HW8.R

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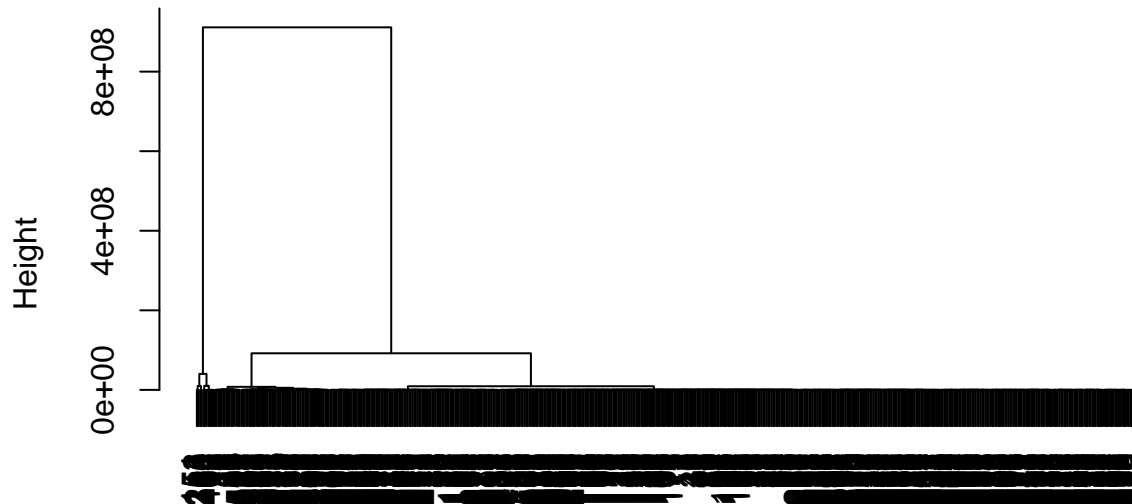
Homework 8

```r
rm(list=ls())
set.seed(513)
```

Data pre-processing

```r
cancerData=read.csv("/Users/davidfu/Downloads/wisc_bc_ContinuousVar.csv", header=TRUE)

cancerData <- na.omit(cancerData)

cancer_dist<-dist(cancerData[,-2])
hclust_resutls<-hclust(cancer_dist)
plot(hclust_resutls)
```

