ROWKSHEET6

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

studentsData <- 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)
```

```r
library(Hmisc)
```

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

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

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

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

```r
library(pastecs)

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

#2.

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

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

```r
# the Fertilize result shows the level as an ordered factor.

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

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

exercise <- c("l", "n", "n", "i", "l", "l", "n", "n", "i", "l")
exercisefactor <- factor(exercise, levels = c("n", "l", "i"), labels = c("none", "light", "intense"))
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 <- 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, 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 factor_with_level variable result is factor with level.

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

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

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

incmeans <- tapply(incomes, factorlevel, mean)

incmeans
```

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

```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.
standardError <- function(x) sqrt(var(x)/length(x))
incster <- tapply(incomes, factorlevel, standardError)
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: It displays the computed standard errors for the means of state incomes. A smaller standard er

#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)

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

```
##    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
```

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

```
##    Class    Sex   Age Survived Freq
## 1    1st   Male Child       No    0
```

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

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

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

```
##           id clump_thickness size_uniformity shape_uniformity marginal_adhesion
## 1    1000025               5               1                1                 1
## 2    1002945               5               4                4                 5
## 3    1015425               3               1                1                 1
## 4    1016277               6               8                8                 1
## 5    1017023               4               1                1                 3
## 6    1017122               8              10               10                 8
## 7    1018099               1               1                1                 1
## 8    1018561               2               1                2                 1
## 9    1033078               2               1                1                 1
## 10   1033078               4               2                1                 1
## 11   1035283               1               1                1                 1
## 12   1036172               2               1                1                 1
## 13   1041801               5               3                3                 3
## 14   1043999               1               1                1                 1
## 15   1044572               8               7                5                10
## 16   1047630               7               4                6                 4
## 17   1048672               4               1                1                 1
## 18   1049815               4               1                1                 1
## 19   1050670              10               7                7                 6
## 20   1050718               6               1                1                 1
## 21   1054590               7               3                2                10
## 22   1054593              10               5                5                 3
## 23   1056784               3               1                1                 1
## 24   1057013               8               4                5                 1
## 25   1059552               1               1                1                 1
## 26   1065726               5               2                3                 4
## 27   1066373               3               2                1                 1
## 28   1066979               5               1                1                 1
## 29   1067444               2               1                1                 1
## 30   1070935               1               1                3                 1
```

```
## 31    1070935              3              1              1              1
## 32    1071760              2              1              1              1
## 33    1072179             10              7              7              3
## 34    1074610              2              1              1              2
## 35    1075123              3              1              2              1
## 36    1079304              2              1              1              1
## 37    1080185             10             10             10              8
## 38    1081791              6              2              1              1
## 39    1084584              5              4              4              9
## 40    1091262              2              5              3              3
## 41    1096800              6              6              6              9
## 42    1099510             10              4              3              1
## 43    1100524              6             10             10              2
## 44    1102573              5              6              5              6
## 45    1103608             10             10             10              4
## 46    1103722              1              1              1              1
## 47    1105257              3              7              7              4
## 48    1105524              1              1              1              1
## 49    1106095              4              1              1              3
## 50    1106829              7              8              7              2
## 51    1108370              9              5              8              1
## 52    1108449              5              3              3              4
## 53    1110102             10              3              6              2
## 54    1110503              5              5              5              8
## 55    1110524             10              5              5              6
## 56    1111249             10              6              6              3
## 57    1112209              8             10             10              1
## 58    1113038              8              2              4              1
## 59    1113483              5              2              3              1
## 60    1113906              9              5              5              2
## 61    1115282              5              3              5              5
## 62    1115293              1              1              1              1
## 63    1116116              9             10             10              1
## 64    1116132              6              3              4              1
## 65    1116192              1              1              1              1
## 66    1116998             10              4              2              1
## 67    1117152              4              1              1              1
## 68    1118039              5              3              4              1
## 69    1120559              8              3              8              3
## 70    1121732              1              1              1              1
## 71    1121919              5              1              3              1
## 72    1123061              6             10              2              8
## 73    1124651              1              3              3              2
## 74    1125035              9              4              5             10
## 75    1126417             10              6              4              1
## 76    1131294              1              1              2              1
## 77    1132347              1              1              4              1
## 78    1133041              5              3              1              2
## 79    1133136              3              1              1              1
## 80    1136142              2              1              1              1
## 81    1137156              2              2              2              1
## 82    1143978              4              1              1              2
## 83    1143978              5              2              1              1
## 84    1147044              3              1              1              1
```

```
## 85   1147699    3    5    7    8
## 86   1147748    5   10    6    1
## 87   1148278    3    3    6    4
## 88   1148873    3    6    6    6
## 89   1152331    4    1    1    1
## 90   1155546    2    1    1    2
## 91   1156272    1    1    1    1
## 92   1156948    3    1    1    2
## 93   1157734    4    1    1    1
## 94   1158247    1    1    1    1
## 95   1160476    2    1    1    1
## 96   1164066    1    1    1    1
## 97   1165297    2    1    1    2
## 98   1165790    5    1    1    1
## 99   1165926    9    6    9    2
## 100  1166630    7    5    6   10
## 101  1166654   10    3    5    1
## 102  1167439    2    3    4    4
## 103  1167471    4    1    2    1
## 104  1168359    8    2    3    1
## 105  1168736   10   10   10   10
## 106  1169049    7    3    4    4
## 107  1170419   10   10   10    8
## 108  1170420    1    6    8   10
## 109  1171710    1    1    1    1
## 110  1171710    6    5    4    4
## 111  1171795    1    3    1    2
## 112  1171845    8    6    4    3
## 113  1172152   10    3    3   10
## 114  1173216   10   10   10    3
## 115  1173235    3    3    2    1
## 116  1173347    1    1    1    1
## 117  1173347    8    3    3    1
## 118  1173509    4    5    5   10
## 119  1173514    1    1    1    1
## 120  1173681    3    2    1    1
## 121  1174057    1    1    2    2
## 122  1174057    4    2    1    1
## 123  1174131   10   10   10    2
## 124  1174428    5    3    5    1
## 125  1175937    5    4    6    7
## 126  1176406    1    1    1    1
## 127  1176881    7    5    3    7
## 128  1177027    3    1    1    1
## 129  1177399    8    3    5    4
## 130  1177512    1    1    1    1
## 131  1178580    5    1    3    1
## 132  1179818    2    1    1    1
## 133  1180194    5   10    8   10
## 134  1180523    3    1    1    1
## 135  1180831    3    1    1    1
## 136  1181356    5    1    1    1
## 137  1182404    4    1    1    1
## 138  1182410    3    1    1    1
```

