RWorksheet_5

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

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

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

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

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

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

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

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

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

```
        stats_Hmisc<-describe(StudentData)
        stats_pastecs <- stat.desc(StudentData)
```

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

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

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

```
      #RESULT: The data 'fertilizeData' shows the ordered data of the said dataset.
```

```
#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?

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

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

```
# 4. Sample of 30 tax accountants from all the states and territories of Australia and their individual
states_Australia <- 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")

      #a. Apply the factor function and factor level. Describe the results.
      factorLevel<-factor(states_Australia, levels = c("act", "nsw", "nt", "qld", "sa", "tas", "vic", "
      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
```

```
      #DESCRIPTION: the 'factorLevel' object 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

same_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()
      sincome_means <- tapply(same_incomes, factorLevel, mean)
      sincome_means
```

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

```
      # b. Copy the results and interpret.
      #RESULT:
      #INTERPRET: By using the tapply() function, the result has the means of each states that has a fa
      # 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
#6. Calculate the standard errors of the state income means (refer again to number 3)
#stdError <- function(x) sqrt(var(x)/length(x)) Note: After this assignment, the standard errors are ca

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

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

```r
      #b. Interpret the result.
      #ANSWER: It shows the calculated standard errors of the state income means. If the standard error
```

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

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

```
##  'table' num [1:4, 1:2, 1:2, 1:2] 0 0 35 0 0 0 17 0 118 154 ...
##  - attr(*, "dimnames")=List of 4
##   ..$ Class   : chr [1:4] "1st" "2nd" "3rd" "Crew"
##   ..$ Sex     : chr [1:2] "Male" "Female"
##   ..$ Age     : chr [1:2] "Child" "Adult"
##   ..$ Survived: chr [1:2] "No" "Yes"
```

```r
      View(Titanic)

      Titanic<-as.data.frame(Titanic)

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

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

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

```
##    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
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## 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
```

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## 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
```

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## 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
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## 651  1319609              3               1               1               2
## 652  1323477              1               2               1               3
## 653  1324572              5               1               1               1
## 654  1324681              4               1               1               1
## 655  1325159              3               1               1               1
## 656  1326892              3               1               1               1
## 657  1330361              5               1               1               1
## 658  1333877              5               4               5               1
## 659  1334015              7               8               8               7
## 660  1334667              1               1               1               1
## 661  1339781              1               1               1               1
## 662  1339781              4               1               1               1
## 663 13454352              1               1               3               1
## 664  1345452              1               1               3               1
## 665  1345593              3               1               1               3
## 666  1347749              1               1               1               1
## 667  1347943              5               2               2               2
## 668  1348851              3               1               1               1
## 669  1350319              5               7               4               1
## 670  1350423              5              10              10               8
## 671  1352848              3              10               7               8
## 672  1353092              3               2               1               2
## 673  1354840              2               1               1               1
```

```
## 674  1354840              5              3              2              1
## 675  1355260              1              1              1              1
## 676  1365075              4              1              4              1
## 677  1365328              1              1              2              1
## 678  1368267              5              1              1              1
## 679  1368273              1              1              1              1
## 680  1368882              2              1              1              1
## 681  1369821             10             10             10             10
## 682  1371026              5             10             10             10
## 683  1371920              5              1              1              1
## 684   466906              1              1              1              1
## 685   466906              1              1              1              1
## 686   534555              1              1              1              1
## 687   536708              1              1              1              1
## 688   566346              3              1              1              1
## 689   603148              4              1              1              1
## 690   654546              1              1              1              1
## 691   654546              1              1              1              3
## 692   695091              5             10             10              5
## 693   714039              3              1              1              1
## 694   763235              3              1              1              1
## 695   776715              3              1              1              1
## 696   841769              2              1              1              1
## 697   888820              5             10             10              3
## 698   897471              4              8              6              4
## 699   897471              4              8              8              5
##     epithelial_size bare_nucleoli bland_chromatin normal_nucleoli mitoses class
## 1                 2            1               3               1       1     2
## 2                 7           10               3               2       1     2
## 3                 2            2               3               1       1     2
## 4                 3            4               3               7       1     2
## 5                 2            1               3               1       1     2
## 6                 7           10               9               7       1     4
## 7                 2           10               3               1       1     2
## 8                 2            1               3               1       1     2
## 9                 2            1               1               1       5     2
## 10                2            1               2               1       1     2
## 11                1            1               3               1       1     2
## 12                2            1               2               1       1     2
## 13                2            3               4               4       1     4
## 14                2            3               3               1       1     2
## 15                7            9               5               5       4     4
## 16                6            1               4               3       1     4
## 17                2            1               2               1       1     2
## 18                2            1               3               1       1     2
## 19                4           10               4               1       2     4
## 20                2            1               3               1       1     2
## 21                5           10               5               4       4     4
## 22                6            7               7              10       1     4
## 23                2            1               2               1       1     2
## 24                2         <NA>               7               3       1     4
## 25                2            1               3               1       1     2
## 26                2            7               3               6       1     4
## 27                1            1               2               1       1     2
```

