Quiz1_77931863

Rui Mao

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Question 1 - Multiple Choice Questions

Put your answers for MC questions in the table below;

MC	answer
(a)	iv
(b)	iii
(c)	iv
(d)	iv
(e)	i

Question 2

```
sample_x <- c(78, 86, 97, 91, 83, 89, 92, 88, 79, 68)
sample_x
```

```
##  [1] 78 86 97 91 83 89 92 88 79 68
```

```
set.seed(1413) #DO NOT REMOVE THIS

#your code here
mean_trim <- mean(sample_x, trim=0.2)
mean_trim
```

part a)

```
## [1] 86
```

```
# add your code here
library(boot)

num_bootstraps <- 1000
bootstrap_means <- numeric(num_bootstraps)
for (i in 1:num_bootstraps) {

  bootstrap_sample <- sample(sample_x, replace = TRUE)
  trimmed_mean <- mean(bootstrap_sample, trim = 0.2)
  bootstrap_means[i] <- trimmed_mean
}
standard_error <- sd(bootstrap_means)
standard_error
```

part b)

```
## [1] 2.683526
```

```
# add your code here
critical_value <- qnorm(1 - (1 - 0.9) / 2)
upper <- mean_trim + standard_error * critical_value
lower <- mean_trim - standard_error * critical_value
lower
```

part c)

```
## [1] 81.58599
```

```
upper
```

```
## [1] 90.41401
```

Question 3 Run this code before continue. note that the data is saved under the name `mydata`.

```
#install.package("mlbench") if needed
library(mlbench)
data("PimaIndiansDiabetes2", package = "mlbench")
mydata <- PimaIndiansDiabetes2
```

part a) Use binomial distribution as a link function since diabetes is a binary outcome.

```
#your code
str(mydata)
```