```
## 139  1183240              4               1               2               1
## 140  1183246              1               1               1               1
## 141  1183516              3               1               1               1
## 142  1183911              2               1               1               1
## 143  1183983              9               5               5               4
## 144  1184184              1               1               1               1
## 145  1184241              2               1               1               1
## 146  1184840              1               1               3               1
## 147  1185609              3               4               5               2
## 148  1185610              1               1               1               1
## 149  1187457              3               1               1               3
## 150  1187805              8               8               7               4
## 151  1188472              1               1               1               1
## 152  1189266              7               2               4               1
## 153  1189286             10              10               8               6
## 154  1190394              4               1               1               1
## 155  1190485              1               1               1               1
## 156  1192325              5               5               5               6
## 157  1193091              1               2               2               1
## 158  1193210              2               1               1               1
## 159  1193683              1               1               2               1
## 160  1196295              9               9              10               3
## 161  1196915             10               7               7               4
## 162  1197080              4               1               1               1
## 163  1197270              3               1               1               1
## 164  1197440              1               1               1               2
## 165  1197510              5               1               1               1
## 166  1197979              4               1               1               1
## 167  1197993              5               6               7               8
## 168  1198128             10               8              10              10
## 169  1198641              3               1               1               1
## 170  1199219              1               1               1               2
## 171  1199731              3               1               1               1
## 172  1199983              1               1               1               1
## 173  1200772              1               1               1               1
## 174  1200847              6              10              10              10
## 175  1200892              8               6               5               4
## 176  1200952              5               8               7               7
## 177  1201834              2               1               1               1
## 178  1201936              5              10              10               3
## 179  1202125              4               1               1               1
## 180  1202812              5               3               3               3
## 181  1203096              1               1               1               1
## 182  1204242              1               1               1               1
## 183  1204898              6               1               1               1
## 184  1205138              5               8               8               8
## 185  1205579              8               7               6               4
## 186  1206089              2               1               1               1
## 187  1206695              1               5               8               6
## 188  1206841             10               5               6              10
## 189  1207986              5               8               4              10
## 190  1208301              1               2               3               1
## 191  1210963             10              10              10               8
## 192  1211202              7               5              10              10
```

```
## 193  1212232              5              1              1              1
## 194  1212251              1              1              1              1
## 195  1212422              3              1              1              1
## 196  1212422              4              1              1              1
## 197  1213375              8              4              4              5
## 198  1213383              5              1              1              4
## 199  1214092              1              1              1              1
## 200  1214556              3              1              1              1
## 201  1214966              9              7              7              5
## 202  1216694             10              8              8              4
## 203  1216947              1              1              1              1
## 204  1217051              5              1              1              1
## 205  1217264              1              1              1              1
## 206  1218105              5             10             10              9
## 207  1218741             10             10              9              3
## 208  1218860              1              1              1              1
## 209  1218860              1              1              1              1
## 210  1219406              5              1              1              1
## 211  1219525              8             10             10             10
## 212  1219859              8             10              8              8
## 213  1220330              1              1              1              1
## 214  1221863             10             10             10             10
## 215  1222047             10             10             10             10
## 216  1222936              8              7              8              7
## 217  1223282              1              1              1              1
## 218  1223426              1              1              1              1
## 219  1223793              6             10              7              7
## 220  1223967              6              1              3              1
## 221  1224329              1              1              1              2
## 222  1225799             10              6              4              3
## 223  1226012              4              1              1              3
## 224  1226612              7              5              6              3
## 225  1227210             10              5              5              6
## 226  1227244              1              1              1              1
## 227  1227481             10              5              7              4
## 228  1228152              8              9              9              5
## 229  1228311              1              1              1              1
## 230  1230175             10             10             10              3
## 231  1230688              7              4              7              4
## 232  1231387              6              8              7              5
## 233  1231706              8              4              6              3
## 234  1232225             10              4              5              5
## 235  1236043              3              3              2              1
## 236  1241232              3              1              4              1
## 237  1241559             10              8              8              2
## 238  1241679              9              8              8              5
## 239  1242364              8             10             10              8
## 240  1243256             10              4              3              2
## 241  1270479              5              1              3              3
## 242  1276091              3              1              1              3
## 243  1277018              2              1              1              1
## 244   128059              1              1              1              1
## 245  1285531              1              1              1              1
## 246  1287775              5              1              1              2
```

```
## 247  144888          8          10          10           8
## 248  145447          8           4           4           1
## 249  167528          4           1           1           1
## 250  169356          3           1           1           1
## 251  183913          1           2           2           1
## 252  191250         10           4           4          10
## 253 1017023          6           3           3           5
## 254 1100524          6          10          10           2
## 255 1116116          9          10          10           1
## 256 1168736          5           6           6           2
## 257 1182404          3           1           1           1
## 258 1182404          3           1           1           1
## 259 1198641          3           1           1           1
## 260  242970          5           7           7           1
## 261  255644         10           5           8          10
## 262  263538          5          10          10           6
## 263  274137          8           8           9           4
## 264  303213         10           4           4          10
## 265  314428          7           9           4          10
## 266 1182404          5           1           4           1
## 267 1198641         10          10           6           3
## 268  320675          3           3           5           2
## 269  324427         10           8           8           2
## 270  385103          1           1           1           1
## 271  390840          8           4           7           1
## 272  411453          5           1           1           1
## 273  320675          3           3           5           2
## 274  428903          7           2           4           1
## 275  431495          3           1           1           1
## 276  432809          3           1           3           1
## 277  434518          3           1           1           1
## 278  452264          1           1           1           1
## 279  456282          1           1           1           1
## 280  476903         10           5           7           3
## 281  486283          3           1           1           1
## 282  486662          2           1           1           2
## 283  488173          1           4           3          10
## 284  492268         10           4           6           1
## 285  508234          7           4           5          10
## 286  527363          8          10          10          10
## 287  529329         10          10          10          10
## 288  535331          3           1           1           1
## 289  543558          6           1           3           1
## 290  555977          5           6           6           8
## 291  560680          1           1           1           1
## 292  561477          1           1           1           1
## 293  563649          8           8           8           1
## 294  601265         10           4           4           6
## 295  606140          1           1           1           1
## 296  606722          5           5           7           8
## 297  616240          5           3           4           3
## 298   61634          5           4           3           1
## 299  625201          8           2           1           1
## 300   63375          9           1           2           6
```