```
## 28      2      1      2      1     1     2
## 29      2      1      2      1     1     2
## 30      2      1      1      1     1     2
## 31      1      1      2      1     1     2
## 32      2      1      3      1     1     2
## 33      8      5      7      4     3     4
## 34      2      1      3      1     1     2
## 35      2      1      2      1     1     2
## 36      2      1      2      1     1     2
## 37      6      1      8      9     1     4
## 38      1      1      7      1     1     2
## 39      2     10      5      6     1     4
## 40      6      7      7      5     1     4
## 41      6   <NA>      7      8     1     2
## 42      3      3      6      5     2     4
## 43      8     10      7      3     3     4
## 44     10      1      3      1     1     4
## 45      8      1      8     10     1     4
## 46      2      1      2      1     2     2
## 47      4      9      4      8     1     4
## 48      2      1      2      1     1     2
## 49      2      1      3      1     1     2
## 50      4      8      3      8     2     4
## 51      2      3      2      1     5     4
## 52      2      4      3      4     1     4
## 53      3      5      4     10     2     4
## 54     10      8      7      3     7     4
## 55      8      8      7      1     1     4
## 56      4      5      3      6     1     4
## 57      3      6      3      9     1     4
## 58      5      1      5      4     4     4
## 59      6     10      5      1     1     4
## 60      2      2      5      1     1     4
## 61      3      3      4     10     1     4
## 62      2      2      2      1     1     2
## 63     10      8      3      3     1     4
## 64      5      2      3      9     1     4
## 65      2      1      2      1     1     2
## 66      3      2      4      3    10     4
## 67      2      1      3      1     1     2
## 68      8     10      4      9     1     4
## 69      4      9      8      9     8     4
## 70      2      1      3      2     1     2
## 71      2      1      2      1     1     2
## 72     10      2      7      8    10     4
## 73      2      1      7      2     1     2
## 74      6     10      4      8     1     4
## 75      3      4      3      2     3     4
## 76      2      2      4      2     1     2
## 77      2      1      2      1     1     2
## 78      2      1      2      1     1     2
## 79      2      3      3      1     1     2
## 80      3      1      2      1     1     2
## 81      1      1      7      1     1     2
```

```
## 82    2  1  2  1  1  2
## 83    2  1  3  1  1  2
## 84    2  2  7  1  1  2
## 85    8  9  7 10  7  4
## 86   10  4  4 10 10  4
## 87    5  8  4  4  1  4
## 88    5 10  6  8  3  4
## 89    2  1  3  1  1  2
## 90    3  1  2  1  1  2
## 91    2  1  3  1  1  2
## 92    2  1  1  1  1  2
## 93    2  1  3  1  1  2
## 94    2  1  2  1  1  2
## 95    2  1  3  1  1  2
## 96    2  1  3  1  1  2
## 97    2  1  1  1  1  2
## 98    2  1  3  1  1  2
## 99   10  6  2  9 10  4
## 100   5 10  7  9  4  4
## 101  10  5  3 10  2  4
## 102   2  5  2  5  1  4
## 103   2  1  3  1  1  2
## 104   6  3  7  1  1  4
## 105  10  1  8  8  8  4
## 106   3  3  3  2  7  4
## 107   2 10  4  1  1  4
## 108   8 10  5  7  1  4
## 109   2  1  2  3  1  2
## 110   3  9  7  8  3  4
## 111   2  2  5  3  2  2
## 112   5  9  3  1  1  4
## 113   2 10  7  3  3  4
## 114  10  8  8  1  1  4
## 115   2  3  3  1  1  2
## 116   2  5  1  1  1  2
## 117   2  2  3  2  1  2
## 118   4 10  7  5  8  4
## 119   4  3  1  1  1  2
## 120   2  2  3  1  1  2
## 121   2  1  3  1  1  2
## 122   2  2  3  1  1  2
## 123  10 10  5  3  3  4
## 124   8 10  5  3  1  4
## 125   9  7  8 10  1  4
## 126   2  1  2  1  1  2
## 127   4 10  7  5  5  4
## 128   2  1  3  1  1  2
## 129   5 10  1  6  2  4
## 130  10  1  1  1  1  2
## 131   2  1  2  1  1  2
## 132   2  1  3  1  1  2
## 133   8 10  3  6  3  4
## 134   2  1  2  2  1  2
## 135   3  1  2  1  1  2
```

