Statistics CH8

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8.1.0.1 Exercise

```
Observed = matrix(c(30,50,20,60),nrow=2,byrow=TRUE)
p_hat = (30+20)/160
Expected = matrix(c(80*p_hat,80*(1-p_hat),80*p_hat,80*(1-p_hat)),nrow=2,byrow=TRUE)
T = sum((Observed - Expected)**2/Expected)
T1 = qchisq(0.95, df = 1)
T2 = qchisq(0.9, df = 1)
c(T, T1, T2)
```

```
## [1] 2.909091 3.841459 2.705543
```

8.1.1.1 Exercise

a.

```
X = c(983, 1041, 1026, 1025, 1033, 968, 1028)
mu0 = 1000
sigma = 25
n = length(X)
Z = (mean(X) - mu0)/(sigma/n**0.5)
Z
```

```
## [1] 1.572332
```

b.

```
Z_cv1 = qnorm(0.975, mean = 0 , sd = 1)
Z_cv1
```

```
## [1] 1.959964
```

c.

```
Z > Z_cv1
```

```
## [1] FALSE
```

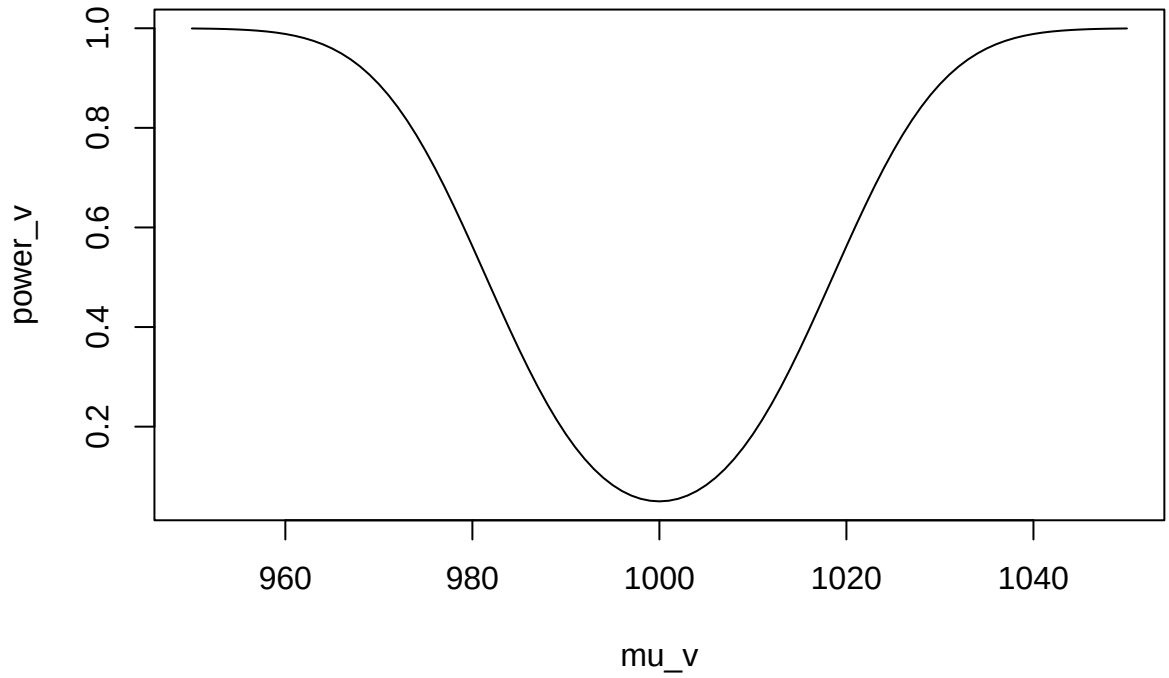
d.

```
power = function(mu){
  pnorm(-Z_cv1, mean = (mu-mu0)/(sigma/n**0.5), sd = 1) + pnorm(Z_cv1, mean = (mu-mu0)/(sigma/n**0.5), s
}
power(980)
```

```
## [1] 0.5622574
```

e.

```
mu_v = seq(950, 1050, 1)
power_v = power(mu_v)
plot(mu_v, power_v, type = 'l')
```



8.1.1.2 Exercise

```r
power = function(mu){
  X1 = rnorm(1e5, mean = (mu-mu0)/(sigma/n**0.5), sd = 1)
  mean(X1 < -Z_cv1 | X1 > Z_cv1)
}
power(980)
```