```
## 301   635844          8           4          10           5
## 302   636130          1           1           1           1
## 303   640744         10          10          10           7
## 304   646904          1           1           1           1
## 305   653777          8           3           4           9
## 306   659642         10           8           4           4
## 307   666090          1           1           1           1
## 308   666942          1           1           1           1
## 309   667204          7           8           7           6
## 310   673637          3           1           1           1
## 311   684955          2           1           1           1
## 312   688033          1           1           1           1
## 313   691628          8           6           4          10
## 314   693702          1           1           1           1
## 315   704097          1           1           1           1
## 316   704168          4           6           5           6
## 317   706426          5           5           5           2
## 318   709287          6           8           7           8
## 319   718641          1           1           1           1
## 320   721482          4           4           4           4
## 321   730881          7           6           3           2
## 322   733639          3           1           1           1
## 323   733639          3           1           1           1
## 324   733823          5           4           6          10
## 325   740492          1           1           1           1
## 326   743348          3           2           2           1
## 327   752904         10           1           1           1
## 328   756136          1           1           1           1
## 329   760001          8          10           3           2
## 330   760239         10           4           6           4
## 331    76389         10           4           7           2
## 332   764974          5           1           1           1
## 333   770066          5           2           2           2
## 334   785208          5           4           6           6
## 335   785615          8           6           7           3
## 336   792744          1           1           1           1
## 337   797327          6           5           5           8
## 338   798429          1           1           1           1
## 339   704097          1           1           1           1
## 340   806423          8           5           5           5
## 341   809912         10           3           3           1
## 342   810104          1           1           1           1
## 343   814265          2           1           1           1
## 344   814911          1           1           1           1
## 345   822829          7           6           4           8
## 346   826923          1           1           1           1
## 347   830690          5           2           2           2
## 348   831268          1           1           1           1
## 349   832226          3           4           4          10
## 350   832567          4           2           3           5
## 351   836433          5           1           1           3
## 352   837082          2           1           1           1
## 353   846832          3           4           5           3
## 354   850831          2           7          10          10
```

```
## 355   855524                 1                 1                 1                 1
## 356   857774                 4                 1                 1                 1
## 357   859164                 5                 3                 3                 1
## 358   859350                 8                10                10                 7
## 359   866325                 8                10                 5                 3
## 360   873549                10                 3                 5                 4
## 361   877291                 6                10                10                10
## 362   877943                 3                10                 3                10
## 363   888169                 3                 2                 2                 1
## 364   888523                 4                 4                 4                 2
## 365   896404                 2                 1                 1                 1
## 366   897172                 2                 1                 1                 1
## 367    95719                 6                10                10                10
## 368   160296                 5                 8                 8                10
## 369   342245                 1                 1                 3                 1
## 370   428598                 1                 1                 3                 1
## 371   492561                 4                 3                 2                 1
## 372   493452                 1                 1                 3                 1
## 373   493452                 4                 1                 2                 1
## 374   521441                 5                 1                 1                 2
## 375   560680                 3                 1                 2                 1
## 376   636437                 1                 1                 1                 1
## 377   640712                 1                 1                 1                 1
## 378   654244                 1                 1                 1                 1
## 379   657753                 3                 1                 1                 4
## 380   685977                 5                 3                 4                 1
## 381   805448                 1                 1                 1                 1
## 382   846423                10                 6                 3                 6
## 383  1002504                 3                 2                 2                 2
## 384  1022257                 2                 1                 1                 1
## 385  1026122                 2                 1                 1                 1
## 386  1071084                 3                 3                 2                 2
## 387  1080233                 7                 6                 6                 3
## 388  1114570                 5                 3                 3                 2
## 389  1114570                 2                 1                 1                 1
## 390  1116715                 5                 1                 1                 1
## 391  1131411                 1                 1                 1                 2
## 392  1151734                10                 8                 7                 4
## 393  1156017                 3                 1                 1                 1
## 394  1158247                 1                 1                 1                 1
## 395  1158405                 1                 2                 3                 1
## 396  1168278                 3                 1                 1                 1
## 397  1176187                 3                 1                 1                 1
## 398  1196263                 4                 1                 1                 1
## 399  1196475                 3                 2                 1                 1
## 400  1206314                 1                 2                 3                 1
## 401  1211265                 3                10                 8                 7
## 402  1213784                 3                 1                 1                 1
## 403  1223003                 5                 3                 3                 1
## 404  1223306                 3                 1                 1                 1
## 405  1223543                 1                 2                 1                 3
## 406  1229929                 1                 1                 1                 1
## 407  1231853                 4                 2                 2                 1
## 408  1234554                 1                 1                 1                 1
```

```
## 409  1236837            2            3            2            2
## 410  1237674            3            1            2            1
## 411  1238021            1            1            1            1
## 412  1238464            1            1            1            1
## 413  1238633           10           10           10            6
## 414  1238915            5            1            2            1
## 415  1238948            8            5            6            2
## 416  1239232            3            3            2            6
## 417  1239347            8            7            8            5
## 418  1239967            1            1            1            1
## 419  1240337            5            2            2            2
## 420  1253505            2            3            1            1
## 421  1255384            3            2            2            3
## 422  1257200           10           10           10            7
## 423  1257648            4            3            3            1
## 424  1257815            5            1            3            1
## 425  1257938            3            1            1            1
## 426  1258549            9           10           10           10
## 427  1258556            5            3            6            1
## 428  1266154            8            7            8            2
## 429  1272039            1            1            1            1
## 430  1276091            2            1            1            1
## 431  1276091            1            3            1            1
## 432  1276091            5            1            1            3
## 433  1277629            5            1            1            1
## 434  1293439            3            2            2            3
## 435  1293439            6            9            7            5
## 436  1294562           10            8           10            1
## 437  1295186           10           10           10            1
## 438   527337            4            1            1            1
## 439   558538            4            1            3            3
## 440   566509            5            1            1            1
## 441   608157           10            4            3           10
## 442   677910            5            2            2            4
## 443   734111            1            1            1            3
## 444   734111            1            1            1            1
## 445   780555            5            1            1            6
## 446   827627            2            1            1            1
## 447  1049837            1            1            1            1
## 448  1058849            5            1            1            1
## 449  1182404            1            1            1            1
## 450  1193544            5            7            9            8
## 451  1201870            4            1            1            3
## 452  1202253            5            1            1            1
## 453  1227081            3            1            1            3
## 454  1230994            4            5            5            8
## 455  1238410            2            3            1            1
## 456  1246562           10            2            2            1
## 457  1257470           10            6            5            8
## 458  1259008            8            8            9            6
## 459  1266124            5            1            2            1
## 460  1267898            5            1            3            1
## 461  1268313            5            1            1            3
## 462  1268804            3            1            1            1
```