Cluster Dendrogram

cancer_dist
hclust (*, "complete")

```
hclust_3<-cutree(hclust_resutls,3)
table(hclust_3,cancerData[,5])
```

```
##
## hclust_3 43.79 47.92 47.98 48.34 51.71 53.27 54.09 54.34 54.42 54.53 54.66
##        1     1     1     1     1     1     0     0     1     1     1     1
##        2     0     0     0     0     1     0     0     0     0     0     0
##        3     0     0     0     0     0     1     0     0     0     0     0
##
## hclust_3 55.27 55.84 56.36 56.74 58.74 58.79 59.01 59.2 59.26 59.6 59.75 59.82
##        1     1     1     1     1     1     2     1     1     1     1     1     0
##        2     0     0     0     0     0     0     0     0     0     0     0     0
##        3     0     0     0     0     0     0     0     0     0     0     0     1
##
## hclust_3 59.96 60.07 60.11 60.21 60.34 60.73 61.05 61.06 61.24 61.49 61.5 61.64
##        1     1     1     1     1     1     1     1     1     1     2     1     1
##        2     0     0     0     0     0     0     0     0     0     0     0     0
##        3     0     0     0     0     0     0     0     0     0     0     0     0
##
## hclust_3 61.68 61.93 62.11 62.5 62.92 63 63.19 63.76 63.78 63.95 64.12 64.41
##        1     1     1     1     1     1   1     1     1     1     1     1     1
##        2     0     0     0     0     0   0     0     0     0     0     0     0
##        3     0     0     0     0     0   0     0     0     0     0     0     0
##
## hclust_3 64.55 64.6 64.73 65.05 65.12 65.31 65.67 65.75 65.85 66.2 66.52 66.62
```

```
##          1     1     1     1     1     1     1     1     0     1     1     1     0
##          2     0     0     0     0     0     0     0     1     0     0     0     1
##          3     0     0     0     0     0     0     0     0     0     0     0     0
##
## hclust_3 66.72 66.82 66.85 66.86 67.41 67.49 68.01 68.26 68.51 68.64 68.69
##          1     1     1     1     1     1     2     0     1     1     1     1
##          2     0     0     0     0     0     0     1     0     0     0     0
##          3     0     0     0     0     0     0     0     0     0     0     0
##
## hclust_3 68.77 68.79 68.89 69.14 69.28 69.5 70.15 70.21 70.31 70.39 70.41 70.47
##          1     1     1     1     1     1     1     1     1     1     1     1     0
##          2     0     0     0     0     0     0     0     0     0     0     0     1
##          3     0     0     0     0     0     0     0     0     0     0     0     0
##
## hclust_3 70.67 70.79 70.87 70.92 70.95 71.24 71.25 71.3 71.38 71.49 71.73 71.76
##          1     2     1     1     1     1     1     0     1     1     2     1     0
##          2     0     1     0     0     0     0     1     0     0     0     0     1
##          3     0     0     0     0     0     0     0     0     0     0     0     0
##
## hclust_3 71.79 71.8 71.9 71.94 72.17 72.23 72.48 72.49 72.76 73 73.02 73.06
##          1     1     1     1     1     0     1     1     1     1 1     1     1
##          2     0     0     0     0     1     0     0     0     0 0     0     0
##          3     0     0     0     0     0     0     0     0     0 0     0     0
##
## hclust_3 73.16 73.28 73.3 73.34 73.38 73.53 73.59 73.66 73.7 73.72 73.73 73.81
##          1     1     0     1     1     1     1     1     1     1     1     1     1
##          2     0     1     0     1     0     0     0     0     0     0     0     0
##          3     0     0     0     0     0     0     0     0     0     0     0     0
##
## hclust_3 73.87 73.88 73.93 73.99 74.2 74.23 74.24 74.33 74.34 74.52 74.65 74.68
##          1     1     0     1     1     1     1     1     1     1     1     1     1
##          2     0     0     0     0     0     0     0     0     0     0     0     0
##          3     0     1     0     0     0     0     0     0     0     0     0     0
##
## hclust_3 74.72 74.87 75 75.03 75.17 75.21 75.26 75.27 75.46 75.49 75.51 75.54
##          1     2     1 1     0     1     0     1     1     1     1     1     1
##          2     0     0 0     1     0     1     0     0     0     0     0     0
##          3     0     0 0     0     0     0     0     0     0     0     0     0
##
## hclust_3 75.71 75.89 76.09 76.1 76.14 76.2 76.31 76.37 76.38 76.39 76.53 76.66
##          1     1     1     1     1     1     1     1     1     1     1     1     1
##          2     0     0     0     0     0     0     0     0     0     0     0     0
##          3     0     0     0     0     0     0     0     0     0     0     0     0
##
## hclust_3 76.77 76.83 76.84 76.85 76.95 77.22 77.23 77.25 77.32 77.42 77.58
##          1     1     1     1     1     1     1     1     1     1     1     0
##          2     0     0     0     0     0     0     0     0     0     0     1
##          3     0     0     0     0     0     0     0     0     0     0     0
##
## hclust_3 77.61 77.79 77.83 77.87 77.88 77.93 78.01 78.04 78.07 78.11 78.18
##          1     1     1     1     1     1     1     0     1     1     1     0
##          2     0     0     0     0     0     0     1     0     0     0     1
##          3     0     0     0     0     0     0     0     0     0     0     0
##
```

```
## hclust_3 78.27 78.29 78.31 78.41 78.54 78.6 78.61 78.75 78.78 78.83 78.85 78.94
##       1    1    2    1    1    1    1    1    1    1    2    0    0
##       2    0    0    0    0    0    0    0    0    0    0    1    1
##       3    0    0    0    0    0    0    0    0    0    0    0    0
##
## hclust_3 78.99 79.01 79.08 79.19 79.42 79.47 79.78 79.83 79.85 80.43 80.45
##       1    1    1    1    2    0    0    1    1    1    1    1
##       2    0    0    0    0    0    1    0    0    0    0    0
##       3    0    0    0    0    1    0    0    0    0    0    0
##
## hclust_3 80.62 80.64 80.88 80.98 81.09 81.15 81.25 81.29 81.35 81.37 81.47
##       1    1    1    1    0    1    1    1    1    1    1    1
##       2    0    0    0    1    0    0    1    0    1    0    0
##       3    0    0    0    0    0    0    0    0    0    0    0
##
## hclust_3 81.72 81.78 81.87 81.89 81.92 82.01 82.02 82.15 82.29 82.38 82.5 82.51
##       1    1    1    1    1    1    1    1    1    0    1    1    1
##       2    0    0    0    0    0    0    0    0    1    0    0    0
##       3    0    0    0    0    0    0    0    0    0    0    0    0
##
## hclust_3 82.53 82.57 82.61 82.63 82.67 82.69 82.71 82.82 82.85 82.89 83.05
##       1    1    1    3    1    1    1    1    1    1    1    0
##       2    0    0    0    0    0    1    0    0    0    0    1
##       3    0    0    0    0    0    0    0    0    0    0    0
##
## hclust_3 83.14 83.18 83.19 83.51 83.74 83.97 84.06 84.07 84.08 84.1 84.13 84.18
##       1    1    1    1    0    1    0    1    1    2    1    1    1
##       2    0    0    0    0    0    1    0    0    0    0    0    0
##       3    0    0    0    1    0    0    0    0    0    0    0    0
##
## hclust_3 84.28 84.45 84.52 84.55 84.74 84.88 84.95 85.09 85.24 85.26 85.31
##       1    0    1    1    1    1    1    1    1    1    1    1
##       2    0    0    0    0    0    0    0    0    0    0    0
##       3    1    0    0    0    0    0    0    0    0    0    0
##
## hclust_3 85.42 85.48 85.63 85.69 85.79 85.84 85.89 85.98 86.1 86.18 86.24 86.34
##       1    0    1    1    1    1    1    1    2    1    1    1    1
##       2    1    0    0    0    0    0    0    0    0    0    0    0
##       3    0    0    0    0    0    0    0    0    0    0    0    0
##
## hclust_3 86.49 86.6 86.87 86.91 87.02 87.16 87.19 87.21 87.32 87.38 87.44 87.46
##       1    1    1    1    1    1    1    1    2    2    0    0    1
##       2    0    0    0    0    0    0    0    0    0    1    1    0
##       3    0    0    0    0    0    0    0    0    0    0    0    0
##
## hclust_3 87.5 87.76 87.84 87.88 87.91 88.05 88.06 88.1 88.12 88.27 88.37 88.4
##       1    1    2    1    1    1    1    1    0    1    1    1    1
##       2    0    1    0    0    0    0    0    1    0    0    1    0
##       3    0    0    0    0    0    0    0    0    0    0    0    0
##
## hclust_3 88.44 88.52 88.54 88.59 88.64 88.68 88.73 88.97 88.99 89.46 89.59
##       1    1    1    0    1    1    1    2    1    1    1    1
##       2    0    0    1    0    0    0    0    0    0    0    0
##       3    0    0    0    0    0    0    0    0    0    0    0
```