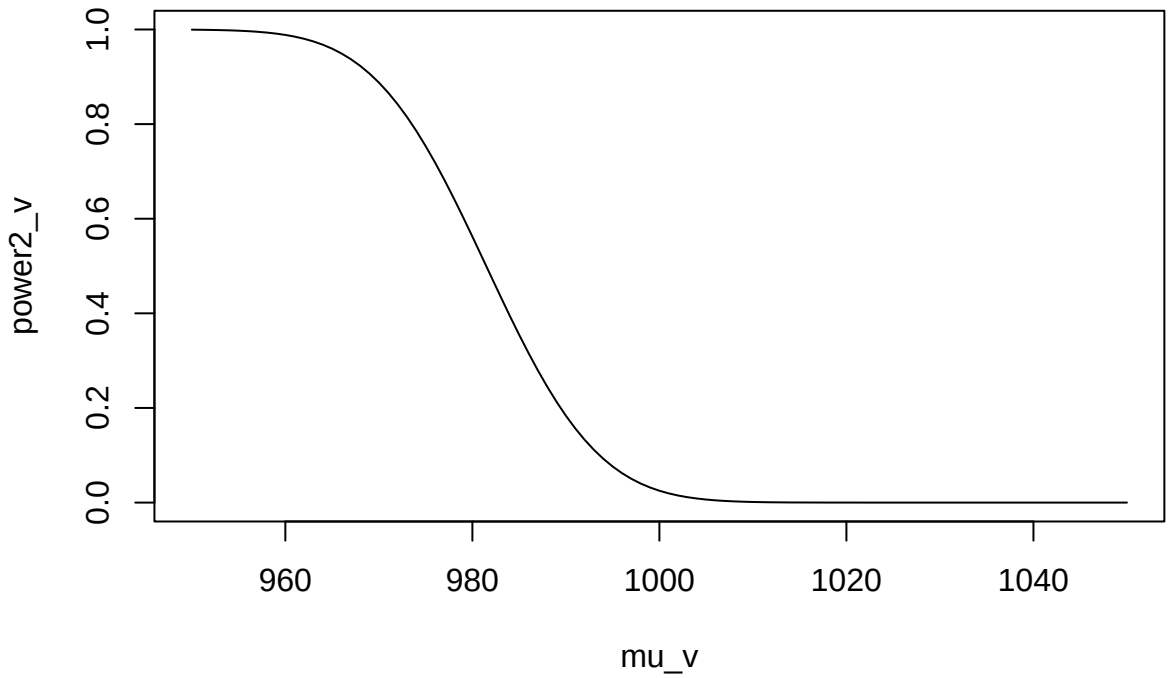
```
## [1] 0.5612
```

8.1.1.3 Exercise

```r
Z_cv2 = qnorm(0.95, mean = 0 , sd = 1)
Z_cv2
```

```
## [1] 1.644854
```

```r
power2 = function(mu){
  pnorm(-Z_cv1, mean = (mu-mu0)/(sigma/n**0.5), sd = 1)
}
power2_v = power2(mu_v)
plot(mu_v, power2_v, type = 'l')
```



8.1.2.2 Exercise ## a.

```
X = c(983, 1041, 1026, 1025, 1033, 968, 1028)
mu0 = 1000
n = length(X)
t = (mean(X) - mu0)/(sd(X)/n**0.5)
t
```

```
## [1] 1.416135
```

b.

```
t_cv = qt(0.975, df = n-1)
t_cv
```

```
## [1] 2.446912
```

c.

```
abs(t) > t_cv
```

```
## [1] FALSE
```

d.

```
power = function(mu){
  k = 1e5
  rej = numeric(k)
  for (i in 1:k){
    X1 = rnorm(n, mean = mu, sd = sd(X))
    t1 = (mean(X1) - mu0)/(sd(X1)/n**0.5)
    rej[i] = abs(t1) > t_cv
  }
  mean(rej)
}
power(980)
```

```
## [1] 0.36213
```