```
## 463  1276091                6                 1                 1                   3
## 464  1280258                4                 1                 1                   1
## 465  1293966                4                 1                 1                   1
## 466  1296572               10                 9                 8                   7
## 467  1298416               10                 6                 6                   2
## 468  1299596                6                 6                 6                   5
## 469  1105524                4                 1                 1                   1
## 470  1181685                1                 1                 2                   1
## 471  1211594                3                 1                 1                   1
## 472  1238777                6                 1                 1                   3
## 473  1257608                6                 1                 1                   1
## 474  1269574                4                 1                 1                   1
## 475  1277145                5                 1                 1                   1
## 476  1287282                3                 1                 1                   1
## 477  1296025                4                 1                 2                   1
## 478  1296263                4                 1                 1                   1
## 479  1296593                5                 2                 1                   1
## 480  1299161                4                 8                 7                  10
## 481  1301945                5                 1                 1                   1
## 482  1302428                5                 3                 2                   4
## 483  1318169                9                10                10                  10
## 484   474162                8                 7                 8                   5
## 485   787451                5                 1                 2                   1
## 486  1002025                1                 1                 1                   3
## 487  1070522                3                 1                 1                   1
## 488  1073960               10                10                10                  10
## 489  1076352                3                 6                 4                  10
## 490  1084139                6                 3                 2                   1
## 491  1115293                1                 1                 1                   1
## 492  1119189                5                 8                 9                   4
## 493  1133991                4                 1                 1                   1
## 494  1142706                5                10                10                  10
## 495  1155967                5                 1                 2                  10
## 496  1170945                3                 1                 1                   1
## 497  1181567                1                 1                 1                   1
## 498  1182404                4                 2                 1                   1
## 499  1204558                4                 1                 1                   1
## 500  1217952                4                 1                 1                   1
## 501  1224565                6                 1                 1                   1
## 502  1238186                4                 1                 1                   1
## 503  1253917                4                 1                 1                   2
## 504  1265899                4                 1                 1                   1
## 505  1268766                1                 1                 1                   1
## 506  1277268                3                 3                 1                   1
## 507  1286943                8                10                10                  10
## 508  1295508                1                 1                 1                   1
## 509  1297327                5                 1                 1                   1
## 510  1297522                2                 1                 1                   1
## 511  1298360                1                 1                 1                   1
## 512  1299924                5                 1                 1                   1
## 513  1299994                5                 1                 1                   1
## 514  1304595                3                 1                 1                   1
## 515  1306282                6                 6                 7                  10
## 516  1313325                4                10                 4                   7
```

```
## 517   1320077                1                 1                 1                 1
## 518   1320077                1                 1                 1                 1
## 519   1320304                3                 1                 2                 2
## 520   1330439                4                 7                 8                 3
## 521    333093                1                 1                 1                 1
## 522    369565                4                 1                 1                 1
## 523    412300               10                 4                 5                 4
## 524    672113                7                 5                 6                10
## 525    749653                3                 1                 1                 1
## 526    769612                3                 1                 1                 2
## 527    769612                4                 1                 1                 1
## 528    798429                4                 1                 1                 1
## 529    807657                6                 1                 3                 2
## 530   8233704                4                 1                 1                 1
## 531    837480                7                 4                 4                 3
## 532    867392                4                 2                 2                 1
## 533    869828                1                 1                 1                 1
## 534   1043068                3                 1                 1                 1
## 535   1056171                2                 1                 1                 1
## 536   1061990                1                 1                 3                 2
## 537   1113061                5                 1                 1                 1
## 538   1116192                5                 1                 2                 1
## 539   1135090                4                 1                 1                 1
## 540   1145420                6                 1                 1                 1
## 541   1158157                5                 1                 1                 1
## 542   1171578                3                 1                 1                 1
## 543   1174841                5                 3                 1                 1
## 544   1184586                4                 1                 1                 1
## 545   1186936                2                 1                 3                 2
## 546   1197527                5                 1                 1                 1
## 547   1222464                6                10                10                10
## 548   1240603                2                 1                 1                 1
## 549   1240603                3                 1                 1                 1
## 550   1241035                7                 8                 3                 7
## 551   1287971                3                 1                 1                 1
## 552   1289391                1                 1                 1                 1
## 553   1299924                3                 2                 2                 2
## 554   1306339                4                 4                 2                 1
## 555   1313658                3                 1                 1                 1
## 556   1313982                4                 3                 1                 1
## 557   1321264                5                 2                 2                 2
## 558   1321321                5                 1                 1                 3
## 559   1321348                2                 1                 1                 1
## 560   1321931                5                 1                 1                 1
## 561   1321942                5                 1                 1                 1
## 562   1321942                5                 1                 1                 1
## 563   1328331                1                 1                 1                 1
## 564   1328755                3                 1                 1                 1
## 565   1331405                4                 1                 1                 1
## 566   1331412                5                 7                10                10
## 567   1333104                3                 1                 2                 1
## 568   1334071                4                 1                 1                 1
## 569   1343068                8                 4                 4                 1
## 570   1343374               10                10                 8                10
```