```
## 136      2      2      3      3      1      2
## 137      2      1      2      1      1      2
## 138      2      1      1      1      1      2
## 139      2      1      2      1      1      2
## 140      1   <NA>      2      1      1      2
## 141      2      1      1      1      1      2
## 142      2      1      1      1      1      2
## 143      4      5      4      3      3      4
## 144      2      5      1      1      1      2
## 145      2      1      2      1      1      2
## 146      2   <NA>      2      1      1      2
## 147      6      8      4      1      1      4
## 148      3      2      2      1      1      2
## 149      8      1      5      8      1      2
## 150     10     10      7      8      7      4
## 151      1      1      3      1      1      2
## 152      6     10      5      4      3      4
## 153      4      5      8     10      1      4
## 154      2      3      1      1      1      2
## 155      2      1      1      1      1      2
## 156      3     10      3      1      1      4
## 157      2      1      2      1      1      2
## 158      2      1      3      1      1      2
## 159      3   <NA>      1      1      1      2
## 160      6     10      7     10      6      4
## 161      5     10      5      7      2      4
## 162      2      1      3      2      1      2
## 163      2      1      3      1      1      2
## 164      1      3      1      1      7      2
## 165      2   <NA>      3      1      1      2
## 166      2      2      3      2      1      2
## 167      8     10      3     10      3      4
## 168      6      1      3      1     10      4
## 169      2      1      3      1      1      2
## 170      1      1      1      1      1      2
## 171      2      1      1      1      1      2
## 172      2      1      3      1      1      2
## 173      2      1      2      1      1      2
## 174      8     10     10     10      7      4
## 175      3     10      6      1      1      4
## 176     10     10      5      7      1      4
## 177      2      1      3      1      1      2
## 178      8      1      5     10      3      4
## 179      2      1      3      1      1      2
## 180      6     10      3      1      1      4
## 181      1      1      3      1      1      2
## 182      2      1      1      1      1      2
## 183      2      1      3      1      1      2
## 184      5     10      7      8      1      4
## 185      4     10      5      1      1      4
## 186      1      1      3      1      1      2
## 187      5      8      7     10      1      4
## 188      6     10      7      7     10      4
## 189      5      8      9     10      1      4
```