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```
## 
## hclust_3 89.75 89.77 89.78 89.79 90.03 90.2 90.3 90.31 90.43 90.63 90.96 91.12
##        1     1     1     1     1     0    1    0     1     1     1     1     1
##        2     0     0     0     0     1    0    1    0     0     0     0     0     0
##        3     0     0     0     0     0    0    0    0     0     0     0     0     0
## 
## hclust_3 91.22 91.38 91.43 91.56 92.25 92.33 92.41 92.51 92.55 92.68 92.87 93.6
##        1     1     1     1     1     1     1     1     0     1     0     1     0
##        2     0     0     0     0     0     0     0     1     0     1     0     1
##        3     0     0     0     0     0     0     0     0     0     0     0     0
## 
## hclust_3 93.63 93.77 93.86 93.97 94.15 94.21 94.25 94.28 94.29 94.37 94.48
##        1     1     0     1     1     1     1     1     1     1     1     1
##        2     0     1     0     1     0     0     1     0     0     0     0
##        3     0     0     0     0     0     0     0     0     0     0     0
## 
## hclust_3 94.49 94.57 94.66 94.7 94.74 94.87 94.89 95.5 95.54 95.55 95.77 95.81
##        1     1     1     1     1     1     1     1     1     1     1     1     1
##        2     0     0     0     0     0     0     0     0     0     0     0     0
##        3     0     0     0     0     0     0     0     0     0     0     0     0
## 
## hclust_3 95.88 96.03 96.12 96.22 96.39 96.42 96.45 96.71 96.73 96.85 97.03
##        1     1     0     1     1     1     1     1     1     0     1     1
##        2     0     1     0     0     0     0     0     0     1     0     0
##        3     0     0     0     0     0     0     0     0     0     0     0
## 
## hclust_3 97.26 97.4 97.41 97.45 97.53 97.65 97.83 97.84 98 98.17 98.22 98.64
##        1     1    1     1     0     1     1     1     0  1     1     1     1
##        2     1    0     0     1     0     0     0     1  0     0     0     0
##        3     0    0     0     0     0     0     0     0  0     0     0     0
## 
## hclust_3 98.73 98.78 98.92 99.58 100 100.2 100.3 100.4 101.2 101.7 102 102.1
##        1     1     1     1     1   1     1     1     0     1     1   1     1
##        2     0     0     0     0   0     0     0     1     0     0   0     0
##        3     0     0     0     0   0     0     0     0     0     0   0     0
## 
## hclust_3 102.4 102.5 102.6 102.7 102.8 102.9 103.2 103.4 103.6 103.7 103.8
##        1     2     2     1     1     1     0     1     1     0     1     1
##        2     0     0     0     0     0     1     0     0     1     1     0
##        3     0     0     0     0     0     0     0     0     0     0     0
## 
## hclust_3 104.1 104.3 104.7 105.1 105.7 105.8 106.2 106.3 106.6 106.9 107 107.1
##        1     1     1     1     1     1     1     0     1     1     1   1     2
##        2     0     0     0     0     0     0     1     0     0     0   0     0
##        3     0     0     0     0     0     0     0     0     0     0   0     0
## 
## hclust_3 107.5 108.1 108.3 108.4 108.8 109 109.3 109.7 109.8 110 110.1 110.2
##        1     1     0     1     1     1   1     1     1     1   1     1     1
##        2     0     1     0     0     0   0     1     0     0   0     0     0
##        3     0     0     0     0     0   0     0     0     0   0     0     0
## 
## hclust_3 111 111.2 111.6 111.8 112.4 112.8 113 113.4 114.2 114.4 114.5 114.6
##        1   1     0     1     0     1     0   1     1     2     1     0     0
##        2   0     0     0     1     0     1   0     1     0     0     0     1
```