part b)

```
## 'data.frame':    768 obs. of  9 variables:
##  $ pregnant: num  6 1 8 1 0 5 3 10 2 8 ...
##  $ glucose : num  148 85 183 89 137 116 78 115 197 125 ...
##  $ pressure: num  72 66 64 66 40 74 50 NA 70 96 ...
##  $ triceps : num  35 29 NA 23 35 NA 32 NA 45 NA ...
##  $ insulin : num  NA NA NA 94 168 NA 88 NA 543 NA ...
##  $ mass    : num  33.6 26.6 23.3 28.1 43.1 25.6 31 35.3 30.5 NA ...
##  $ pedigree: num  0.627 0.351 0.672 0.167 2.288 ...
##  $ age     : num  50 31 32 21 33 30 26 29 53 54 ...
##  $ diabetes: Factor w/ 2 levels "neg","pos": 2 1 2 1 2 1 2 1 2 2 ...
```

```
newdata <- na.omit(mydata)
newdata
```

```
##     pregnant glucose pressure triceps insulin mass pedigree age diabetes
## 4          1      89       66      23      94 28.1    0.167  21      neg
## 5          0     137       40      35     168 43.1    2.288  33      pos
## 7          3      78       50      32      88 31.0    0.248  26      pos
## 9          2     197       70      45     543 30.5    0.158  53      pos
## 14         1     189       60      23     846 30.1    0.398  59      pos
## 15         5     166       72      19     175 25.8    0.587  51      pos
## 17         0     118       84      47     230 45.8    0.551  31      pos
```

```
## 19          1     103        30       38       83 43.3    0.183  33       neg
## 20          1     115        70       30       96 34.6    0.529  32       pos
## 21          3     126        88       41      235 39.3    0.704  27       neg
## 25         11     143        94       33      146 36.6    0.254  51       pos
## 26         10     125        70       26      115 31.1    0.205  41       pos
## 28          1      97        66       15      140 23.2    0.487  22       neg
## 29         13     145        82       19      110 22.2    0.245  57       neg
## 32          3     158        76       36      245 31.6    0.851  28       pos
## 33          3      88        58       11       54 24.8    0.267  22       neg
## 36          4     103        60       33      192 24.0    0.966  33       neg
## 40          4     111        72       47      207 37.1    1.390  56       pos
## 41          3     180        64       25       70 34.0    0.271  26       neg
## 44          9     171       110       24      240 45.4    0.721  54       pos
## 51          1     103        80       11       82 19.4    0.491  22       neg
## 52          1     101        50       15       36 24.2    0.526  26       neg
## 53          5      88        66       21       23 24.4    0.342  30       neg
## 54          8     176        90       34      300 33.7    0.467  58       pos
## 55          7     150        66       42      342 34.7    0.718  42       neg
## 57          7     187        68       39      304 37.7    0.254  41       pos
## 58          0     100        88       60      110 46.8    0.962  31       neg
## 60          0     105        64       41      142 41.5    0.173  22       neg
## 64          2     141        58       34      128 25.4    0.699  24       neg
## 69          1      95        66       13       38 19.6    0.334  25       neg
## 70          4     146        85       27      100 28.9    0.189  27       neg
## 71          2     100        66       20       90 32.9    0.867  28       pos
## 72          5     139        64       35      140 28.6    0.411  26       neg
## 74          4     129        86       20      270 35.1    0.231  23       neg
## 83          7      83        78       26       71 29.3    0.767  36       neg
## 86          2     110        74       29      125 32.4    0.698  27       neg
## 88          2     100        68       25       71 38.5    0.324  26       neg
## 89         15     136        70       32      110 37.1    0.153  43       pos
## 92          4     123        80       15      176 32.0    0.443  34       neg
## 93          7      81        78       40       48 46.7    0.261  42       neg
## 95          2     142        82       18       64 24.7    0.761  21       neg
## 96          6     144        72       27      228 33.9    0.255  40       neg
## 98          1      71        48       18       76 20.4    0.323  22       neg
## 99          6      93        50       30       64 28.7    0.356  23       neg
## 100         1     122        90       51      220 49.7    0.325  31       pos
## 104         1      81        72       18       40 26.6    0.283  24       neg
## 106         1     126        56       29      152 28.7    0.801  21       neg
## 108         4     144        58       28      140 29.5    0.287  37       neg
## 109         3      83        58       31       18 34.3    0.336  25       neg
## 110         0      95        85       25       36 37.4    0.247  24       pos
## 111         3     171        72       33      135 33.3    0.199  24       pos
## 112         8     155        62       26      495 34.0    0.543  46       pos
## 113         1      89        76       34       37 31.2    0.192  23       neg
## 115         7     160        54       32      175 30.5    0.588  39       pos
## 120         4      99        76       15       51 23.2    0.223  21       neg
## 121         0     162        76       56      100 53.2    0.759  25       pos
## 123         2     107        74       30      100 33.6    0.404  23       neg
## 126         1      88        30       42       99 55.0    0.496  26       pos
## 127         3     120        70       30      135 42.9    0.452  30       neg
## 128         1     118        58       36       94 33.3    0.261  23       neg
## 129         1     117        88       24      145 34.5    0.403  40       pos
```

```
## 131     4   173    70    14   168 29.7   0.361  33   pos
## 133     3   170    64    37   225 34.5   0.356  30   pos
## 135     2    96    68    13    49 21.1   0.647  26   neg
## 136     2   125    60    20   140 33.8   0.088  31   neg
## 137     0   100    70    26    50 30.8   0.597  21   neg
## 138     0    93    60    25    92 28.7   0.532  22   neg
## 140     5   105    72    29   325 36.9   0.159  28   neg
## 143     2   108    52    26    63 32.5   0.318  22   neg
## 145     4   154    62    31   284 32.8   0.237  23   neg
## 148     2   106    64    35   119 30.5   1.400  34   neg
## 151     1   136    74    50   204 37.4   0.399  24   neg
## 153     9   156    86    28   155 34.3   1.189  42   pos
## 154     1   153    82    42   485 40.6   0.687  23   neg
## 157     2    99    52    15    94 24.6   0.637  21   neg
## 158     1   109    56    21   135 25.2   0.833  23   neg
## 159     2    88    74    19    53 29.0   0.229  22   neg
## 160    17   163    72    41   114 40.9   0.817  47   pos
## 162     7   102    74    40   105 37.2   0.204  45   neg
## 163     0   114    80    34   285 44.2   0.167  27   neg
## 166     6   104    74    18   156 29.9   0.722  41   pos
## 170     3   111    90    12    78 28.4   0.495  29   neg
## 172     6   134    70    23   130 35.4   0.542  29   pos
## 174     1    79    60    42    48 43.5   0.678  23   neg
## 175     2    75    64    24    55 29.7   0.370  33   neg
## 176     8   179    72    42   130 32.7   0.719  36   pos
## 178     0   129   110    46   130 67.1   0.319  26   pos
## 182     0   119    64    18    92 34.9   0.725  