```
## 190   2   1   3   1   1   2
## 191   6   8   7  10   1   4
## 192  10  10   4  10   3   4
## 193   2   1   2   1   1   2
## 194   2   1   3   1   1   2
## 195   2   1   3   1   1   2
## 196   2   1   3   1   1   2
## 197   4   7   7   8   2   2
## 198   2   1   3   1   1   2
## 199   2   1   1   1   1   2
## 200   2   1   2   1   1   2
## 201   5  10   7   8   3   4
## 202  10  10   8   1   1   4
## 203   2   1   3   1   1   2
## 204   2   1   3   1   1   2
## 205   2   1   3   1   1   2
## 206   6  10   7  10   5   4
## 207   7   5   3   5   1   4
## 208   1   1   3   1   1   2
## 209   1   1   3   1   1   2
## 210   1   1   3   1   1   2
## 211   5  10   8  10   6   4
## 212   4   8   7   7   1   4
## 213   2   1   3   1   1   2
## 214   7  10   7  10   4   4
## 215   3  10  10   6   1   4
## 216   5   5   5  10   2   4
## 217   2   1   2   1   1   2
## 218   2   1   3   1   1   2
## 219   6   4   8  10   2   4
## 220   2   1   3   1   1   2
## 221   2   1   3   1   1   2
## 222  10  10   9  10   1   4
## 223   1   5   2   1   1   4
## 224   3   8   7   4   1   4
## 225   3  10   7   9   2   4
## 226   2   1   2   1   1   2
## 227   4  10   8   9   1   4
## 228   3   5   7   7   1   4
## 229   1   1   3   1   1   2
## 230  10  10   9  10   1   4
## 231   3   7   7   6   1   4
## 232   6   8   8   9   2   4
## 233   3   1   4   3   1   2
## 234   5  10   4   1   1   4
## 235   3   1   3   6   1   2
## 236   2  <NA>  3   1   1   2
## 237   8  10   4   8  10   4
## 238   6   2   4  10   4   4
## 239   6   9   3  10  10   4
## 240   3  10   5   3   2   4
## 241   2   2   2   3   1   2
## 242   1   1   3   1   1   2
## 243   2   1   3   1   1   2
```

## 244	2	5	5	1	1	2
## 245	2	1	3	1	1	2
## 246	2	2	3	1	1	2
## 247	5	10	7	8	1	4
## 248	2	9	3	3	1	4
## 249	2	1	3	6	1	2
## 250	2	<NA>	3	1	1	2
## 251	2	1	1	1	1	2
## 252	2	10	5	3	3	4
## 253	3	10	3	5	3	2
## 254	8	10	7	3	3	4
## 255	10	8	3	3	1	4
## 256	4	10	3	6	1	4
## 257	2	1	1	1	1	2
## 258	2	1	2	1	1	2
## 259	2	1	3	1	1	2
## 260	5	8	3	4	1	2
## 261	3	10	5	1	3	4
## 262	10	10	10	6	5	4
## 263	5	10	7	8	1	4
## 264	6	10	5	5	1	4
## 265	10	3	5	3	3	4
## 266	2	1	3	2	1	2
## 267	3	10	4	3	2	4
## 268	3	10	7	1	1	4
## 269	3	4	8	7	8	4
## 270	2	1	3	1	1	2
## 271	3	10	3	9	2	4
## 272	2	1	3	1	1	2
## 273	3	10	7	1	1	4
## 274	3	4	3	3	1	4
## 275	2	1	3	2	1	2
## 276	2	<NA>	2	1	1	2
## 277	2	1	2	1	1	2
## 278	2	1	2	1	1	2
## 279	2	1	3	1	1	2
## 280	3	7	3	3	8	4
## 281	2	1	3	1	1	2
## 282	2	1	3	1	1	2
## 283	4	10	5	6	1	4
## 284	2	10	5	3	1	4
## 285	2	10	3	8	2	4
## 286	8	10	10	7	3	4
## 287	10	10	4	10	10	4
## 288	3	1	2	1	1	2
## 289	4	5	5	10	1	4
## 290	6	10	4	10	4	4
## 291	2	1	1	1	1	2
## 292	2	1	3	1	1	2
## 293	2	<NA>	6	10	1	4
## 294	2	10	2	3	1	4
## 295	2	<NA>	2	1	1	2
## 296	6	10	7	4	1	4
## 297	4	5	4	7	1	2

```
## 298   2   <NA>   2   3   1   2
## 299   5     1   1   1   1   2
## 300   4    10   7   7   2   4
## 301   4     4   7  10   1   4
## 302   2     1   3   1   1   2
## 303   9    10   7  10  10   4
## 304   2     1   3   1   1   2
## 305   3    10   3   3   1   4
## 306   4    10   3  10   4   4
## 307   2     1   3   1   1   2
## 308   2     1   3   1   1   2
## 309   4     3   8   8   4   4
## 310   2     5   5   1   1   2
## 311   3     1   2   1   1   2
## 312   2     1   1   1   1   2
## 313  10     1   3   5   1   4
## 314   2     1   1   1   1   2
## 315   1     1   2   1   1   2
## 316   7   <NA>   4   9   1   2
## 317   5    10   4   3   1   4
## 318   6     8   8   9   1   4
## 319   5     1   3   1   1   2
## 320   6     5   7   3   1   2
## 321   5    10   7   4   6   4
## 322   2   <NA>   3   1   1   2
## 323   2     1   3   1   1   2
## 324   2    10   4   1   1   4
## 325   2     1   3   1   1   2
## 326   2     1   2   3   1   2
## 327   2    10   5   4   1   4
## 328   2     1   2   1   1   2
## 329   6     4   3  10   1   4
## 330   5    10   7   1   1   4
## 331   2     8   6   1   1   4
## 332   2     1   3   1   2   2
## 333   2     1   2   2   1   2
## 334   4    10   4   3   1   4
## 335   3    10   3   4   2   4
## 336   2     1   1   1   1   2
## 337   4    10   3   4   1   4
## 338   2     1   3   1   1   2
## 339   1     1   2   1   1   2
## 340   2    10   4   3   1   4
## 341   2    10   7   6   1   4
## 342   2     1   3   1   1   2
## 343   2     1   1   1   1   2
## 344   2     1   1   1   1   2
## 345  10    10   9   5   3   4
## 346   2     1   1   1   1   2
## 347   3     1   1   3   1   2
## 348   1     1   1   3   1   2
## 349   5     1   3   3   1   4
## 350   3     8   7   6   1   4
## 351   2     1   1   1   1   2
```