```
##        3   0    1    0     0     0     0   0     0     0     0     1     0
##
## hclust_3 115 115.1 115.2 116 116.1 117.3 117.4 117.5 117.8 118.4 118.6 118.7
##        1   1    1     1    1    1     1     1     2     1     0     1     1     1
##        2   0    0     0    0    0     0     0     0     0     1     0     0     0
##        3   0    0     0    0    0     0     0     0     0     0     0     0     0
##
## hclust_3 119 119.6 120.2 120.3 120.8 120.9 121.1 121.3 121.4 122 122.1 122.8
##        1   1    1     1     2     1     1     1     1     1     1   0     1     1
##        2   0    0     0     0     0     0     0     0     0     0   1     0     0
##        3   0    0     0     0     0     0     0     0     0     0   0     0     0
##
## hclust_3 122.9 123.4 123.6 123.7 124.4 124.8 125.5 126.2 126.3 126.5 127.2
##        1   1     1     1     1     2     0     1     1     1     1     1     1
##        2   0     0     0     0     0     1     0     0     0     0     0     0
##        3   0     0     0     0     0     0     0     0     0     0     0     0
##
## hclust_3 127.5 127.7 127.9 128 128.1 128.3 128.9 129.1 129.5 129.7 129.9 130
##        1   1     1     1     1   0     1     1     1     2     1     1     1   1
##        2   0     0     0     0   1     0     0     0     0     0     0     0   1
##        3   0     0     0     0   0     0     0     0     0     0     0     0   0
##
## hclust_3 130.4 130.5 130.7 131.1 131.2 132.4 132.5 132.9 133.6 133.7 133.8
##        1   1     1     1     2     1     1     2     1     2     0     1     2
##        2   0     0     0     0     0     0     0     0     0     1     0     0
##        3   0     0     0     0     0     0     0     0     0     0     0     0
##
## hclust_3 134.4 134.7 134.8 135.1 135.7 135.9 137.2 137.8 138.1 138.9 140.1
##        1   0     0     1     0     0     1     1     2     0     1     1
##        2   1     2     0     1     1     0     0     0     0     0     0
##        3   0     1     0     0     0     0     0     0     1     0     0
##
## hclust_3 140.9 141.3 142 142.7 143 143.7 144.4 147.2 147.3 152.1 152.8 153.5
##        1   1     1     1   1     1   1     1     1     1     2     1     0
##        2   0     0     0   0     0   0     0     0     0     0     0     1
##        3   0     0     0   0     0   0     0     0     0     0     0     0
##
## hclust_3 155.1 158.9 165.5 166.2 171.5 174.2 182.1 186.9 188.5
##        1   1     1     0     1     1     1     1     0     1
##        2   0     0     1     0     0     0     0     0     0
##        3   0     0     0     0     0     0     0     1     0
```

```
kmeans_3<- kmeans(cancerData[,-2],3,nstart = 10)
kmeans_3$cluster
```

```
##    1   2   3   4   5   6   7   8   9  10  11  12  13  14  15  16  17  18  19  20
##    2   2   1   1   1   2   2   1   2   1   2   1   2   2   1   1   2   1   2   2
##   21  22  23  24  25  26  27  28  29  30  31  32  33  34  35  36  37  38  39  40
##    2   2   2   2   2   2   2   2   2   2   2   2   1   2   2   2   2   2   2   2
##   41  42  43  44  45  46  47  48  49  50  51  52  53  54  55  56  57  58  59  60
##    2   2   2   2   1   2   1   2   2   2   2   2   2   2   2   1   2   2   2   2
##   61  62  63  64  65  66  67  68  69  70  71  72  73  74  75  76  77  78  79  80
##    2   2   2   2   1   2   2   2   2   2   2   2   2   2   2   2   2   2   2   2
##   81  82  83  84  85  86  87  88  89  90  91  92  93  94  95  96  97  98  99 100
```