23   neg
## 187     8   181    68    36   495 30.1   0.615  60   pos
## 188     1   128    98    41    58 32.0   1.321  33   pos
## 189     8   109    76    39   114 27.9   0.640  31   pos
## 190     5   139    80    35   160 31.6   0.361  25   pos
## 192     9   123    70    44    94 33.1   0.374  40   neg
## 196     5   158    84    41   210 39.4   0.395  29   pos
## 198     3   107    62    13    48 22.9   0.678  23   pos
## 199     4   109    64    44    99 34.8   0.905  26   pos
## 200     4   148    60    27   318 30.9   0.150  29   pos
## 204     2    99    70    16    44 20.4   0.235  27   neg
## 205     6   103    72    32   190 37.7   0.324  55   neg
## 207     8   196    76    29   280 37.5   0.605  57   pos
## 209     1    96    64    27    87 33.2   0.289  21   neg
## 214     0   140    65    26   130 42.6   0.431  24   pos
## 215     9   112    82    32   175 34.2   0.260  36   pos
## 216    12   151    70    40   271 41.8   0.742  38   pos
## 217     5   109    62    41   129 35.8   0.514  25   pos
## 218     6   125    68    30   120 30.0   0.464  32   neg
## 221     0   177    60    29   478 34.6   1.072  21   pos
## 224     7   142    60    33   190 28.8   0.687  61   neg
## 225     1   100    66    15    56 23.6   0.666  26   neg
## 226     1    87    78    27    32 34.6   0.101  22   neg
## 229     4   197    70    39   744 36.7   2.329  31   neg
## 230     0   117    80    31    53 45.2   0.089  24   neg
## 232     6   134    80    37   370 46.2   0.238  46   pos
## 233     1    79    80    25    37 25.4   0.583  22   neg
## 235     3    74    68    28    45 29.7   0.293  23   neg
```

```
## 237      7    181      84      21     192 35.9    0.586  51      pos
## 242      4     91      70      32      88 33.1    0.446  22      neg
## 244      6    119      50      22     176 27.1    1.318  33      pos
## 245      2    146      76      35     194 38.2    0.329  29      neg
## 248      0    165      90      33     680 52.3    0.427  23      neg
## 249      9    124      70      33     402 35.4    0.282  34      neg
## 253      2     90      80      14      55 24.4    0.249  24      neg
## 255     12     92      62       7     258 27.6    0.926  44      pos
## 259      1    193      50      16     375 25.9    0.655  24      neg
## 260     11    155      76      28     150 33.3    1.353  51      pos
## 261      3    191      68      15     130 30.9    0.299  34      neg
## 266      5     96      74      18      67 33.6    0.997  43      neg
## 272      2    108      62      32      56 25.2    0.128  21      neg
## 274      1     71      78      50      45 33.2    0.422  21      neg
## 276      2    100      70      52      57 40.5    0.677  25      neg
## 278      0    104      64      23     116 27.8    0.454  23      neg
## 280      2    108      62      10     278 25.3    0.881  22      neg
## 282     10    129      76      28     122 35.9    0.280  39      neg
## 283      7    133      88      15     155 32.4    0.262  37      neg
## 286      7    136      74      26     135 26.0    0.647  51      neg
## 287      5    155      84      44     545 38.7    0.619  34      neg
## 288      1    119      86      39     220 45.6    0.808  29      pos
## 289      4     96      56      17      49 20.8    0.340  26      neg
## 290      5    108      72      43      75 36.1    0.263  33      neg
## 291      0     78      88      29      40 36.9    0.434  21      neg
## 292      0    107      62      30      74 36.6    0.757  25      pos
## 293      2    128      78      37     182 43.3    1.224  31      pos
## 294      1    128      48      45     194 40.5    0.613  24      pos
## 296      6    151      62      31     120 35.5    0.692  28      neg
## 297      2    146      70      38     360 28.0    0.337  29      pos
## 298      0    126      84      29     215 30.7    0.520  24      neg
## 299     14    100      78      25     184 36.6    0.412  46      pos
## 302      2    144      58      33     135 31.6    0.422  25      pos
## 303      5     77      82      41      42 35.8    0.156  35      neg
## 306      2    120      76      37     105 39.7    0.215  29      neg
## 307     10    161      68      23     132 25.5    0.326  47      pos
## 308      0    137      68      14     148 24.8    0.143  21      neg
## 309      0    128      68      19     180 30.5    1.391  25      pos
## 310      2    124      68      28     205 32.9    0.875  30      pos
## 312      0    106      70      37     148 39.4    0.605  22      neg
## 313      2    155      74      17      96 26.6    0.433  27      pos
## 314      3    113      50      10      85 29.5    0.626  25      neg
## 316      2    112      68      22      94 34.1    0.315  26      neg
## 317      3     99      80      11      64 19.3    0.284  30      neg
## 319      3    115      66      39     140 38.1    0.150  28      neg
## 321      4    129      60      12     231 27.5    0.527  31      neg
## 324     13    152      90      33      29 26.8    0.731  43      pos
## 326      1    157      72      21     168 25.6    0.123  24      neg
## 327      1    122      64      32     156 35.1    0.692  30      pos
## 329      2    102      86      36     120 45.5    0.127  23      pos
## 330      6    105      70      32      68 30.8    0.122  37      neg
## 332      2     87      58      16      52 32.7    0.166  25      neg
## 335      1     95      60      18      58 23.9    0.260  22      neg
## 336      0    165      76      43     255 47.9    0.259  26      neg
```

```
## 339      9     152      78      34     171 34.2    0.893  33     pos
## 341      1     130      70      13     105 25.9    0.472  22     neg
## 342      1      95      74      21      73 25.9    0.673  36     neg
## 346      8     126      88      36     108 38.5    0.349  49     neg
## 347      1     139      46      19      83 28.7    0.654  22     neg
## 349      3      99      62      19      74 21.8    0.279  26     neg
## 354      1      90      62      12      43 27.2    0.580  24     neg
## 357      1     125      50      40     167 33.3    0.962  28     pos
## 359     12      88      74      40      54 35.3    0.378  48     neg
## 360      1     196      76      36     249 36.5    0.875  29     pos
## 361      5     189      64      33     325 31.2    0.583  29     pos
## 365      4     147      74      25     293 34.9    0.385  30     neg
## 366      5      99      54      28      83 34.0    0.499  30     neg
## 369      3      81      86      16      66 27.5    0.306  22     neg
## 370      1     133     102      28     140 32.8    0.234  45     pos
## 371      3     173      82      48     465 38.4    2.137  25     pos
## 373      0      84      64      22      66 35.8    0.545  21     neg
## 374      2     105      58      40      94 34.9    0.225  25     neg
## 375      2     122      52      43     158 36.2    0.816  28     neg
## 376     12     140      82      43     325 39.2    0.528  58     pos
## 377      0      98      82      15      84 25.2    0.299  22     neg
## 378      1      87      60      37      75 37.2    0.509  22     neg
## 380      0      93     100      39      72 43.4    1.021  35     neg
## 381      1     107      72      30      82 30.8    0.821  