```
## 352   2   1   3   1   1   2
## 353   7   3   4   6   1   2
## 354   7  10   4   9   4   4
## 355   2   1   2   1   1   2
## 356   3   1   2   2   1   2
## 357   3   3   3   3   3   4
## 358  10  10   7   3   8   4
## 359   8   4   4  10   3   4
## 360   3   7   3   5   3   4
## 361  10  10   8  10  10   4
## 362   6  10   5   1   4   4
## 363   4   3   2   1   1   2
## 364   2   3   2   1   1   2
## 365   2   1   3   1   1   2
## 366   2   1   2   1   1   2
## 367   8  10   7  10   7   4
## 368   5  10   8  10   3   4
## 369   2   1   1   1   1   2
## 370   1   1   2   1   1   2
## 371   3   1   2   1   1   2
## 372   2   1   1   1   1   2
## 373   2   1   2   1   1   2
## 374   2   1   2   1   1   2
## 375   2   1   2   1   1   2
## 376   2   1   1   1   1   2
## 377   2   1   2   1   1   2
## 378   1   1   2   1   1   2
## 379   3   1   2   2   1   2
## 380   4   1   3   1   1   2
## 381   2   1   1   1   1   2
## 382   4  10   7   8   4   4
## 383   2   1   3   2   1   2
## 384   2   1   1   1   1   2
## 385   2   1   1   1   1   2
## 386   3   1   1   2   3   2
## 387   2  10   7   1   1   4
## 388   3   1   3   1   1   2
## 389   2   1   2   2   1   2
## 390   3   2   2   2   1   2
## 391   2   1   2   1   1   2
## 392   3  10   7   9   1   4
## 393   2   1   2   1   1   2
## 394   1   1   1   1   1   2
## 395   2   1   2   1   1   2
## 396   2   1   2   1   1   2
## 397   2   1   3   1   1   2
## 398   2   1   1   1   1   2
## 399   2   1   2   2   1   2
## 400   2   1   1   1   1   2
## 401   6   9   9   3   8   4
## 402   2   1   1   1   1   2
## 403   2   1   2   1   1   2
## 404   2   4   1   1   1   2
## 405   2   1   1   2   1   2
```

```
## 406    2    1    2    1    1    2
## 407    2    1    2    1    1    2
## 408    2    1    2    1    1    2
## 409    2    2    3    1    1    2
## 410    2    1    2    1    1    2
## 411    2    1    2    1    1    2
## 412    1 <NA>    2    1    1    2
## 413    8    4    8    5    1    4
## 414    2    1    3    1    1    2
## 415    3   10    6    6    1    4
## 416    3    3    3    5    1    2
## 417   10   10    7    2    1    4
## 418    2    1    2    1    1    2
## 419    2    2    3    2    2    2
## 420    5    1    1    1    1    2
## 421    2    3    3    1    1    2
## 422   10   10    8    2    1    4
## 423    2    1    3    3    1    2
## 424    2    1    2    1    1    2
## 425    2    1    1    1    1    2
## 426   10   10   10   10    1    4
## 427    2    1    1    1    1    2
## 428    4    2    5   10    1    4
## 429    2    1    2    1    1    2
## 430    2    1    2    1    1    2
## 431    2    1    2    2    1    2
## 432    4    1    3    2    1    2
## 433    2    1    2    2    1    2
## 434    2    1    1    1    1    2
## 435    5    8    4    2    1    2
## 436    3   10    5    1    1    4
## 437    6    1    2    8    1    4
## 438    2    1    1    1    1    2
## 439    2    1    1    1    1    2
## 440    2    1    1    1    1    2
## 441    4   10   10    1    1    4
## 442    2    4    1    1    1    2
## 443    2    3    1    1    1    2
## 444    2    2    1    1    1    2
## 445    3    1    2    1    1    2
## 446    2    1    1    1    1    2
## 447    2    1    1    1    1    2
## 448    2    1    1    1    1    2
## 449    1    1    1    1    1    2
## 450    6   10    8   10    1    4
## 451    1    1    2    1    1    2
## 452    2    1    1    1    1    2
## 453    2    1    1    1    1    2
## 454    6   10   10    7    1    4
## 455    3    1    1    1    1    2
## 456    2    6    1    1    2    4
## 457    5   10    8    6    1    4
## 458    6    3   10   10    1    4
## 459    2    1    1    1    1    2
```