```
## 571  1344121                8                10                 4                 4
## 572   142932                7                 6                10                 5
## 573   183936                3                 1                 1                 1
## 574   324382                1                 1                 1                 1
## 575   378275               10                 9                 7                 3
## 576   385103                5                 1                 2                 1
## 577   690557                5                 1                 1                 1
## 578   695091                1                 1                 1                 1
## 579   695219                1                 1                 1                 1
## 580   824249                1                 1                 1                 1
## 581   871549                5                 1                 2                 1
## 582   878358                5                 7                10                 6
## 583  1107684                6                10                 5                 5
## 584  1115762                3                 1                 1                 1
## 585  1217717                5                 1                 1                 6
## 586  1239420                1                 1                 1                 1
## 587  1254538                8                10                10                10
## 588  1261751                5                 1                 1                 1
## 589  1268275                9                 8                 8                 9
## 590  1272166                5                 1                 1                 1
## 591  1294261                4                10                 8                 5
## 592  1295529                2                 5                 7                 6
## 593  1298484               10                 3                 4                 5
## 594  1311875                5                 1                 2                 1
## 595  1315506                4                 8                 6                 3
## 596  1320141                5                 1                 1                 1
## 597  1325309                4                 1                 2                 1
## 598  1333063                5                 1                 3                 1
## 599  1333495                3                 1                 1                 1
## 600  1334659                5                 2                 4                 1
## 601  1336798                3                 1                 1                 1
## 602  1344449                1                 1                 1                 1
## 603  1350568                4                 1                 1                 1
## 604  1352663                5                 4                 6                 8
## 605   188336                5                 3                 2                 8
## 606   352431               10                 5                10                 3
## 607   353098                4                 1                 1                 2
## 608   411453                1                 1                 1                 1
## 609   557583                5                10                10                10
## 610   636375                5                 1                 1                 1
## 611   736150               10                 4                 3                10
## 612   803531                5                10                10                10
## 613   822829                8                10                10                10
## 614  1016634                2                 3                 1                 1
## 615  1031608                2                 1                 1                 1
## 616  1041043                4                 1                 3                 1
## 617  1042252                3                 1                 1                 1
## 618  1057067                1                 1                 1                 1
## 619  1061990                4                 1                 1                 1
## 620  1073836                5                 1                 1                 1
## 621  1083817                3                 1                 1                 1
## 622  1096352                6                 3                 3                 3
## 623  1140597                7                 1                 2                 3
## 624  1149548                1                 1                 1                 1
```

```
## 625  1174009               5                 1                 1                  2
## 626  1183596               3                 1                 3                  1
## 627  1190386               4                 6                 6                  5
## 628  1190546               2                 1                 1                  1
## 629  1213273               2                 1                 1                  1
## 630  1218982               4                 1                 1                  1
## 631  1225382               6                 2                 3                  1
## 632  1235807               5                 1                 1                  1
## 633  1238777               1                 1                 1                  1
## 634  1253955               8                 7                 4                  4
## 635  1257366               3                 1                 1                  1
## 636  1260659               3                 1                 4                  1
## 637  1268952              10                10                 7                  8
## 638  1275807               4                 2                 4                  3
## 639  1277792               4                 1                 1                  1
## 640  1277792               5                 1                 1                  3
## 641  1285722               4                 1                 1                  3
## 642  1288608               3                 1                 1                  1
## 643  1290203               3                 1                 1                  1
## 644  1294413               1                 1                 1                  1
## 645  1299596               2                 1                 1                  1
## 646  1303489               3                 1                 1                  1
## 647  1311033               1                 2                 2                  1
## 648  1311108               1                 1                 1                  3
## 649  1315807               5                10                10                 10
## 650  1318671               3                 1                 1                  1
## 651  1319609               3                 1                 1                  2
## 652  1323477               1                 2                 1                  3
## 653  1324572               5                 1                 1                  1
## 654  1324681               4                 1                 1                  1
## 655  1325159               3                 1                 1                  1
## 656  1326892               3                 1                 1                  1
## 657  1330361               5                 1                 1                  1
## 658  1333877               5                 4                 5                  1
## 659  1334015               7                 8                 8                  7
## 660  1334667               1                 1                 1                  1
## 661  1339781               1                 1                 1                  1
## 662  1339781               4                 1                 1                  1
## 663 13454352               1                 1                 3                  1
## 664  1345452               1                 1                 3                  1
## 665  1345593               3                 1                 1                  3
## 666  1347749               1                 1                 1                  1
## 667  1347943               5                 2                 2                  2
## 668  1348851               3                 1                 1                  1
## 669  1350319               5                 7                 4                  1
## 670  1350423               5                10                10                  8
## 671  1352848               3                10                 7                  8
## 672  1353092               3                 2                 1                  2
## 673  1354840               2                 1                 1                  1
## 674  1354840               5                 3                 2                  1
## 675  1355260               1                 1                 1                  1
## 676  1365075               4                 1                 4                  1
## 677  1365328               1                 1                 2                  1
## 678  1368267               5                 1                 1                  1
```

```
## 679  1368273               1               1               1               1
## 680  1368882               2               1               1               1
## 681  1369821              10              10              10              10
## 682  1371026               5              10              10              10
## 683  1371920               5               1               1               1
## 684   466906               1               1               1               1
## 685   466906               1               1               1               1
## 686   534555               1               1               1               1
## 687   536708               1               1               1               1
## 688   566346               3               1               1               1
## 689   603148               4               1               1               1
## 690   654546               1               1               1               1
## 691   654546               1               1               1               3
## 692   695091               5              10              10               5
## 693   714039               3               1               1               1
## 694   763235               3               1               1               1
## 695   776715               3               1               1               1
## 696   841769               2               1               1               1
## 697   888820               5              10              10               3
## 698   897471               4               8               6               4
## 699   897471               4               8               8               5
##     epithelial_size bare_nucleoli bland_chromatin normal_nucleoli mitoses class
## 1                 2             1               3               1       1     2
## 2                 7            10               3               2       1     2
## 3                 2             2               3               1       1     2
## 4                 3             4               3               7       1     2
## 5                 2             1               3               1       1     2
## 6                 7            10               9               7       1     4
## 7                 2            10               3               1       1     2
## 8                 2             1               3               1       1     2
## 9                 2             1               1               1       5     2
## 10                2             1               2               1       1     2
## 11                1             1               3               1       1     2
## 12                2             1               2               1       1     2
## 13                2             3               4               4       1     4
## 14                2             3               3               1       1     2
## 15                7             9               5               5       4     4
## 16                6             1               4               3       1     4
## 17                2             1               2               1       1     2
## 18                2             1               3               1       1     2
## 19                4            10               4               1       2     4
## 20                2             1               3               1       1     2
## 21                5            10               5               4       4     4
## 22                6             7               7              10       1     4
## 23                2             1               2               1       1     2
## 24                2          <NA>               7               3       1     4
## 25                2             1               3               1       1     2
## 26                2             7               3               6       1     4
## 27                1             1               2               1       1     2
## 28                2             1               2               1       1     2
## 29                2             1               2               1       1     2
## 30                2             1               1               1       1     2
## 31                1             1               2               1       1     2
## 32                2             1               3               1       1     2
```