24     neg
## 383      1     109      60       8     182 25.4    0.947  21     neg
## 384      1      90      62      18      59 25.1    1.268  25     neg
## 385      1     125      70      24     110 24.3    0.221  25     neg
## 386      1     119      54      13      50 22.3    0.205  24     neg
## 389      5     144      82      26     285 32.0    0.452  58     pos
## 390      3     100      68      23      81 31.6    0.949  28     neg
## 391      1     100      66      29     196 32.0    0.444  42     neg
## 393      1     131      64      14     415 23.7    0.389  21     neg
## 394      4     116      72      12      87 22.1    0.463  37     neg
## 396      2     127      58      24     275 27.7    1.600  25     neg
## 397      3      96      56      34     115 24.7    0.944  39     neg
## 403      5     136      84      41      88 35.0    0.286  35     pos
## 406      2     123      48      32     165 42.1    0.520  26     neg
## 410      1     172      68      49     579 42.4    0.702  28     pos
## 412      1     112      72      30     176 34.4    0.528  25     neg
## 413      1     143      84      23     310 42.4    1.076  22     neg
## 414      1     143      74      22      61 26.2    0.256  21     neg
## 415      0     138      60      35     167 34.6    0.534  21     pos
## 416      3     173      84      33     474 35.7    0.258  22     pos
## 420      3     129      64      29     115 26.4    0.219  28     pos
## 421      1     119      88      41     170 45.3    0.507  26     neg
## 422      2      94      68      18      76 26.0    0.561  21     neg
## 423      0     102      64      46      78 40.6    0.496  21     neg
## 425      8     151      78      32     210 42.9    0.516  36     pos
## 426      4     184      78      39     277 37.0    0.264  31     pos
## 428      1     181      64      30     180 34.1    0.328  38     pos
## 429      0     135      94      46     145 40.6    0.284  26     neg
## 430      1      95      82      25     180 35.0    0.233  43     pos
## 432      3      89      74      16      85 30.4    0.551  38     neg
## 433      1      80      74      11      60 30.0    0.527  22     neg
```

```
## 442      2     83     66     23     50 32.2    0.497  22     neg
## 443      4    117     64     27    120 33.2    0.230  24     neg
## 446      0    180     78     63     14 59.4    2.420  25     pos
## 447      1    100     72     12     70 25.3    0.658  28     neg
## 448      0     95     80     45     92 36.5    0.330  26     neg
## 449      0    104     64     37     64 33.6    0.510  22     pos
## 450      0    120     74     18     63 30.5    0.285  26     neg
## 451      1     82     64     13     95 21.2    0.415  23     neg
## 453      0     91     68     32    210 39.9    0.381  25     neg
## 455      2    100     54     28    105 37.8    0.498  24     neg
## 458      5     86     68     28     71 30.2    0.364  24     neg
## 459     10    148     84     48    237 37.6    1.001  51     pos
## 460      9    134     74     33     60 25.9    0.460  81     neg
## 461      9    120     72     22     56 20.8    0.733  48     neg
## 463      8     74     70     40     49 35.3    0.705  39     neg
## 466      0    124     56     13    105 21.8    0.452  21     neg
## 467      0     74     52     10     36 27.8    0.269  22     neg
## 468      0     97     64     36    100 36.8    0.600  25     neg
## 470      6    154     78     41    140 46.1    0.571  27     neg
## 477      2    105     80     45    191 33.7    0.711  29     pos
## 478      7    114     76     17    110 23.8    0.466  31     neg
## 479      8    126     74     38     75 25.9    0.162  39     neg
## 481      3    158     70     30    328 35.5    0.344  35     pos
## 483      4     85     58     22     49 27.8    0.306  28     neg
## 484      0     84     82     31    125 38.2    0.233  23     neg
## 486      0    135     68     42    250 42.3    0.365  24     pos
## 487      1    139     62     41    480 40.7    0.536  21     neg
## 488      0    173     78     32    265 46.5    1.159  58     neg
## 491      2     83     65     28     66 36.8    0.629  24     neg
## 494      4    125     70     18    122 28.9    1.144  45     pos
## 498      2     81     72     15     76 30.1    0.547  25     neg
## 499      7    195     70     33    145 25.1    0.163  55     pos
## 500      6    154     74     32    193 29.3    0.839  39     neg
## 501      2    117     90     19     71 25.2    0.313  21     neg
## 504      7     94     64     25     79 33.3    0.738  41     neg
## 507      0    180     90     26     90 36.5    0.314  35     pos
## 508      1    130     60     23    170 28.6    0.692  21     neg
## 509      2     84     50     23     76 30.4    0.968  21     neg
## 512      0    139     62     17    210 22.1    0.207  21     neg
## 515      3     99     54     19     86 25.6    0.154  24     neg
## 516      3    163     70     18    105 31.6    0.268  28     pos
## 517      9    145     88     34    165 30.3    0.771  53     pos
## 520      6    129     90      7    326 19.6    0.582  60     neg
## 521      2     68     70     32     66 25.0    0.187  25     neg
## 522      3    124     80     33    130 33.2    0.305  26     neg
## 527      1     97     64     19     82 18.2    0.299  21     neg
## 528      3    116     74     15    105 26.3    0.107  24     neg
## 529      0    117     66     31    188 30.8    0.493  22     neg
## 531      2    122     60     18    106 29.8    0.717  22     neg
## 533      1     86     66     52     65 41.3    0.917  29     neg
## 535      1     77     56     30     56 33.3    1.251  24     neg
## 539      0    127     80     37    210 36.3    0.804  23     neg
## 540      3    129     92     49    155 36.4    0.968  32     pos
## 541      8    100     74     40    215 39.4    0.661  43     pos
```

```
## 542      3   128      72      25     190 32.4    0.549  27     pos
## 544      4    84      90      23      56 39.5    0.159  25     neg
## 545      1    88      78      29      76 32.0    0.365  29     neg
## 546      8   186      90      35     225 34.5    0.423  37     pos
## 547      5   187      76      27     207 43.6    1.034  53     pos
## 548      4   131      68      21     166 33.1    0.160  28     neg
## 549      1   164      82      43      67 32.8    0.341  50     neg
## 552      3    84      68      30     106 31.9    0.591  25     neg
## 554      1    88      62      24      44 29.9    0.422  23     neg
## 555      1    84      64      23     115 36.9    0.471  28     neg
## 556      7   124      70      33     215 25.5    0.161  37     neg
## 562      0   198      66      32     274 41.3    0.502  28     pos
## 563      1    87      68      34      77 37.6    0.401  24     neg
## 564      6    99      60      19      54 26.9    0.497  32     neg
## 566      2    95      54      14      88 26.1    0.748  22     neg
## 567      1    99      72      30      18 38.6    0.412  21     neg
## 568      6    92      62      32     126 32.0    0.085  46     neg
## 569      4   154      72      29     126 31.3    0.338  37     neg
## 570      0   121      66      30     165 34.3    0.203  33     pos
## 573      3   111      58      31      44 29.5    0.430  