```
## 460   2   1   1   1   1   2
## 461   2   1   1   1   1   2
## 462   2   5   1   1   1   2
## 463   2   1   1   1   1   2
## 464   2   1   1   2   1   2
## 465   2   1   1   1   1   2
## 466   6   4   7   10  3   4
## 467   4   10  9   7   1   4
## 468   4   10  7   6   2   4
## 469   2   1   1   1   1   2
## 470   2   1   2   1   1   2
## 471   1   1   2   1   1   2
## 472   2   1   1   1   1   2
## 473   1   1   1   1   1   2
## 474   2   1   1   1   1   2
## 475   2   1   1   1   1   2
## 476   2   1   1   1   1   2
## 477   2   1   1   1   1   2
## 478   2   1   1   1   1   2
## 479   2   1   1   1   1   2
## 480   4   10  7   5   1   4
## 481   1   1   1   1   1   2
## 482   2   1   1   1   1   2
## 483   10  5   10  10  10  4
## 484   5   10  9   10  1   4
## 485   2   1   1   1   1   2
## 486   1   3   1   1   1   2
## 487   1   1   2   1   1   2
## 488   6   10  8   1   5   4
## 489   3   3   3   4   1   4
## 490   3   4   4   1   1   4
## 491   2   1   1   1   1   2
## 492   3   10  7   1   1   4
## 493   1   1   2   1   1   2
## 494   6   10  6   5   2   4
## 495   4   5   2   1   1   2
## 496   1   1   2   1   1   2
## 497   1   1   1   1   1   2
## 498   2   1   1   1   1   2
## 499   2   1   2   1   1   2
## 500   2   1   2   1   1   2
## 501   2   1   3   1   1   2
## 502   2   1   2   1   1   2
## 503   2   1   2   1   1   2
## 504   2   1   3   1   1   2
## 505   2   1   1   1   1   2
## 506   2   1   1   1   1   2
## 507   7   5   4   8   7   4
## 508   2   4   1   1   1   2
## 509   2   1   1   1   1   2
## 510   2   1   1   1   1   2
## 511   2   1   1   1   1   2
## 512   2   1   2   1   1   2
## 513   2   1   1   1   1   2
```

```
## 514          1           1           2           1     1     2
## 515          3          10           8          10     2     4
## 516          3          10           9          10     1     4
## 517          1           1           1           1     1     2
## 518          1           1           2           1     1     2
## 519          2           1           1           1     1     2
## 520          4          10           9           1     1     4
## 521          3           1           1           1     1     2
## 522          3           1           1           1     1     2
## 523          3           5           7           3     1     4
## 524          4          10           5           3     1     4
## 525          2           1           2           1     1     2
## 526          2           1           1           1     1     2
## 527          2           1           1           1     1     2
## 528          2           1           3           1     1     2
## 529          2           1           1           1     1     2
## 530          1           1           2           1     1     2
## 531          4          10           6           9     1     4
## 532          2           1           2           1     1     2
## 533          1           1           3           1     1     2
## 534          2           1           2           1     1     2
## 535          2           1           2           1     1     2
## 536          2           1           3           1     1     2
## 537          2           1           3           1     1     2
## 538          2           1           3           1     1     2
## 539          2           1           2           1     1     2
## 540          2           1           2           1     1     2
## 541          2           2           2           1     1     2
## 542          2           1           1           1     1     2
## 543          2           1           1           1     1     2
## 544          2           1           2           1     1     2
## 545          2           1           2           1     1     2
## 546          2           1           2           1     1     2
## 547          4          10           7          10     1     4
## 548          1           1           1           1     1     2
## 549          1           1           1           1     1     2
## 550          4           5           7           8     2     4
## 551          2           1           2           1     1     2
## 552          2           1           3           1     1     2
## 553          2           1           4           2     1     2
## 554          2           5           2           1     2     2
## 555          2           1           1           1     1     2
## 556          2           1           4           8     1     2
## 557          1           1           2           1     1     2
## 558          2           1           1           1     1     2
## 559          2           1           2           1     1     2
## 560          2           1           2           1     1     2
## 561          2           1           3           1     1     2
## 562          2           1           3           1     1     2
## 563          2           1           3           1     1     2
## 564          2           1           2           1     1     2
## 565          2           1           3           2     1     2
## 566          5          10          10          10     1     4
## 567          2           1           3           1     1     2
```

