       1     2
## 631               2             1                1               1       1     2
## 632               2             1                2               1       1     2
## 633               2             1                1               1       1     2
## 634               5             3                5              10       1     4
## 635               2             1                1               1       1     2
## 636               2             1                1               1       1     2
## 637               7             1               10              10       3     4
## 638               2             2                2               1       1     2
## 639               2             1                1               1       1     2
## 640               2             1                1               1       1     2
## 641               2             1                1               1       1     2
## 642               2             1                2               1       1     2
## 643               2             1                2               1       1     2
## 644               2             1                1               1       1     2
## 645               2             1                1               1       1     2
## 646               2             1                2               1       1     2
## 647               2             1                1               1       1     2
## 648               2             1                1               1       1     2
## 649              10             2               10              10      10     4
```

```
## 650                         2                  1                     2                      1           1       2
## 651                         3                  4                     1                      1           1       2
## 652                         2                  1                     2                      1           1       2
## 653                         2                  1                     2                      2           1       2
## 654                         2                  1                     2                      1           1       2
## 655                         2                  1                     3                      1           1       2
## 656                         2                  1                     2                      1           1       2
## 657                         2                  1                     2                      1           1       2
## 658                         8                  1                     3                      6           1       2
## 659                         3                 10                     7                      2           3       4
## 660                         2                  1                     1                      1           1       2
## 661                         2                  1                     2                      1           1       2
## 662                         2                  1                     3                      1           1       2
## 663                         2                  1                     2                      1           1       2
## 664                         2                  1                     2                      1           1       2
## 665                         2                  1                     2                      1           1       2
## 666                         2                  1                     1                      1           1       2
## 667                         2                  1                     1                      1           2       2
## 668                         2                  1                     3                      1           1       2
## 669                         6                  1                     7                     10           3       4
## 670                         5                  5                     7                     10           1       4
## 671                         5                  8                     7                      4           1       4
## 672                         2                  1                     3                      1           1       2
## 673                         2                  1                     3                      1           1       2
## 674                         3                  1                     1                      1           1       2
## 675                         2                  1                     2                      1           1       2
## 676                         2                  1                     1                      1           1       2
## 677                         2                  1                     2                      1           1       2
## 678                         2                  1                     1                      1           1       2
## 679                         2                  1                     1                      1           1       2
## 680                         2                  1                     1                      1           1       2
## 681                         5                 10                    10                     10           7       4
## 682                         4                 10                     5                      6           3       4
## 683                         2                  1                     3                      2           1       2
## 684                         2                  1                     1                      1           1       2
## 685                         2                  1                     1                      1           1       2
## 686                         2                  1                     1                      1           1       2
## 687                         2                  1                     1                      1           1       2
## 688                         2                  1                     2                      3           1       2
## 689                         2                  1                     1                      1           1       2
## 690                         2                  1                     1                      1           8       2
## 691                         2                  1                     1                      1           1       2
## 692                         4                  5                     4                      4           1       4
## 693                         2                  1                     1                      1           1       2
## 694                         2                  1                     2                      1           2       2
## 695                         3                  2                     1                      1           1       2
## 696                         2                  1                     1                      1           1       2
## 697                         7                  3                     8                     10           2       4
## 698                         3                  4                    10                      6           1       4
## 699                         4                  5                    10                      4           1       4
```

```
#a. describe what is the dataset all about.
#answer.The 'breastcancer_wisconsin' dataset comprises clinical records of cases, providing identificat
#d. Compute the descriptive statistics using different packages. Find the values of:
```

```r
#d.1 Standard error of the mean for clump thickness.
#Using stdError function
clumpthcknss_data <- breastcancer_wisconsin$clump_thickness
std_error_clump_thickness <- stdError(clumpthcknss_data)
std_error_clump_thickness
```

```
## [1] 0.1065011
```

```r
#0.1065011

#d.2 Coefficient of variability for Marginal Adhesion.
#Using mean and standard deviation to get the Coefficient of Variation.
marginal_adhesion <- breastcancer_wisconsin$marginal_adhesion
mean <- mean(marginal_adhesion)
sd <- sd(marginal_adhesion)
cv <- sd / mean
cv
```

```
## [1] 1.017283
```

```r
cv<-cv*100
cv
```

```
## [1] 101.7283
```

```r
#d.3 Number of null values of Bare Nuclei.
bare_nuclei <- breastcancer_wisconsin$bare_nucleoli
num_null <- sum(is.na(bare_nuclei))
num_null
```