```
##     2   2   2   2   2   2   1   1   2   2   2   2   2   2   2   2   2   2   2   2
## 101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120
##     2   2   2   2   2   2   2   2   2   2   2   2   2   2   2   2   2   2   2   2
## 121 122 123 124 125 126 127 128 129 130 131 132 133 134 135 136 137 138 139 140
##     2   2   2   2   2   2   2   2   2   2   2   2   1   2   2   2   2   2   2   2
## 141 142 143 144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160
##     2   2   2   2   2   2   2   1   1   2   3   3   2   2   2   2   2   2   2   2
## 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179 180
##     2   2   2   2   2   2   2   2   2   2   1   2   2   2   2   2   2   1   2   2
## 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200
##     2   2   2   2   2   2   2   2   2   2   2   2   2   2   1   2   2   2   2   2
## 201 202 203 204 205 206 207 208 209 210 211 212 213 214 215 216 217 218 219 220
##     2   2   2   2   2   2   2   2   2   2   3   2   2   3   2   2   2   2   2   1
## 221 222 223 224 225 226 227 228 229 230 231 232 233 234 235 236 237 238 239 240
##     2   2   2   2   2   1   1   1   1   2   2   1   1   1   2   1   1   2   2   1
## 241 242 243 244 245 246 247 248 249 250 251 252 253 254 255 256 257 258 259 260
##     1   2   2   1   2   2   2   2   1   2   2   1   2   2   2   2   1   2   2   1
## 261 262 263 264 265 266 267 268 269 270 271 272 273 274 275 276 277 278 279 280
##     2   2   2   2   2   1   2   2   2   2   2   2   2   2   2   2   2   2   2   2
## 281 282 283 284 285 286 287 288 289 290 291 292 293 294 295 296 297 298 299 300
##     2   2   2   2   2   2   2   2   2   1   1   2   2   2   2   2   2   2   2   2
## 301 302 303 304 305 306 307 308 309 310 311 312 313 314 315 316 317 318 319 320
##     2   2   1   2   2   2   2   2   2   2   2   1   1   2   2   2   2   2   2   2
## 321 322 323 324 325 326 327 328 329 330 331 332 333 334 335 336 337 338 339 340
##     2   2   2   2   1   1   2   2   2   2   2   2   2   2   2   1   2   2   2   2
## 341 342 343 344 345 346 347 348 349 350 351 352 353 354 355 356 357 358 359 360
##     2   2   2   2   1   2   2   2   2   2   2   2   2   2   2   2   2   2   2   3
## 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375 376 377 378 379 380
##     3   2   2   2   2   2   2   2   2   2   2   2   2   2   2   2   2   2   2   2
## 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395 396 397 398 399 400
##     2   2   2   2   2   2   2   2   2   2   1   2   2   2   2   2   1   1   2   2
## 401 402 403 404 405 406 407 408 409 410 411 412 413 414 415 416 417 418 419 420
##     1   2   2   2   2   2   2   2   1   2   2   2   2   2   2   2   2   1   2   2
## 421 422 423 424 425 426 427 428 429 430 431 432 433 434 435 436 437 438 439 440
##     2   2   2   2   2   2   2   2   1   1   2   2   2   2   2   2   2   2   2   2
## 441 442 443 444 445 446 447 448 449 450 451 452 453 454 455 456 457 458 459 460
##     2   2   1   2   2   2   2   2   2   3   2   2   2   2   2   2   2   2   2   2
## 461 462 463 464 465 466 467 468 469 470 471 472 473 474 475 476 477 478 479 480
##     3   3   2   3   3   2   2   2   2   2   2   2   2   2   2   2   2   2   2   2
## 481 482 483 484 485 486 487 488 489 490 491 492 493 494 495 496 497 498 499 500
##     2   2   2   2   2   2   2   2   2   2   1   1   2   2   2   2   2   2   2   2
## 501 502 503 504 505 506 507 508 509 510 511 512 513 514 515 516 517 518 519 520
##     2   2   2   2   2   2   1   1   2   2   2   2   2   2   1   2   2   2   2   2
## 521 522 523 524 525 526 527 528 529 530 531 532 533 534 535 536 537 538 539 540
##     2   1   2   2   2   2   1   1   2   2   2   1   1   1   2   2   1   2   2   2
## 541 542 543 544 545 546 547 548 549 550 551 552 553 554 555 556 557 558 559 560
##     2   2   2   2   2   2   2   2   2   2   2   2   2   2   2   2   2   2   2   2
## 561 562 563 564 565 566 567 568 569
##     2   2   2   2   2   2   2   2   2
```

kmeans_3$centers

```
##          id radius_mean texture_mean perimeter_mean area_mean smoothness_mean
## 1  88503100    14.70694     20.73714       96.10414  703.5186      0.09790857
```

```
## 2    2507687    14.01102       19.03303       91.15473  643.2129       0.09618264
## 3 896600329    15.59682       21.46273      101.78000  863.4273       0.09438818
##    compactness_mean concavity_mean concave.points_mean symmetry_mean
## 1       0.11389486     0.09856614          0.05582261     0.1847043
## 2       0.10309373     0.08688436          0.04775207     0.1807932
## 3       0.09887636     0.11160127          0.05676355     0.1749727
##   fractal_dimension_mean radius_se texture_se perimeter_se  area_se
## 1             0.06279014 0.4274029   1.096401     2.980616 44.48384
## 2             0.06285447 0.3959795   1.233076     2.807079 38.51406
## 3             0.06032273 0.6715182   1.263664     4.753636 94.82455
##   smoothness_se compactness_se concavity_se concave.points_se symmetry_se
## 1   0.006352543     0.02556279   0.03019136        0.01154913  0.01898424
## 2   0.007081525     0.02536502   0.03184036        0.01174904  0.02076605
## 3   0.009623182     0.02995773   0.04509390        0.01545745  0.02053091
##   fractal_dimension_se radius_worst texture_worst perimeter_worst area_worst
## 1          0.003783869     17.30220      27.47786        114.2601   989.5286
## 2          0.003784427     16.07247      25.37973        105.9302   856.7814
## 3          0.004329909     18.42291      27.41636        121.7718  1243.2273
##   smoothness_worst compactness_worst concavity_worst concave.points_worst
## 1        0.1358306         0.2926386       0.3061407            0.1290910
## 2        0.1318723         0.2493314       0.2669695            0.1123579
## 3        0.1323573         0.2289427       0.2876637            0.1221727
##   symmetry_worst fractal_dimension_worst
## 1      0.3011629              0.08728671
## 2      0.2890645              0.08358965
## 3      0.2643727              0.07848636
```