```
## 568   2   3   2   1   1   2
## 569   6  10   2   5   2   4
## 570   6   5  10   3   1   4
## 571   8  10   8   2   1   4
## 572   3  10   9  10   2   4
## 573   2   1   2   1   1   2
## 574   2   1   2   1   1   2
## 575   4   2   7   7   1   4
## 576   2   1   3   1   1   2
## 577   2   1   2   1   1   2
## 578   2   1   2   1   1   2
## 579   2   1   2   1   1   2
## 580   2   1   3   1   1   2
## 581   2   1   2   1   1   2
## 582   5  10   7   5   1   4
## 583   4  10   6  10   1   4
## 584   2   1   1   1   1   2
## 585   3   1   1   1   1   2
## 586   2   1   1   1   1   2
## 587   6  10  10  10   1   4
## 588   2   1   2   2   1   2
## 589   6   3   4   1   1   4
## 590   2   1   1   1   1   2
## 591   4   1  10   1   1   4
## 592   4  10   7   6   1   4
## 593   3  10   4   1   1   4
## 594   2   1   1   1   1   2
## 595   4  10   7   1   1   4
## 596   2   1   2   1   1   2
## 597   2   1   2   1   1   2
## 598   2   1   3   1   1   2
## 599   2   1   2   1   1   2
## 600   1   1   1   1   1   2
## 601   2   1   2   1   1   2
## 602   1   1   2   1   1   2
## 603   2   1   2   1   1   2
## 604   4   1   8  10   1   4
## 605   5  10   8   1   2   4
## 606   5   8   7   8   3   4
## 607   2   1   1   1   1   2
## 608   2   1   1   1   1   2
## 609  10  10  10   1   1   4
## 610   2   1   1   1   1   2
## 611   3  10   7   1   2   4
## 612   5   2   8   5   1   4
## 613   6  10  10  10  10   4
## 614   2   1   2   1   1   2
## 615   1   1   2   1   1   2
## 616   2   1   2   1   1   2
## 617   2   1   2   1   1   2
## 618   1   ?   1   1   1   2
## 619   2   1   2   1   1   2
## 620   2   1   2   1   1   2
## 621   2   1   2   1   1   2
```

```
## 622   3   2   6   1   1   2
## 623   2   1   2   1   1   2
## 624   2   1   1   1   1   2
## 625   1   1   2   1   1   2
## 626   3   4   1   1   1   2
## 627   7   6   7   7   3   4
## 628   2   5   1   1   1   2
## 629   2   1   1   1   1   2
## 630   2   1   1   1   1   2
## 631   2   1   1   1   1   2
## 632   2   1   2   1   1   2
## 633   2   1   1   1   1   2
## 634   5   3   5  10   1   4
## 635   2   1   1   1   1   2
## 636   2   1   1   1   1   2
## 637   7   1  10  10   3   4
## 638   2   2   2   1   1   2
## 639   2   1   1   1   1   2
## 640   2   1   1   1   1   2
## 641   2   1   1   1   1   2
## 642   2   1   2   1   1   2
## 643   2   1   2   1   1   2
## 644   2   1   1   1   1   2
## 645   2   1   1   1   1   2
## 646   2   1   2   1   1   2
## 647   2   1   1   1   1   2
## 648   2   1   1   1   1   2
## 649  10   2  10  10  10   4
## 650   2   1   2   1   1   2
## 651   3   4   1   1   1   2
## 652   2   1   2   1   1   2
## 653   2   1   2   2   1   2
## 654   2   1   2   1   1   2
## 655   2   1   3   1   1   2
## 656   2   1   2   1   1   2
## 657   2   1   2   1   1   2
## 658   8   1   3   6   1   2
## 659   3  10   7   2   3   4
## 660   2   1   1   1   1   2
## 661   2   1   2   1   1   2
## 662   2   1   3   1   1   2
## 663   2   1   2   1   1   2
## 664   2   1   2   1   1   2
## 665   2   1   2   1   1   2
## 666   2   1   1   1   1   2
## 667   2   1   1   1   2   2
## 668   2   1   3   1   1   2
## 669   6   1   7  10   3   4
## 670   5   5   7  10   1   4
## 671   5   8   7   4   1   4
## 672   2   1   3   1   1   2
## 673   2   1   3   1   1   2
## 674   3   1   1   1   1   2
## 675   2   1   2   1   1   2
```