```
## 33                8             5               7              4       3     4
## 34                2             1               3              1       1     2
## 35                2             1               2              1       1     2
## 36                2             1               2              1       1     2
## 37                6             1               8              9       1     4
## 38                1             1               7              1       1     2
## 39                2            10               5              6       1     4
## 40                6             7               7              5       1     4
## 41                6          <NA>               7              8       1     2
## 42                3             3               6              5       2     4
## 43                8            10               7              3       3     4
## 44               10             1               3              1       1     4
## 45                8             1               8             10       1     4
## 46                2             1               2              1       2     2
## 47                4             9               4              8       1     4
## 48                2             1               2              1       1     2
## 49                2             1               3              1       1     2
## 50                4             8               3              8       2     4
## 51                2             3               2              1       5     4
## 52                2             4               3              4       1     4
## 53                3             5               4             10       2     4
## 54               10             8               7              3       7     4
## 55                8             8               7              1       1     4
## 56                4             5               3              6       1     4
## 57                3             6               3              9       1     4
## 58                5             1               5              4       4     4
## 59                6            10               5              1       1     4
## 60                2             2               5              1       1     4
## 61                3             3               4             10       1     4
## 62                2             2               2              1       1     2
## 63               10             8               3              3       1     4
## 64                5             2               3              9       1     4
## 65                2             1               2              1       1     2
## 66                3             2               4              3      10     4
## 67                2             1               3              1       1     2
## 68                8            10               4              9       1     4
## 69                4             9               8              9       8     4
## 70                2             1               3              2       1     2
## 71                2             1               2              1       1     2
## 72               10             2               7              8      10     4
## 73                2             1               7              2       1     2
## 74                6            10               4              8       1     4
## 75                3             4               3              2       3     4
## 76                2             2               4              2       1     2
## 77                2             1               2              1       1     2
## 78                2             1               2              1       1     2
## 79                2             3               3              1       1     2
## 80                3             1               2              1       1     2
## 81                1             1               7              1       1     2
## 82                2             1               2              1       1     2
## 83                2             1               3              1       1     2
## 84                2             2               7              1       1     2
## 85                8             9               7             10       7     4
## 86               10             4               4             10      10     4
```

```
## 87      5    8    4     4    1   4
## 88      5   10    6     8    3   4
## 89      2    1    3     1    1   2
## 90      3    1    2     1    1   2
## 91      2    1    3     1    1   2
## 92      2    1    1     1    1   2
## 93      2    1    3     1    1   2
## 94      2    1    2     1    1   2
## 95      2    1    3     1    1   2
## 96      2    1    3     1    1   2
## 97      2    1    1     1    1   2
## 98      2    1    3     1    1   2
## 99     10    6    2     9   10   4
## 100     5   10    7     9    4   4
## 101    10    5    3    10    2   4
## 102     2    5    2     5    1   4
## 103     2    1    3     1    1   2
## 104     6    3    7     1    1   4
## 105    10    1    8     8    8   4
## 106     3    3    3     2    7   4
## 107     2   10    4     1    1   4
## 108     8   10    5     7    1   4
## 109     2    1    2     3    1   2
## 110     3    9    7     8    3   4
## 111     2    2    5     3    2   2
## 112     5    9    3     1    1   4
## 113     2   10    7     3    3   4
## 114    10    8    8     1    1   4
## 115     2    3    3     1    1   2
## 116     2    5    1     1    1   2
## 117     2    2    3     2    1   2
## 118     4   10    7     5    8   4
## 119     4    3    1     1    1   2
## 120     2    2    3     1    1   2
## 121     2    1    3     1    1   2
## 122     2    2    3     1    1   2
## 123    10   10    5     3    3   4
## 124     8   10    5     3    1   4
## 125     9    7    8    10    1   4
## 126     2    1    2     1    1   2
## 127     4   10    7     5    5   4
## 128     2    1    3     1    1   2
## 129     5   10    1     6    2   4
## 130    10    1    1     1    1   2
## 131     2    1    2     1    1   2
## 132     2    1    3     1    1   2
## 133     8   10    3     6    3   4
## 134     2    1    2     2    1   2
## 135     3    1    2     1    1   2
## 136     2    2    3     3    1   2
## 137     2    1    2     1    1   2
## 138     2    1    1     1    1   2
## 139     2    1    2     1    1   2
## 140     1 <NA>    2     1    1   2
```

```
## 141                2            1             1             1      1     2
## 142                2            1             1             1      1     2
## 143                4            5             4             3      3     4
## 144                2            5             1             1      1     2
## 145                2            1             2             1      1     2
## 146                2         <NA>             2             1      1     2
## 147                6            8             4             1      1     4
## 148                3            2             2             1      1     2
## 149                8            1             5             8      1     2
## 150               10           10             7             8      7     4
## 151                1            1             3             1      1     2
## 152                6           10             5             4      3     4
## 153                4            5             8            10      1     4
## 154                2            3             1             1      1     2
## 155                2            1             1             1      1     2
## 156                3           10             3             1      1     4
## 157                2            1             2             1      1     2
## 158                2            1             3             1      1     2
## 159                3         <NA>             1             1      1     2
## 160                6           10             7            10      6     4
## 161                5           10             5             7      2     4
## 162                2            1             3             2      1     2
## 163                2            1             3             1      1     2
## 164                1            3             1             1      7     2
## 165                2         <NA>             3             1      1     2
## 166                2            2             3             2      1     2
## 167                8           10             3            10      3     4
## 168                6            1             3             1     10     4
## 169                2            1             3             1      1     2
## 170                1            1             1             1      1     2
## 171                2            1             1             1      1     2
## 172                2            1             3             1      1     2
## 173                2            1             2             1      1     2
## 174                8           10            10            10      7     4
## 175                3           10             6             1      1     4
## 176               10           10             5             7      1     4
## 177                2            1             3             1      1     2
## 178                8            1             5            10      3     4
## 179                2            1             3             1      1     2
## 180                6           10             3             1      1     4
## 181                1            1             3             1      1     2
## 182                2            1             1             1      1     2
## 183                2            1             3             1      1     2
## 184                5           10             7             8      1     4
## 185                4           10             5             1      1     4
## 186                1            1             3             1      1     2
## 187                5            8             7            10      1     4
## 188                6           10             7             7     10     4
## 189                5            8             9            10      1     4
## 190                2            1             3             1      1     2
## 191                6            8             7            10      1     4
## 192               10           10             4            10      3     4
## 193                2            1             2             1      1     2
## 194                2            1             3             1      1     2
```