```
table(kmeans_3$cluster,cancerData[,5])
```

```
##
##     43.79 47.92 47.98 48.34 51.71 53.27 54.09 54.34 54.42 54.53 54.66 55.27
##   1     0     0     0     0     1     0     0     0     0     0     0     0
##   2     1     1     1     1     0     0     1     1     1     1     1     1
##   3     0     0     0     0     0     1     0     0     0     0     0     0
##
##     55.84 56.36 56.74 58.74 58.79 59.01 59.2 59.26 59.6 59.75 59.82 59.96 60.07
##   1     0     0     0     0     0     0    0     0    0     0     0     0     0
##   2     1     1     1     1     2     1    1     1    1     1     0     1     1
##   3     0     0     0     0     0     0    0     0    0     0     1     0     0
##
##     60.11 60.21 60.34 60.73 61.05 61.06 61.24 61.49 61.5 61.64 61.68 61.93
##   1     0     0     0     0     0     0     0     0    0     0     0     0
##   2     1     1     1     1     1     1     1     2    1     1     1     1
##   3     0     0     0     0     0     0     0     0    0     0     0     0
##
##     62.11 62.5 62.92 63 63.19 63.76 63.78 63.95 64.12 64.41 64.55 64.6 64.73
##   1     0    0     0  0     0     0     0     0     0     0     0    0     0
##   2     1    1     1  1     1     1     1     1     1     1     1    1     1
##   3     0    0     0  0     0     0     0     0     0     0     0    0     0
##
##     65.05 65.12 65.31 65.67 65.75 65.85 66.2 66.52 66.62 66.72 66.82 66.85
##   1     0     0     0     0     1     0    0     0     1     0     0     0
##   2     1     1     1     1     0     1    1     1     0     1     1     1
##   3     0     0     0     0     0     0    0     0     0     0     0     0
```

