RWorksheet_5

BSIT-2B

2023-12-10

##Basic Statistics

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

```
students_score <- 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)
)
students_score
```

```
##    Students preTest postTest
## 1         1      55       61
## 2         2      54       60
## 3         3      47       56
## 4         4      57       63
## 5         5      51       56
## 6         6      61       63
## 7         7      57       59
## 8         8      54       56
## 9         9      63       62
## 10       10      58       61
```

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

```
## Warning: package 'Hmisc' was built under R version 4.3.2
```

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

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

```
library(pastecs)
```

```
## Warning: package 'pastecs' was built under R version 4.3.2
```

```r
stats_hmisc <- describe(students_score)
stats_hmisc
```

```
## students_score
##
##  3  Variables      10  Observations
## ---------------------------------------------------------------------------
## Students
##        n  missing distinct     Info     Mean      Gmd      .05      .10
##       10        0       10        1      5.5    3.667     1.45     1.90
##      .25      .50      .75      .90      .95
##     3.25     5.50     7.75     9.10     9.55
##
## Value        1   2   3   4   5   6   7   8   9  10
## Frequency    1   1   1   1   1   1   1   1   1   1
## Proportion 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1
##
## For the frequency table, variable is rounded to the nearest 0
## ---------------------------------------------------------------------------
## preTest
##        n  missing distinct     Info     Mean      Gmd
##       10        0        8    0.988     55.7    5.444
##
## Value       47  51  54  55  57  58  61  63
## Frequency    1   1   2   1   2   1   1   1
## Proportion 0.1 0.1 0.2 0.1 0.2 0.1 0.1 0.1
##
## For the frequency table, variable is rounded to the nearest 0
## ---------------------------------------------------------------------------
## postTest
##        n  missing distinct     Info     Mean      Gmd
##       10        0        6    0.964     59.7    3.311
##
## Value       56  59  60  61  62  63
## Frequency    3   1   1   2   1   2
## Proportion 0.3 0.1 0.1 0.2 0.1 0.2
##
## For the frequency table, variable is rounded to the nearest 0
## ---------------------------------------------------------------------------
```

```r
stats_pastics <- stat.desc(students_score)
stats_pastics
```

```
##                Students      preTest     postTest
## nbr.val      10.0000000  10.00000000  10.00000000
## nbr.null      0.0000000   0.00000000   0.00000000
## nbr.na        0.0000000   0.00000000   0.00000000
## min           1.0000000  47.00000000  56.00000000
## max          10.0000000  63.00000000  63.00000000
## range         9.0000000  16.00000000   7.00000000
## sum          55.0000000 557.00000000 597.00000000
## median        5.5000000  56.00000000  60.50000000
```

```
## mean          5.5000000  55.70000000  59.70000000
## SE.mean       0.9574271   1.46855938   0.89504811
## CI.mean.0.95  2.1658506   3.32211213   2.02473948
## var           9.1666667  21.56666667   8.01111111
## std.dev       3.0276504   4.64399254   2.83039063
## coef.var      0.5504819   0.08337509   0.04741023
```

##2. The Department of Agriculture was studying the effects of several levels of a fertilizer on the growth of a plant. For some analyses, it might be useful to convert the fertilizer levels to an ordered factor.

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

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

```
# the data_fertilize result shows the level as an ordered factor.
```

##3. Abdul Hassan, president of Floor Coverings Unlimited, has asked you to study the ex-ercise levels undertaken by 10 subjects were “l”, “n”, “n”, “i”, “l” , “l”, “n”,“n”, “i”, “l” ; n=none, l=light, i=intense.

```
# a. What is the best way to represent this in R?
exe_levels <- c("l", "n", "n", "i", "l", "l", "n", "n", "i", "l")
exe_factor <- factor(exe_levels, levels = c("n", "l", "i"), labels = c("none", "light", "intense"))
exe_factor
```

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

4. Sample of 30 tax accountants from all the states and territories of Australia and their individual state of origin is specified by a character vector of state mnemonics as:

```
#a. Apply the factor function and factor level. Describe the results.
#the factor_with_level variable result is factor with level.

aussie_state <- 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")
aussie_state
```

```
##  [1] "tas" "sa"  "qld" "nsw" "nsw" "nt"  "wa"  "wa"  "qld" "vic" "nsw" "vic"
## [13] "qld" "qld" "sa"  "tas" "sa"  "nt"  "wa"  "vic" "qld" "nsw" "nsw" "wa"
## [25] "sa"  "act" "nsw" "vic" "vic" "act"
```

```
factor_and_level <-factor(aussie_state, levels = c("act", "nsw", "nt", "qld", "sa", "tas", "vic", "wa"))
factor_and_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
```

##5. From #4 - continuation:

```
aussie_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)
aussie_incomes
```

```
##  [1] 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
## [26] 46 59 46 58 43
```

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

incmeans <- tapply(aussie_incomes, factor_and_level, mean)
incmeans
```

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

```
# b. Copy the results and interpret.
#The result has the means of each states that has factor with levels
```

##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.
stdErrors <- function(x) sqrt(var(x)/length(x))
stdErrors
```

```
## function(x) sqrt(var(x)/length(x))
```

```
incster <- tapply(aussie_incomes, factor_and_level, stdErrors)
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
```

```
#b. Interpret the result.
#It displays the state income means' computed standard errors. The sample mean income is a reasonably a
```

```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)

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

```
##    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_subset_titanic<- subset(Titanic, Survived == "No")
not_subset_titanic
```

```
##    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
```

##8. The data sets are about the breast cancer Wisconsin. The samples arrive periodically as Dr. Wolberg reports his clinical cases.