22     neg
## 574      2    98      60      17     120 34.7    0.198  22     neg
## 575      1   143      86      30     330 30.1    0.892  23     neg
## 576      1   119      44      47      63 35.5    0.280  25     neg
## 577      6   108      44      20     130 24.0    0.813  35     neg
## 585      8   124      76      24     600 28.7    0.687  52     pos
## 589      3   176      86      27     156 33.3    1.154  52     pos
## 592      2   112      78      50     140 39.4    0.175  24     neg
## 594      2    82      52      22     115 28.5    1.699  25     neg
## 595      6   123      72      45     230 33.6    0.733  34     neg
## 596      0   188      82      14     185 32.0    0.682  22     pos
## 598      1    89      24      19      25 27.8    0.559  21     neg
## 600      1   109      38      18     120 23.1    0.407  26     neg
## 604      7   150      78      29     126 35.2    0.692  54     pos
## 607      1   181      78      42     293 40.0    1.258  22     pos
## 608      1    92      62      25      41 19.5    0.482  25     neg
## 609      0   152      82      39     272 41.5    0.270  27     neg
## 610      1   111      62      13     182 24.0    0.138  23     neg
## 611      3   106      54      21     158 30.9    0.292  24     neg
## 612      3   174      58      22     194 32.9    0.593  36     pos
## 613      7   168      88      42     321 38.2    0.787  40     pos
## 615     11   138      74      26     144 36.1    0.557  50     pos
## 618      2    68      62      13      15 20.1    0.257  23     neg
## 621      2   112      86      42     160 38.4    0.246  28     neg
## 624      0    94      70      27     115 43.5    0.347  21     neg
## 626      4    90      88      47      54 37.7    0.362  29     neg
## 632      0   102      78      40      90 34.5    0.238  24     neg
## 634      1   128      82      17     183 27.5    0.115  22     neg
## 638      2    94      76      18      66 31.6    0.649  23     neg
## 639      7    97      76      32      91 40.9    0.871  32     pos
## 640      1   100      74      12      46 19.5    0.149  28     neg
## 641      0   102      86      17     105 29.3    0.695  27     neg
## 645      3   103      72      30     152 27.6    0.730  27     neg
## 646      2   157      74      35     440 39.4    0.134  30     neg
## 647      1   167      74      17     144 23.4    0.447  33     pos
```

```
## 648        0     179       50       36     159 37.8    0.455  22      pos
## 649       11     136       84       35     130 28.3    0.260  42      pos
## 651        1      91       54       25     100 25.2    0.234  23      neg
## 652        1     117       60       23     106 33.8    0.466  27      neg
## 653        5     123       74       40      77 34.1    0.269  28      neg
## 655        1     106       70       28     135 34.2    0.142  22      neg
## 656        2     155       52       27     540 38.7    0.240  25      pos
## 657        2     101       58       35      90 21.8    0.155  22      neg
## 658        1     120       80       48     200 38.9    1.162  41      neg
## 660        3      80       82       31      70 34.2    1.292  27      pos
## 663        8     167      106       46     231 37.6    0.165  43      pos
## 664        9     145       80       46     130 37.9    0.637  40      pos
## 666        1     112       80       45     132 34.8    0.217  24      neg
## 669        6      98       58       33     190 34.0    0.430  43      neg
## 670        9     154       78       30     100 30.9    0.164  45      neg
## 671        6     165       68       26     168 33.6    0.631  49      neg
## 673       10      68      106       23      49 35.5    0.285  47      neg
## 674        3     123      100       35     240 57.3    0.880  22      neg
## 680        2     101       58       17     265 24.2    0.614  23      neg
## 681        2      56       56       28      45 24.2    0.332  22      neg
## 683        0      95       64       39     105 44.6    0.366  22      neg
## 686        2     129       74       26     205 33.2    0.591  25      neg
## 689        1     140       74       26     180 24.1    0.828  23      neg
## 690        1     144       82       46     180 46.1    0.335  46      pos
## 693        2     121       70       32      95 39.1    0.886  23      neg
## 694        7     129       68       49     125 38.5    0.439  43      pos
## 696        7     142       90       24     480 30.4    0.128  43      pos
## 697        3     169       74       19     125 29.9    0.268  31      pos
## 699        4     127       88       11     155 34.5    0.598  28      neg
## 701        2     122       76       27     200 35.9    0.483  26      neg
## 705        4     110       76       20     100 28.4    0.118  27      neg
## 708        2     127       46       21     335 34.4    0.176  22      neg
## 710        2      93       64       32     160 38.0    0.674  23      pos
## 711        3     158       64       13     387 31.2    0.295  24      neg
## 712        5     126       78       27      22 29.6    0.439  40      neg
## 714        0     134       58       20     291 26.4    0.352  21      neg
## 716        7     187       50       33     392 33.9    0.826  34      pos
## 717        3     173       78       39     185 33.8    0.970  31      pos
## 719        1     108       60       46     178 35.5    0.415  24      neg
## 722        1     114       66       36     200 38.1    0.289  21      neg
## 723        1     149       68       29     127 29.3    0.349  42      pos
## 724        5     117       86       30     105 39.1    0.251  42      neg
## 727        1     116       78       29     180 36.1    0.496  25      neg
## 731        3     130       78       23      79 28.4    0.323  34      pos
## 733        2     174       88       37     120 44.5    0.646  24      pos
## 734        2     106       56       27     165 29.0    0.426  22      neg
## 737        0     126       86       27     120 27.4    0.515  21      neg
## 739        2      99       60       17     160 36.6    0.453  21      neg
## 741       11     120       80       37     150 42.3    0.785  48      pos
## 742        3     102       44       20      94 30.8    0.400  26      neg
## 743        1     109       58       18     116 28.5    0.219  22      neg
## 745       13     153       88       37     140 40.6    1.174  39      neg
## 746       12     100       84       33     105 30.0    0.488  46      neg
## 748        1      81       74       41      57 46.3    1.096  32      neg
```

```
## 749        3     187       70      22     200 36.4    0.408  36      pos
## 752        1     121       78      39      74 39.0    0.261  28      neg
## 754        0     181       88      44     510 43.3    0.222  26      pos
## 756        1     128       88      39     110 36.5    1.057  37      pos
## 761        2      88       58      26      16 28.4    0.766  22      neg
## 764       10     101       76      48     180 32.9    0.171  63      neg
## 766        5     121       72      23     112 26.2    0.245  30      neg
```

```
# your codes here
glm_diabetes <- glm(diabetes ~ pregnant + glucose + pressure + triceps + insulin + mass + pedigree + ag
glm_diabetes
```