```
## 
##      66.86 67.41 67.49 68.01 68.26 68.51 68.64 68.69 68.77 68.79 68.89 69.14
## 1       0     0     0     1     0     0     0     0     0     0     0     0
## 2       1     1     2     0     1     1     1     1     1     1     1     1
## 3       0     0     0     0     0     0     0     0     0     0     0     0
## 
##      69.28 69.5 70.15 70.21 70.31 70.39 70.41 70.47 70.67 70.79 70.87 70.92
## 1       0    0     0     0     0     0     0     1     0     1     0     0
## 2       1    1     1     1     1     1     1     0     2     1     1     1
## 3       0    0     0     0     0     0     0     0     0     0     0     0
## 
##      70.95 71.24 71.25 71.3 71.38 71.49 71.73 71.76 71.79 71.8 71.9 71.94 72.17
## 1       0     0     1     0     0     0     0     1     0     0     0     0     1
## 2       1     1     0     1     1     2     1     0     1     1    1     1     0
## 3       0     0     0     0     0     0     0     0     0     0    0     0     0
## 
##      72.23 72.48 72.49 72.76 73 73.02 73.06 73.16 73.28 73.3 73.34 73.38 73.53
## 1       0     0     0     0  0     0     0     0     1    0     1     0     0
## 2       1     1     1     1  1     1     1     1     0    1     1     1     1
## 3       0     0     0     0  0     0     0     0     0    0     0     0     0
## 
##      73.59 73.66 73.7 73.72 73.73 73.81 73.87 73.88 73.93 73.99 74.2 74.23 74.24
## 1       0     0    0     0     0     0     0     0     0     0    0     0     0
## 2       1     1    1     1     1     1     1     0     1     1    1     1     1
## 3       0     0    0     0     0     0     0     1     0     0    0     0     0
## 
##      74.33 74.34 74.52 74.65 74.68 74.72 74.87 75 75.03 75.17 75.21 75.26 75.27
## 1       0     0     0     0     0     0     0  0     1     0     1     0     0
## 2       1     1     1     1     1     2     1  1     0     1     0     1     1
## 3       0     0     0     0     0     0     0  0     0     0     0     0     0
## 
##      75.46 75.49 75.51 75.54 75.71 75.89 76.09 76.1 76.14 76.2 76.31 76.37 76.38
## 1       0     0     0     0     0     0     0    0     0    0     0     0     0
## 2       1     1     1     1     1     1     1    1     1    1     1     1     1
## 3       0     0     0     0     0     0     0    0     0    0     0     0     0
## 
##      76.39 76.53 76.66 76.77 76.83 76.84 76.85 76.95 77.22 77.23 77.25 77.32
## 1       0     0     0     0     0     0     0     0     0     0     0     0
## 2       1     1     1     1     1     1     1     1     1     1     1     1
## 3       0     0     0     0     0     0     0     0     0     0     0     0
## 
##      77.42 77.58 77.61 77.79 77.83 77.87 77.88 77.93 78.01 78.04 78.07 78.11
## 1       0     1     0     0     0     0     0     0     1     0     0     0
## 2       1     0     1     1     1     1     1     1     0     1     1     1
## 3       0     0     0     0     0     0     0     0     0     0     0     0
## 
##      78.18 78.27 78.29 78.31 78.41 78.54 78.6 78.61 78.75 78.78 78.83 78.85
## 1       1     0     0     0     0     0    0     0     0     0     0     1
## 2       0     1     2     1     1     1    1     1     1     1     2     0
## 3       0     0     0     0     0     0    0     0     0     0     0     0
## 
##      78.94 78.99 79.01 79.08 79.19 79.42 79.47 79.78 79.83 79.85 80.43 80.45
## 1       1     0     0     0     0     0     1     0     0     0     0     0
## 2       0     1     1     1     2     0     0     1     1     1     1     1
```

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```
## 3     0     0     0     0     0     1     0     0     0     0     0     0
##
##    80.62 80.64 80.88 80.98 81.09 81.15 81.25 81.29 81.35 81.37 81.47 81.72
## 1     0     0     0     1     0     0     1     0     1     0     0     0
## 2     1     1     1     0     1     1     1     1     1     1     1     1
## 3     0     0     0     0     0     0     0     0     0     0     0     0
##
##    81.78 81.87 81.89 81.92 82.01 82.02 82.15 82.29 82.38 82.5 82.51 82.53
## 1     0     0     0     0     0     0     0     1     0     0    0     0
## 2     1     1     1     1     1     1     1     0     1     1    1     1
## 3     0     0     0     0     0     0     0     0     0     0    0     0
##
##    82.57 82.61 82.63 82.67 82.69 82.71 82.82 82.85 82.89 83.05 83.14 83.18
## 1     0     0     0     0     1     0     0     0     0     1     0     0
## 2     1     3     1     1     1     1     1     1     1     0     1     1
## 3     0     0     0     0     0     0     0     0     0     0     0     0
##
##    83.19 83.51 83.74 83.97 84.06 84.07 84.08 84.1 84.13 84.18 84.28 84.45
## 1     0     0     0     1     0     0     0    0     0     0     0     0
## 2     1     0     1     0     1     1     2    1     1     1     0     1
## 3     0     1     0     0     0     0     0    0     0     0     1     0
##
##    84.52 84.55 84.74 84.88 84.95 85.09 85.24 85.26 85.31 85.42 85.48 85.63
## 1     0     0     0     0     0     0     0     0     0     1     0     0
## 2     1     1     1     1     1     1     1     1     1     0     1     1
## 3     0     0     0     0     0     0     0     0     0     0     0     0
##
##    85.69 85.79 85.84 85.89 85.98 86.1 86.18 86.24 86.34 86.49 86.6 86.87 86.91
## 1     0     0     0     0     0    0     0     0     0     0    0     0     0
## 2     1     1     1     1     2    1     1     1     1     1    1     1     1
## 3     0     0     0     0     0    0     0     0     0     0    0     0     0
##
##    87.02 87.16 87.19 87.21 87.32 87.38 87.44 87.46 87.5 87.76 87.84 87.88
## 1     0     0     0     0     0     1     1     0    0     1     0     0
## 2     1     1     1     2     2     0     0     1    1     2     1     1
## 3     0     0     0     0     0     0     0     0    0     0     0     0
##
##    87.91 