```
## 195                2             1               3                1       1     2
## 196                2             1               3                1       1     2
## 197                4             7               7                8       2     2
## 198                2             1               3                1       1     2
## 199                2             1               1                1       1     2
## 200                2             1               2                1       1     2
## 201                5            10               7                8       3     4
## 202               10            10               8                1       1     4
## 203                2             1               3                1       1     2
## 204                2             1               3                1       1     2
## 205                2             1               3                1       1     2
## 206                6            10               7               10       5     4
## 207                7             5               3                5       1     4
## 208                1             1               3                1       1     2
## 209                1             1               3                1       1     2
## 210                1             1               3                1       1     2
## 211                5            10               8               10       6     4
## 212                4             8               7                7       1     4
## 213                2             1               3                1       1     2
## 214                7            10               7               10       4     4
## 215                3            10              10                6       1     4
## 216                5             5               5               10       2     4
## 217                2             1               2                1       1     2
## 218                2             1               3                1       1     2
## 219                6             4               8               10       2     4
## 220                2             1               3                1       1     2
## 221                2             1               3                1       1     2
## 222               10            10               9               10       1     4
## 223                1             5               2                1       1     4
## 224                3             8               7                4       1     4
## 225                3            10               7                9       2     4
## 226                2             1               2                1       1     2
## 227                4            10               8                9       1     4
## 228                3             5               7                7       1     4
## 229                1             1               3                1       1     2
## 230               10            10               9               10       1     4
## 231                3             7               7                6       1     4
## 232                6             8               8                9       2     4
## 233                3             1               4                3       1     2
## 234                5            10               4                1       1     4
## 235                3             1               3                6       1     2
## 236                2          <NA>               3                1       1     2
## 237                8            10               4                8      10     4
## 238                6             2               4               10       4     4
## 239                6             9               3               10      10     4
## 240                3            10               5                3       2     4
## 241                2             2               2                3       1     2
## 242                1             1               3                1       1     2
## 243                2             1               3                1       1     2
## 244                2             5               5                1       1     2
## 245                2             1               3                1       1     2
## 246                2             2               3                1       1     2
## 247                5            10               7                8       1     4
## 248                2             9               3                3       1     4
```

```
## 249          2     1     3     6  1 2
## 250          2  <NA>     3     1  1 2
## 251          2     1     1     1  1 2
## 252          2    10     5     3  3 4
## 253          3    10     3     5  3 2
## 254          8    10     7     3  3 4
## 255         10     8     3     3  1 4
## 256          4    10     3     6  1 4
## 257          2     1     1     1  1 2
## 258          2     1     2     1  1 2
## 259          2     1     3     1  1 2
## 260          5     8     3     4  1 2
## 261          3    10     5     1  3 4
## 262         10    10    10     6  5 4
## 263          5    10     7     8  1 4
## 264          6    10     5     5  1 4
## 265         10     3     5     3  3 4
## 266          2     1     3     2  1 2
## 267          3    10     4     3  2 4
## 268          3    10     7     1  1 4
## 269          3     4     8     7  8 4
## 270          2     1     3     1  1 2
## 271          3    10     3     9  2 4
## 272          2     1     3     1  1 2
## 273          3    10     7     1  1 4
## 274          3     4     3     3  1 4
## 275          2     1     3     2  1 2
## 276          2  <NA>     2     1  1 2
## 277          2     1     2     1  1 2
## 278          2     1     2     1  1 2
## 279          2     1     3     1  1 2
## 280          3     7     3     3  8 4
## 281          2     1     3     1  1 2
## 282          2     1     3     1  1 2
## 283          4    10     5     6  1 4
## 284          2    10     5     3  1 4
## 285          2    10     3     8  2 4
## 286          8    10    10     7  3 4
## 287         10    10     4    10 10 4
## 288          3     1     2     1  1 2
## 289          4     5     5    10  1 4
## 290          6    10     4    10  4 4
## 291          2     1     1     1  1 2
## 292          2     1     3     1  1 2
## 293          2  <NA>     6    10  1 4
## 294          2    10     2     3  1 4
## 295          2  <NA>     2     1  1 2
## 296          6    10     7     4  1 4
## 297          4     5     4     7  1 2
## 298          2  <NA>     2     3  1 2
## 299          5     1     1     1  1 2
## 300          4    10     7     7  2 4
## 301          4     4     7    10  1 4
## 302          2     1     3     1  1 2
```