part c)

```
##
## Call:  glm(formula = diabetes ~ pregnant + glucose + pressure + triceps +
##     insulin + mass + pedigree + age, family = binomial, data = newdata)
##
## Coefficients:
## (Intercept)     pregnant      glucose     pressure      triceps      insulin
##  -1.004e+01    8.216e-02    3.827e-02   -1.420e-03    1.122e-02   -8.253e-04
##        mass     pedigree          age
##   7.054e-02    1.141e+00    3.395e-02
##
## Degrees of Freedom: 391 Total (i.e. Null);  383 Residual
## Null Deviance:       498.1
## Residual Deviance: 344   AIC: 362
```

part d) The coefficient for glucose is 0.03827, this means that for every one unit increase in the glucose variable, holding all other variables constant, the diabetes increases by 0.03827.

```
summary(glm_diabetes)
```

part e)

```
##
## Call:
## glm(formula = diabetes ~ pregnant + glucose + pressure + triceps +
##     insulin + mass + pedigree + age, family = binomial, data = newdata)
##
## Coefficients:
##               Estimate Std. Error z value Pr(>|z|)
## (Intercept) -1.004e+01  1.218e+00  -8.246  < 2e-16 ***
## pregnant     8.216e-02  5.543e-02   1.482  0.13825
## glucose      3.827e-02  5.768e-03   6.635 3.24e-11 ***
## pressure    -1.420e-03  1.183e-02  -0.120  0.90446
## triceps      1.122e-02  1.708e-02   0.657  0.51128
## insulin     -8.253e-04  1.306e-03  -0.632  0.52757
## mass         7.054e-02  2.734e-02   2.580  0.00989 **
## pedigree     1.141e+00  4.274e-01   2.669  0.00760 **
## age          3.395e-02  1.838e-02   1.847  0.06474 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
##
## (Dispersion parameter for binomial family taken to be 1)
##
##     Null deviance: 498.10  on 391  degrees of freedom
## Residual deviance: 344.02  on 383  degrees of freedom
## AIC: 362.02
##
## Number of Fisher Scoring iterations: 5
```