```
## 676              2            1              1              1       1     2
## 677              2            1              2              1       1     2
## 678              2            1              1              1       1     2
## 679              2            1              1              1       1     2
## 680              2            1              1              1       1     2
## 681              5           10             10             10       7     4
## 682              4           10              5              6       3     4
## 683              2            1              3              2       1     2
## 684              2            1              1              1       1     2
## 685              2            1              1              1       1     2
## 686              2            1              1              1       1     2
## 687              2            1              1              1       1     2
## 688              2            1              2              3       1     2
## 689              2            1              1              1       1     2
## 690              2            1              1              1       8     2
## 691              2            1              1              1       1     2
## 692              4            5              4              4       1     4
## 693              2            1              1              1       1     2
## 694              2            1              2              1       2     2
## 695              3            2              1              1       1     2
## 696              2            1              1              1       1     2
## 697              7            3              8             10       2     4
## 698              3            4             10              6       1     4
## 699              4            5             10              4       1     4
```

```
summary(breastcancer_wisconsin)
```

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

```
    #a. describe what is the dataset all about.
    #ANSWER: The dataset 'breastcancer_wisconsin' is a database of clinical reports of the cases. It st
```

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

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

```r
#d.2 Coefficient of variability for Marginal Adhesion.
    #Statistics/Packages used: Using mean and standard deviation to get the Coefficient of Variation.
    marginal_adhesion_data <- breastcancer_wisconsin$marginal_adhesion
    meanMA <- mean(marginal_adhesion_data)
    standardDevMA <- sd(marginal_adhesion_data)
    CoeffVarMA <- standardDevMA / meanMA
    CoeffVarMA
```

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

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

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

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

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

```r
#d.4 Mean and standard deviation for Bland Chromatin
    #Statistics/Packages used:mean and standard deviation
    BlandChromatin <- breastcancer_wisconsin$bland_chromatin
    meanBC <- mean(BlandChromatin)
    sdBC <- sd(BlandChromatin)
    meanBC
```

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

```r
    sdBC
```

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

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

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

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

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

```
    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"
```

```
#e. Find the percentage of respondents who are malignant. Interpret the results
str(breastcancer_wisconsin)
```

```
## 'data.frame':    699 obs. of  11 variables:
##  $ id               : int  1000025 1002945 1015425 1016277 1017023 1017122 1018099 1018561 1033078 10
##  $ clump_thickness  : int  5 5 3 6 4 8 1 2 2 4 ...
##  $ size_uniformity  : int  1 4 1 8 1 10 1 1 1 2 ...
##  $ shape_uniformity : int  1 4 1 8 1 10 1 2 1 1 ...
##  $ marginal_adhesion: int  1 5 1 1 3 8 1 1 1 1 ...
##  $ epithelial_size  : int  2 7 2 3 2 7 2 2 2 2 ...
##  $ bare_nucleoli    : chr  "1" "10" "2" "4" ...
##  $ bland_chromatin  : int  3 3 3 3 3 9 3 3 1 2 ...
##  $ normal_nucleoli  : int  1 2 1 7 1 7 1 1 1 1 ...
##  $ mitoses          : int  1 1 1 1 1 1 1 1 5 1 ...
##  $ class            : int  2 2 2 2 2 4 2 2 2 2 ...
```

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

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

```
#INTERPRET: Based on the class data belonged to the breastcancer data, class 4 is considered to be mali
```

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

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

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

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

```
summary(abalone)
```

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

```
getwd()
```

```
## [1] "C:/Users/User/Documents/Rstudio Files/Worksheet#6"
```

```
Abalone_excel<-"C:/Users/User/Documents/Rstudio Files/AbaloneData.xlsx"
#install.packages("writexl")
library(writexl)
```

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

```
write_xlsx(abalone, Abalone_excel)
```