RWorksheet_Conlu#6a

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

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

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

install.packages("Hmisc")
```

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

```
library(Hmisc)
```

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

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

```
install.packages("pastecs")
```

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

```
library(pastecs)

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

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

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

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

```
# the fertilizeData 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 w
```

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

exerciseLevels <- c("l", "n", "n", "i", "l", "l", "n", "n", "i", "l")
exerciseFactor <- factor(exerciseLevels, levels = c("n", "l", "i"), labels = c("none", "light", "intens
exerciseFactor
```

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

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


state_territories<- 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")

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

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

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

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

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

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

inc_txmeans <- tapply(income_tax, factorLevel, mean)

inc_txmeans
```

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

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

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

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

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

```
#b. Interpret the result.
#ANSWER: The provided information details the computed standard errors of the mean state incomes. A sma

#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)

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

```
##    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
```

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

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

```r
#8. The data sets are about the breast cancer Wisconsin. The samples arrive periodically as Dr. Wolberg

library(readr)
csv.file<-"breastcancer_wisconsin.csv"
breastcancerWisconsin<-read.csv("breastcancer_wisconsin.csv")
breastcancerWisconsin
```

```
##           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(breastcancerWisconsin)
```

```
##        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.
#ANSWER: The 'breastcancerWisconsin' dataset consists of clinical reports identifying breast cancer cas

#d. Compute the descriptive statistics using different packages. Find the values of:
#d.1 Standard error of the mean for clump thickness.
#Using stdError function
clump_thickness_data <- breastcancerWisconsin$clump_thickness
std_error_clump_thickness <- stdError(clump_thickness_data)
std_error_clump_thickness
```

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

```
#0.1065011
#d.2 Coefficient of variability for Marginal Adhesion.
#Using mean and standard deviation to get the Coefficient of Variation.
marginalAdhesionData <- breastcancerWisconsin$marginal_adhesion
marginalAdhesionData
```

```
##   [1]  1  5  1  1  3  8  1  1  1  1  1  1  3  1 10  4  1  1  6  1 10  3  1  1  1
##  [26]  4  1  1  1  1  1  1  3  2  1  1  8  1  9  3  9  1  2  6  4  1  4  1  3  2
##  [51]  1  4  2  8  6  3  1  1  1  2  5  1  1  1  1  1  1  1  3  1  1  8  2 10  1
##  [76]  1  1  2  1  1  1  2  1  1  8  1  4  6  1  2  1  2  1  1  1  1  2  1  2 10
## [101]  1  4  1  1 10  4  8 10  1  4  2  3 10  3  1  1  1 10  1  1  2  1  2  1  7
## [126]  1  7  1  4  1  1  1 10  1  1  1  1  1  1  1  1  1  4  1  1  1  2  1  3  4
## [151]  1  1  6  1  1  6  1  1  1  3  4  1  1  2  1  1  8 10  1  2  1  1  1 10  4
## [176]  7  1  3  1  3  1  1  1  8  4  1  6 10 10  1  8 10  1  1  1  1  5  4  1  1
## [201]  5  4  1  1  1  9  3  1  1  1 10  8  1 10 10  7  1  1  7  1  2  3  3  3  6
## [226]  1  4  5  1  3  4  5  3  5  1  1  2  5  8  2  3  3  1  1  1  2  8  1  1  1
```

```
## [251]  1 10  5  2  1  2  1  1  1  1 10  6  4 10 10  1  3  2  2  1  1  1  2  1  1
## [276]  1  1  1  1  3  1  2 10  1 10 10 10  1  1  8  1  1  1  6  1  8  3  1  1  6
## [301]  5  1  7  1  9  4  1  1  6  1  1  1 10  1  1  6  2  8  1  4  2  1  1 10  1
## [326]  1  1  1  2  4  2  1  2  6  3  1  8  1  1  5  1  1  1  1  8  1  2  1 10  5
## [351]  3  1  3 10  1  1  1  7  3  4 10 10  1  2  1  1 10 10  1  1  1  1  1  2  1
## [376]  1  1  1  4  1  1  6  2  1  1  2  3  2  1  1  2  4  1  1  1  1  1  1  1  1
## [401]  7  1  1  1  3  1  1  1  2  1  1  1  6  1  2  6  5  1  2  1  3  7  1  1  1
## [426] 10  1  2  1  1  1  3  1  3  5  1  1  1  3  1 10  4  3  1  6  1  1  1  1  8
## [451]  3  1  3  8  1  1  8  6  1  1  3  1  3  1  1  7  2  5  1  1  1  3  1  1  1
## [476]  1  1  1  1 10  1  4 10  5  1  3  1 10 10  1  1  4  1 10 10  1  1  1  1  1
## [501]  1  1  2  1  1  1 10  1  1  1  1  1  1  1 10  7  1  1  2  3  1  1  4 10  1
## [526]  2  1  1  2  1  3  1  1  1  1  2  1  1  1  1  1  1  1  1  2  1 10  1  1  7
## [551]  1  1  2  1  1  1  2  3  1  1  1  1  1  1  1 10  1  1  1 10  4  5  1  1  3
## [576]  1  1  1  1  1  1  6  5  1  6  1 10  1  9  1  5  6  5  1  3  1  1  1  1  1
## [601]  1  1  1  8  8  3  2  1 10  1 10 10 10  1  1  1  1  1  1  1  1  3  3  1  2
## [626]  1  5  1  1  1  1  1  1  4  1  1  8  3  1  3  3  1  1  1  1  1  1  3 10  1
## [651]  2  3  1  1  1  1  1  1  7  1  1  1  1  1  3  1  2  1  1  8  8  2  1  1  1
## [676]  1  1  1  1  1 10 10  1  1  1  1  1  1  1  1  3  5  1  1  1  1  3  4  5
```

```
mean <- mean(marginalAdhesionData)
sd <- sd(marginalAdhesionData)
cv <- sd / mean
cv
```

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

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

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

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

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

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

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

```
sd_blandChromatin
```

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

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

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

```
## [1] 0.95
```

```
#d. How many attributes?
length(breastcancerWisconsin)
```

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

```
names(breastcancerWisconsin)
```

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

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

percentage_of_malignant <- sum(breastcancerWisconsin$class == 4) / nrow(breastcancerWisconsin) * 100
percentage_of_malignant
```

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

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

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

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

head(abalone)
```

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

```
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
```

```
getwd()
```

```
## [1] "/cloud/project/RWorksheet_Conlu#6a"
```

```
Abalone_excel<-"/cloud/project/RWorksheet_Conlu#6a/AbaloneData.xlsx"
install.packages("writexl")
```

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

```
library(writexl)

write_xlsx(abalone, Abalone_excel)
```