Add your explanation here: Variables of glucose, mass, pedigree are significant since their p-value is very small.

```
#your code
step(glm_diabetes, direction = "backward")
```

part f)

```
## Start:  AIC=362.02
## diabetes ~ pregnant + glucose + pressure + triceps + insulin +
##     mass + pedigree + age
##
##            Df Deviance    AIC
## - pressure  1   344.04 360.04
## - insulin   1   344.42 360.42
## - triceps   1   344.45 360.45
## <none>          344.02 362.02
## - pregnant  1   346.24 362.24
## - age       1   347.55 363.55
## - mass      1   350.89 366.89
## - pedigree  1   351.58 367.58
## - glucose   1   396.95 412.95
##
## Step:  AIC=360.04
## diabetes ~ pregnant + glucose + triceps + insulin + mass + pedigree +
##     age
##
##            Df Deviance    AIC
## - insulin   1   344.42 358.42
## - triceps   1   344.46 358.46
## <none>          344.04 360.04
## - pregnant  1   346.24 360.24
## - age       1   347.60 361.60
## - mass      1   351.28 365.28
## - pedigree  1   351.67 365.67
## - glucose   1   397.31 411.31
##
## Step:  AIC=358.42
## diabetes ~ pregnant + glucose + triceps + mass + pedigree + age
##
##            Df Deviance    AIC
## - triceps   1   344.89 356.89
## <none>          344.42 358.42
## - pregnant  1   346.74 358.74
## - age       1   347.87 359.87
```

```
## - mass      1   351.32 363.32
## - pedigree  1   351.90 363.90
## - glucose   1   411.11 423.11
##
## Step:  AIC=356.89
## diabetes ~ pregnant + glucose + mass + pedigree + age
##
##            Df Deviance    AIC
## <none>          344.89 356.89
## - pregnant  1   347.23 357.23
## - age       1   348.72 358.72
## - pedigree  1   352.72 362.72
## - mass      1   360.44 370.44
## - glucose   1   411.85 421.85
```

```
##
## Call:  glm(formula = diabetes ~ pregnant + glucose + mass + pedigree +
##     age, family = binomial, data = newdata)
##
## Coefficients:
## (Intercept)     pregnant      glucose         mass     pedigree          age
##    -9.99208      0.08395      0.03646      0.07814      1.15091      0.03436
##
## Degrees of Freedom: 391 Total (i.e. Null);  386 Residual
## Null Deviance:       498.1
## Residual Deviance: 344.9     AIC: 356.9
```