```
## 303              9         10          7         10    10    4
## 304              2          1          3          1     1    2
## 305              3         10          3          3     1    4
## 306              4         10          3         10     4    4
## 307              2          1          3          1     1    2
## 308              2          1          3          1     1    2
## 309              4          3          8          8     4    4
## 310              2          5          5          1     1    2
## 311              3          1          2          1     1    2
## 312              2          1          1          1     1    2
## 313             10          1          3          5     1    4
## 314              2          1          1          1     1    2
## 315              1          1          2          1     1    2
## 316              7       <NA>          4          9     1    2
## 317              5         10          4          3     1    4
## 318              6          8          8          9     1    4
## 319              5          1          3          1     1    2
## 320              6          5          7          3     1    2
## 321              5         10          7          4     6    4
## 322              2       <NA>          3          1     1    2
## 323              2          1          3          1     1    2
## 324              2         10          4          1     1    4
## 325              2          1          3          1     1    2
## 326              2          1          2          3     1    2
## 327              2         10          5          4     1    4
## 328              2          1          2          1     1    2
## 329              6          4          3         10     1    4
## 330              5         10          7          1     1    4
## 331              2          8          6          1     1    4
## 332              2          1          3          1     2    2
## 333              2          1          2          2     1    2
## 334              4         10          4          3     1    4
## 335              3         10          3          4     2    4
## 336              2          1          1          1     1    2
## 337              4         10          3          4     1    4
## 338              2          1          3          1     1    2
## 339              1          1          2          1     1    2
## 340              2         10          4          3     1    4
## 341              2         10          7          6     1    4
## 342              2          1          3          1     1    2
## 343              2          1          1          1     1    2
## 344              2          1          1          1     1    2
## 345             10         10          9          5     3    4
## 346              2          1          1          1     1    2
## 347              3          1          1          3     1    2
## 348              1          1          1          3     1    2
## 349              5          1          3          3     1    4
## 350              3          8          7          6     1    4
## 351              2          1          1          1     1    2
## 352              2          1          3          1     1    2
## 353              7          3          4          6     1    2
## 354              7         10          4          9     4    4
## 355              2          1          2          1     1    2
## 356              3          1          2          2     1    2
```

## 357	3	3	3	3	3	4
## 358	10	10	7	3	8	4
## 359	8	4	4	10	3	4
## 360	3	7	3	5	3	4
## 361	10	10	8	10	10	4
## 362	6	10	5	1	4	4
## 363	4	3	2	1	1	2
## 364	2	3	2	1	1	2
## 365	2	1	3	1	1	2
## 366	2	1	2	1	1	2
## 367	8	10	7	10	7	4
## 368	5	10	8	10	3	4
## 369	2	1	1	1	1	2
## 370	1	1	2	1	1	2
## 371	3	1	2	1	1	2
## 372	2	1	1	1	1	2
## 373	2	1	2	1	1	2
## 374	2	1	2	1	1	2
## 375	2	1	2	1	1	2
## 376	2	1	1	1	1	2
## 377	2	1	2	1	1	2
## 378	1	1	2	1	1	2
## 379	3	1	2	2	1	2
## 380	4	1	3	1	1	2
## 381	2	1	1	1	1	2
## 382	4	10	7	8	4	4
## 383	2	1	3	2	1	2
## 384	2	1	1	1	1	2
## 385	2	1	1	1	1	2
## 386	3	1	1	2	3	2
## 387	2	10	7	1	1	4
## 388	3	1	3	1	1	2
## 389	2	1	2	2	1	2
## 390	3	2	2	2	1	2
## 391	2	1	2	1	1	2
## 392	3	10	7	9	1	4
## 393	2	1	2	1	1	2
## 394	1	1	1	1	1	2
## 395	2	1	2	1	1	2
## 396	2	1	2	1	1	2
## 397	2	1	3	1	1	2
## 398	2	1	1	1	1	2
## 399	2	1	2	2	1	2
## 400	2	1	1	1	1	2
## 401	6	9	9	3	8	4
## 402	2	1	1	1	1	2
## 403	2	1	2	1	1	2
## 404	2	4	1	1	1	2
## 405	2	1	1	2	1	2
## 406	2	1	2	1	1	2
## 407	2	1	2	1	1	2
## 408	2	1	2	1	1	2
## 409	2	2	3	1	1	2
## 410	2	1	2	1	1	2

```
## 411               2             1               2               1        1     2
## 412               1          <NA>               2               1        1     2
## 413               8             4               8               5        1     4
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## 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
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## 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
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## 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
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## 558                  2              1                 1                1       1      2
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## 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
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## 575                 4              2                7                7       1     4
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## 577                 2              1                2                1       1     2
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## 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
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## 611                 3             10                7                1       2     4
## 612                 5              2                8                5       1     4
## 613                 6             10               10               10      10     4
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## 617                 2              1                2                1       1     2
## 618                 1              ?                1                1       1     2
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## 621                 2              1                2                1       1     2
## 622                 3              2                6                1       1     2
## 623                 2              1                2                1       1     2
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## 625                 1              1                2                1       1     2
## 626                 3              4                1                1       1     2
```

## 627	7	6	7	7	3	4
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## 629	2	1	1	1	1	2
## 630	2	1	1	1	1	2
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## 632	2	1	2	1	1	2
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## 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
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## 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
```

```r
summary(breastcancer_wisconsin)
```

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

```r
#a. describe what is the dataset all about.
#ANSWER: The 'breastcancer_wisconsin' dataset comprises clinical records detailing various cases. These

#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 <- breastcancer_wisconsin$clump_thickness
standarderrorclumpthickness <- standardError(clump_thickness)
standarderrorclumpthickness
```

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

```r
#0.1065011

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

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

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

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

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

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

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

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

```r
sdblandchromatin
```

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

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

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

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

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

```r
names(breastcancer_wisconsin)
```

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

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

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

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

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

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

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

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

```r
summary(abalone)
```

```
##  Type       LongestShell      Diameter           Height         WholeWeight
##  F:1307   Min.   :0.075   Min.   :0.0550   Min.   :0.0000   Min.   :0.0020
##  I:1342   1st Qu.:0.450   1st Qu.:0.3500   1st Qu.:0.1150   1st Qu.:0.4415
```

```
## M:1528   Median :0.545   Median :0.4250   Median :0.1400   Median :0.7995
##          Mean   :0.524   Mean   :0.4079   Mean   :0.1395   Mean   :0.8287
##          3rd Qu.:0.615   3rd Qu.:0.4800   3rd Qu.:0.1650   3rd Qu.:1.1530
##          Max.   :0.815   Max.   :0.6500   Max.   :1.1300   Max.   :2.8255
##  ShuckedWeight    VisceraWeight     ShellWeight         Rings
##  Min.   :0.0010   Min.   :0.0005   Min.   :0.0015   Min.   : 1.000
##  1st Qu.:0.1860   1st Qu.:0.0935   1st Qu.:0.1300   1st Qu.: 8.000
##  Median :0.3360   Median :0.1710   Median :0.2340   Median : 9.000
##  Mean   :0.3594   Mean   :0.1806   Mean   :0.2388   Mean   : 9.934
##  3rd Qu.:0.5020   3rd Qu.:0.2530   3rd Qu.:0.3290   3rd Qu.:11.000
##  Max.   :1.4880   Max.   :0.7600   Max.   :1.0050   Max.   :29.000
```