88.05 88.06 88.1 88.12 88.27 88.37 88.4 88.44 88.52 88.54 88.59 88.64
## 1     0     0     0    1     0     0     1    0     0     0     1     0     0
## 2     1     1     1    0     1     1     1    1     1     1     0     1     1
## 3     0     0     0    0     0     0     0    0     0     0     0     0     0
##
##    88.68 88.73 88.97 88.99 89.46 89.59 89.75 89.77 89.78 89.79 90.03 90.2 90.3
## 1     0     0     0     0     0     0     0     0     0     1     0    1    0
## 2     1     2     1     1     1     1     1     1     1     0     1    0    1
## 3     0     0     0     0     0     0     0     0     0     0     0    0    0
##
##    90.31 90.43 90.63 90.96 91.12 91.22 91.38 91.43 91.56 92.25 92.33 92.41
## 1     0     0     0     0     0     0     0     0     0     0     0     0
## 2     1     1     1     1     1     1     1     1     1     1     1     1
## 3     0     0     0     0     0     0     0     0     0     0     0     0
##
##    92.51 92.55 92.68 92.87 93.6 93.63 93.77 93.86 93.97 94.15 94.21 94.25
## 1     1     0     1     0    1     0     1     0     1     0     0     1
```

```
## 2     0    1    0    1    0    1    0    1    1    1    1    1
## 3     0    0    0    0    0    0    0    0    0    0    0    0
##
##    94.28 94.29 94.37 94.48 94.49 94.57 94.66 94.7 94.74 94.87 94.89 95.5 95.54
## 1     0     0     0     0     0     0     0     0     0     0     0     0     0
## 2     1     1     1     1     1     1     1     1     1     1     1     1     1
## 3     0     0     0     0     0     0     0     0     0     0     0     0     0
##
##    95.55 95.77 95.81 95.88 96.03 96.12 96.22 96.39 96.42 96.45 96.71 96.73
## 1     0     0     0     0     1     0     0     0     0     0     0     1
## 2     1     1     1     1     0     1     1     1     1     1     1     0
## 3     0     0     0     0     0     0     0     0     0     0     0     0
##
##    96.85 97.03 97.26 97.4 97.41 97.45 97.53 97.65 97.83 97.84 98 98.17 98.22
## 1     0     0     1    0     0     1     0     0     0     1   0     0     0
## 2     1     1     1    1     1     0     1     1     1     0   1     1     1
## 3     0     0     0    0     0     0     0     0     0     0   0     0     0
##
##    98.64 98.73 98.78 98.92 99.58 100 100.2 100.3 100.4 101.2 101.7 102 102.1
## 1     0     0     0     0     0   0     0     0     1     0     0   0     0
## 2     1     1     1     1     1   1     1     1     0     1     1   1     1
## 3     0     0     0     0     0   0     0     0     0     0     0   0     0
##
##    102.4 102.5 102.6 102.7 102.8 102.9 103.2 103.4 103.6 103.7 103.8 104.1
## 1     0     0     0     0     0     1     0     0     1     1     0     0
## 2     2     2     1     1     1     0     1     1     0     1     1     1
## 3     0     0     0     0     0     0     0     0     0     0     0     0
##
##    104.3 104.7 105.1 105.7 105.8 106.2 106.3 106.6 106.9 107 107.1 107.5 108.1
## 1     0     0     0     0     0     1     0     0     0   0     0     0     1
## 2     1     1     1     1     1     0     1     1     1   1     2     1     0
## 3     0     0     0     0     0     0     0     0     0   0     0     0     0
##
##    108.3 108.4 108.8 109 109.3 109.7 109.8 110 110.1 110.2 111 111.2 111.6
## 1     0     0     0   0     1     0     0   0     0     0   0     0     0
## 2     1     1     1   1     1     1     1   1     1     1   1     0     1
## 3     0     0     0   0     0     0     0   0     0     0   0     1     0
##
##    111.8 112.4 112.8 113 113.4 114.2 114.4 114.5 114.6 115 115.1 115.2 116
## 1     1     0     1   0     1     0     0     0     1   0     0     0   0
## 2     0     1     0   1     1     2     1     0     0   1     1     1   1
## 3     0     0     0   0     0     0     0     1     0   0     0     0   0
##
##    116.1 117.3 117.4 117.5 117.8 118.4 118.6 118.7 119 119.6 120.2 120.3 120.8
## 1     0     0     0     0     1     0     0     0   0     0     0     0     0
## 2     1     1     2     1     0     1     1     1   1     1     2     1     1
## 3     0     0     0     0     0     0     0     0   0     0     0     0     0
##
##    120.9 121.1 121.3 121.4 122 122.1 122.8 122.9 123.4 123.6 123.7 124.4 124.8
## 1     0     0     0     0   1     0     0     0     0     0     0     1     0
## 2     1     1     1     1   0     1     1     1     1     1     2     0     1
## 3     0     0     0     0   0     0     0     0     0     0     0     0     0
##
##    125.5 126.2 126.3 126.5 127.2 127.5 127.7 127.9 128 128.1 128.3 128.9 129.1
```

```
## 1    0    0    0    0    0    0    0    0  1    0    0    0    0
## 2    1    1    1    1    1    1    1    1  0    1    1    1    2
## 3    0    0    0    0    0    0    0    0  0    0    0    0    0
##
##    129.5 129.7 129.9 130 130.4 130.5 130.7 131.1 131.2 132.4 132.5 132.9 133.6
## 1    0    0    0  1    0    0    0    0    0    0    0    0    1
## 2    1    1    1  1    1    1    2    1    1    2    1    2    0
## 3    0    0    0  0    0    0    0    0    0    0    0    0    0
##
##    133.7 133.8 134.4 134.7 134.8 135.1 135.7 135.9 137.2 137.8 138.1 138.9
## 1    0    0    1    2    0    1    1    0    0    0    0    0
## 2    1    2    0    0    1    0    0    1    1    2    0    1
## 3    0    0    0    1    0    0    0    0    0    0    1    0
##
##    140.1 140.9 141.3 142 142.7 143 143.7 144.4 147.2 147.3 152.1 152.8 153.5
## 1    0    0    0  0    0  0    0    0    0    0    0    0    1
## 2    1    1    1  1    1  1    1    1    1    1    2    1    0
## 3    0    0    0  0    0  0    0    0    0    0    0    0    0
##
##    155.1 158.9 165.5 166.2 171.5 174.2 182.1 186.9 188.5
## 1    0    0    1    0    0    0    0    0    0
## 2    1    1    0    1    1    1    1    0    1
## 3    0    0    0    0    0    0    0    1    0
```

Memory Clean up

```
rm(list=ls())
```