```
## [1] 15
```

```r
#d.4 Mean and standard deviation for Bland Chromatin
#Using mean and standard deviation
bland_chromatin_data <- breastcancer_wisconsin$bland_chromatin
mean_bland_chromatin <- mean(bland_chromatin_data)
sd_bland_chromatin <- sd(bland_chromatin_data)
mean_bland_chromatin
```

```
## [1] 3.437768
```

```r
sd_bland_chromatin
```

```
## [1] 2.438364
```

```r
#d.5 Confidence interval of the mean for Uniformity of Cell Shape
#Using t.test function
uniformity_cellShape_data <- breastcancer_wisconsin$shape_uniformity
confidence_interval <- t.test(uniformity_cellShape_data, na.rm = TRUE)$conf.int
print(confidence_interval)
```

```
## [1] 2.986741 3.428138
## attr(,"conf.level")
## [1] 0.95
```

```r
#d. How many attributes?
length(breastcancer_wisconsin)
```

```
## [1] 11
```

```r
names(breastcancer_wisconsin)
```

```
##  [1] "id"                "clump_thickness"   "size_uniformity"
##  [4] "shape_uniformity"  "marginal_adhesion" "epithelial_size"
##  [7] "bare_nucleoli"     "bland_chromatin"   "normal_nucleoli"
## [10] "mitoses"           "class"
```

```r
#e. Find the percentage of respondents who are malignant. Interpret the results

malignant_percentage <- sum(breastcancer_wisconsin$class == 4) / nrow(breastcancer_wisconsin) * 100
malignant_percentage
```

```
## [1] 34.47783
```

```r
#9. Export the data abalone to the Microsoft excel file. Copy the codes.
install.packages("AppliedPredictiveModeling")
```

```
## Installing package into '/cloud/lib/x86_64-pc-linux-gnu-library/4.3'
## (as 'lib' is unspecified)
```

```r
library("AppliedPredictiveModeling")
data("abalone")
head(abalone)
```

```
##   Type LongestShell Diameter Height WholeWeight ShuckedWeight VisceraWeight
## 1    M        0.455    0.365  0.095      0.5140        0.2245        0.1010
## 2    M        0.350    0.265  0.090      0.2255        0.0995        0.0485
## 3    F        0.530    0.420  0.135      0.6770        0.2565        0.1415
## 4    M        0.440    0.365  0.125      0.5160        0.2155        0.1140
## 5    I        0.330    0.255  0.080      0.2050        0.0895        0.0395
## 6    I        0.425    0.300  0.095      0.3515        0.1410        0.0775
##   ShellWeight Rings
## 1       0.150    15
## 2       0.070     7
## 3       0.210     9
## 4       0.155    10
## 5       0.055     7
## 6       0.120     8
```

```r
summary(abalone)
```

```
##  Type      LongestShell      Diameter          Height        WholeWeight
##  F:1307   Min.   :0.075   Min.   :0.0550   Min.   :0.0000   Min.   :0.0020
##  I:1342   1st Qu.:0.450   1st Qu.:0.3500   1st Qu.:0.1150   1st Qu.:0.4415
##  M:1528   Median :0.545   Median :0.4250   Median :0.1400   Median :0.7995
##           Mean   :0.524   Mean   :0.4079   Mean   :0.1395   Mean   :0.8287
##           3rd Qu.:0.615   3rd Qu.:0.4800   3rd Qu.:0.1650   3rd Qu.:1.1530
##           Max.   :0.815   Max.   :0.6500   Max.   :1.1300   Max.   :2.8255
##  ShuckedWeight    VisceraWeight     ShellWeight         Rings
##  Min.   :0.0010   Min.   :0.0005   Min.   :0.0015   Min.   : 1.000
##  1st Qu.:0.1860   1st Qu.:0.0935   1st Qu.:0.1300   1st Qu.: 8.000
##  Median :0.3360   Median :0.1710   Median :0.2340   Median : 9.000
##  Mean   :0.3594   Mean   :0.1806   Mean   :0.2388   Mean   : 9.934
##  3rd Qu.:0.5020   3rd Qu.:0.2530   3rd Qu.:0.3290   3rd Qu.:11.000
##  Max.   :1.4880   Max.   :0.7600   Max.   :1.0050   Max.   :29.000
```

```r
getwd()
```

```
## [1] "/cloud/project/RWorksheet_6"
```

```r
Abalone_excel<-"/cloud/project/RWorksheet_6/AbaloneData.xlsx"
#install.packages("writexl")
library(writexl)

write_xlsx(abalone, Abalone_excel)
```