Add your explanation here: The new model is diabetes ~ pregnant + glucose + mass + pedigree + age

Question 4:

Run this code before continue. note that the data is saved under the name `mydata`.

```
attach(mtcars)
mtcars
```

```
##                     mpg cyl  disp  hp drat    wt  qsec vs am gear carb
## Mazda RX4          21.0   6 160.0 110 3.90 2.620 16.46  0  1    4    4
## Mazda RX4 Wag      21.0   6 160.0 110 3.90 2.875 17.02  0  1    4    4
## Datsun 710         22.8   4 108.0  93 3.85 2.320 18.61  1  1    4    1
## Hornet 4 Drive     21.4   6 258.0 110 3.08 3.215 19.44  1  0    3    1
## Hornet Sportabout  18.7   8 360.0 175 3.15 3.440 17.02  0  0    3    2
## Valiant            18.1   6 225.0 105 2.76 3.460 20.22  1  0    3    1
## Duster 360         14.3   8 360.0 245 3.21 3.570 15.84  0  0    3    4
## Merc 240D          24.4   4 146.7  62 3.69 3.190 20.00  1  0    4    2
## Merc 230           22.8   4 140.8  95 3.92 3.150 22.90  1  0    4    2
## Merc 280           19.2   6 167.6 123 3.92 3.440 18.30  1  0    4    4
## Merc 280C          17.8   6 167.6 123 3.92 3.440 18.90  1  0    4    4
## Merc 450SE         16.4   8 275.8 180 3.07 4.070 17.40  0  0    3    3
## Merc 450SL         17.3   8 275.8 180 3.07 3.730 17.60  0  0    3    3
## Merc 450SLC        15.2   8 275.8 180 3.07 3.780 18.00  0  0    3    3
## Cadillac Fleetwood 10.4   8 472.0 205 2.93 5.250 17.98  0  0    3    4
## Lincoln Continental 10.4  8 460.0 215 3.00 5.424 17.82  0  0    3    4
## Chrysler Imperial  14.7   8 440.0 230 3.23 5.345 17.42  0  0    3    4
## Fiat 128           32.4   4  78.7  66 4.08 2.200 19.47  1  1    4    1
## Honda Civic        30.4   4  75.7  52 4.93 1.615 18.52  1  1    4    2
```

```
## Toyota Corolla      33.9   4  71.1  65 4.22 1.835 19.90  1  1    4    1
## Toyota Corona       21.5   4 120.1  97 3.70 2.465 20.01  1  0    3    1
## Dodge Challenger    15.5   8 318.0 150 2.76 3.520 16.87  0  0    3    2
## AMC Javelin         15.2   8 304.0 150 3.15 3.435 17.30  0  0    3    2
## Camaro Z28          13.3   8 350.0 245 3.73 3.840 15.41  0  0    3    4
## Pontiac Firebird    19.2   8 400.0 175 3.08 3.845 17.05  0  0    3    2
## Fiat X1-9           27.3   4  79.0  66 4.08 1.935 18.90  1  1    4    1
## Porsche 914-2       26.0   4 120.3  91 4.43 2.140 16.70  0  1    5    2
## Lotus Europa        30.4   4  95.1 113 3.77 1.513 16.90  1  1    5    2
## Ford Pantera L      15.8   8 351.0 264 4.22 3.170 14.50  0  1    5    4
## Ferrari Dino        19.7   6 145.0 175 3.62 2.770 15.50  0  1    5    6
## Maserati Bora       15.0   8 301.0 335 3.54 3.570 14.60  0  1    5    8
## Volvo 142E          21.4   4 121.0 109 4.11 2.780 18.60  1  1    4    2
```

```
# you can select a column of a dataset by $ operator, for example
# wt_col <- mtcars$wt
```

part a the matrix size is 32x3

```
#your code
wt_col <- mtcars$wt
hp_col <- mtcars$hp
X <- cbind(1, wt_col, hp_col)
y <- mtcars$mpg
p <- 3
X.QR <- qr(X)
R <- qr.R(X.QR, complete = TRUE)
Q <- qr.Q(X.QR, complete = TRUE)
U <- qr.R(X.QR)
U_inverse <- solve(U)
Q1 <- Q[, 1:p]
Q1y <- t(Q1) %*% y
betahat <- solve(U, Q1y)
betahat
```

part b

```
##                [,1]
##        37.22727012
## wt_col -3.87783074
## hp_col -0.03177295
```

```
Q2 <- Q[, -(1:3)]
Q2y <- t(Q2) %*% y
SSE <- t(Q2y) %*% Q2y
SSE
```

part c

```
##          [,1]
## [1,] 195.0478
```

```
# Part d error variance
MSE <- SSE/(32-3)
```

```
MSE
```

```
##           [,1]
## [1,] 6.725785
```