```r
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
```

```
summary(breastcancer_wisconsin)
```

```
##        id           clump_thickness  size_uniformity  shape_uniformity
##  Min.   :   61634   Min.   : 1.000   Min.   : 1.000   Min.   : 1.000
##  1st Qu.:  870688   1st Qu.: 2.000   1st Qu.: 1.000   1st Qu.: 1.000
##  Median : 1171710   Median : 4.000   Median : 1.000   Median : 1.000
##  Mean   : 1071704   Mean   : 4.418   Mean   : 3.134   Mean   : 3.207
##  3rd Qu.: 1238298   3rd Qu.: 6.000   3rd Qu.: 5.000   3rd Qu.: 5.000
##  Max.   :13454352   Max.   :10.000   Max.   :10.000   Max.   :10.000
##  marginal_adhesion epithelial_size  bare_nucleoli      bland_chromatin
##  Min.   : 1.000    Min.   : 1.000   Length:699         Min.   : 1.000
##  1st Qu.: 1.000    1st Qu.: 2.000   Class :character   1st Qu.: 2.000
##  Median : 1.000    Median : 2.000   Mode  :character   Median : 3.000
##  Mean   : 2.807    Mean   : 3.216                      Mean   : 3.438
##  3rd Qu.: 4.000    3rd Qu.: 4.000                      3rd Qu.: 5.000
##  Max.   :10.000    Max.   :10.000                      Max.   :10.000
##  normal_nucleoli     mitoses           class
##  Min.   : 1.000   Min.   : 1.000   Min.   :2.00
##  1st Qu.: 1.000   1st Qu.: 1.000   1st Qu.:2.00
##  Median : 1.000   Median : 1.000   Median :2.00
##  Mean   : 2.867   Mean   : 1.589   Mean   :2.69
##  3rd Qu.: 4.000   3rd Qu.: 1.000   3rd Qu.:4.00
##  Max.   :10.000   Max.   :10.000   Max.   :4.00
```

```
#a. describe what is the dataset all about.
#It displays the state income means' computed standard errors. The sample mean income is a reasonably a

#d. Compute the descriptive statistics using different packages. Find the values of:

#d.1 Standard error of the mean for clump thickness.
clumpThickness_dataset <- breastcancer_wisconsin$clump_thickness
stdError_clump_thickness <- stdErrors(clumpThickness_dataset)
stdError_clump_thickness
```

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

```
#d.2 Coefficient of variability for Marginal Adhesion.
marginalAdhesion_data <- breastcancer_wisconsin$marginal_adhesion
mean <- mean(marginalAdhesion_data)
sd <- sd(marginalAdhesion_data)
cv <- sd / mean
cv
```

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

```
cv<-cv*100 #getting the percentage
cv
```

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

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

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

```r
#d.4 Mean and standard deviation for Bland Chromatin
blandChromatin_data <- breastcancer_wisconsin$bland_chromatin
mean_blandChromatin <- mean(blandChromatin_data)
sd_blandChromatin <- sd(blandChromatin_data)
mean_blandChromatin
```

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

```r
sd_blandChromatin
```

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

```r
#d.5 Confidence interval of the mean for Uniformity of Cell Shape
#Using t.test function
shapeUniformity_data <- breastcancer_wisconsin$shape_uniformity
confidence_Interval <- t.test(shapeUniformity_data, na.rm = TRUE)$conf.int
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
percentage_malignant <- sum(breastcancer_wisconsin$class == 4) / nrow(breastcancer_wisconsin) * 100
percentage_malignant
```

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

```
#Accordingly, the result 34.47783 indicates that roughly 34.48% of the participants in the dataset on b
```

##9. Export the data abalone to the Microsoft excel file. Copy the codes.

```
library("AppliedPredictiveModeling")
```

```
## Warning: package 'AppliedPredictiveModeling' was built under R version 4.3.2
```

```
data("abalone")
View(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
```

```
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
```

```
abalone_excel<-"C:/Users/missy/OneDrive/Documents/Github/RWorksheets_Sadsad/Worksheet#5/abaloneData.xlsx
install.packages("writexl")
```

```
## Installing package into 'C:/Users/missy/AppData/Local/R/win-library/4.3'
## (as 'lib' is unspecified)
```

```
## package 'writexl' successfully unpacked and MD5 sums checked
##
## The downloaded binary packages are in
##  C:\Users\missy\AppData\Local\Temp\Rtmpg319Da\downloaded_packages
```

```
library(writexl)
```

```
## Warning: package 'writexl' was built under R version 4.3.2
```

```
write_xlsx(abalone, abalone_excel)
```