8.2.0.1 Exercise

```
x=140
n=250
p0=seq(0.05,0.95,0.001)
z=(x - n*p0)/sqrt(n*p0*(1-p0))
reject=abs(z)>1.96
cbind(p0,z,reject)
```

```
##           p0           z reject
##   [1,] 0.050  36.99928876      1
##   [2,] 0.051  36.58218085      1
##   [3,] 0.052  36.17661068      1
##   [4,] 0.053  35.78203526      1
##   [5,] 0.054  35.39794687      1
##   [6,] 0.055  35.02387010      1
##   [7,] 0.056  34.65935929      1
##   [8,] 0.057  34.30399617      1
##   [9,] 0.058  33.95738771      1
##  [10,] 0.059  33.61916423      1
##  [11,] 0.060  33.28897758      1
##  [12,] 0.061  32.96649963      1
##  [13,] 0.062  32.65142074      1
##  [14,] 0.063  32.34344849      1
##  [15,] 0.064  32.04230644      1
##  [16,] 0.065  31.74773302      1
##  [17,] 0.066  31.45948055      1
##  [18,] 0.067  31.17731425      1
##  [19,] 0.068  30.90101142      1
##  [20,] 0.069  30.63036067      1
##  [21,] 0.070  30.36516113      1
##  [22,] 0.071  30.10522186      1
##  [23,] 0.072  29.85036116      1
##  [24,] 0.073  29.60040604      1
##  [25,] 0.074  29.35519167      1
##  [26,] 0.075  29.11456092      1
##  [27,] 0.076  28.87836387      1
##  [28,] 0.077  28.64645740      1
##  [29,] 0.078  28.41870479      1
##  [30,] 0.079  28.19497540      1
##  [31,] 0.080  27.97514425      1
##  [32,] 0.081  27.75909177      1
##  [33,] 0.082  27.54670348      1
##  [34,] 0.083  27.33786971      1
##  [35,] 0.084  27.13248535      1
##  [36,] 0.085  26.93044961      1
##  [37,] 0.086  26.73166578      1
##  [38,] 0.087  26.53604103      1
##  [39,] 0.088  26.34348622      1
##  [40,] 0.089  26.15391570      1
##  [41,] 0.090  25.96724715      1
##  [42,] 0.091  25.78340137      1
##  [43,] 0.092  25.60230220      1
##  [44,] 0.093  25.42387632      1
##  [45,] 0.094  25.24805313      1
##  [46,] 0.095  25.07476462      1
##  [47,] 0.096  24.90394526      1
##  [48,] 0.097  24.73553187      1
##  [49,] 0.098  24.56946350      1
##  [50,] 0.099  24.40568137      1
##  [51,] 0.100  24.24412873      1
##  [52,] 0.101  24.08475080      1
##  [53,] 0.102  23.92749467      1
```

```
##   [54,] 0.103  23.77230921      1
##   [55,] 0.104  23.61914501      1
##   [56,] 0.105  23.46795430      1
##   [57,] 0.106  23.31869087      1
##   [58,] 0.107  23.17131003      1
##   [59,] 0.108  23.02576851      1
##   [60,] 0.109  22.88202444      1
##   [61,] 0.110  22.74003727      1
##   [62,] 0.111  22.59976772      1
##   [63,] 0.112  22.46117772      1
##   [64,] 0.113  22.32423039      1
##   [65,] 0.114  22.18888996      1
##   [66,] 0.115  22.05512176      1
##   [67,] 0.116  21.92289215      1
##   [68,] 0.117  21.79216848      1
##   [69,] 0.118  21.66291908      1
##   [70,] 0.119  21.53511320      1
##   [71,] 0.120  21.40872096      1
##   [72,] 0.121  21.28371338      1
##   [73,] 0.122  21.16006228      1
##   [74,] 0.123  21.03774026      1
##   [75,] 0.124  20.91672073      1
##   [76,] 0.125  20.79697780      1
##   [77,] 0.126  20.67848632      1
##   [78,] 0.127  20.56122182      1
##   [79,] 0.128  20.44516048      1
##   [80,] 0.129  20.33027915      1
##   [81,] 0.130  20.21655527      1
##   [82,] 0.131  20.10396690      1
##   [83,] 0.132  19.99249266      1
##   [84,] 0.133  19.88211173      1
##   [85,] 0.134  19.77280386      1
##   [86,] 0.135  19.66454927      1
##   [87,] 0.136  19.55732872      1
##   [88,] 0.137  19.45112345      1
##   [89,] 0.138  19.34591517      1
##   [90,] 0.139  19.24168605      1
##   [91,] 0.140  19.13841869      1
##   [92,] 0.141  19.03609612      1
##   [93,] 0.142  18.93470181      1
##   [94,] 0.143  18.83421959      1
##   [95,] 0.144  18.73463372      1
##   [96,] 0.145  18.63592880      1
##   [97,] 0.146  18.53808983      1
##   [98,] 0.147  18.44110213      1
##   [99,] 0.148  18.34495139      1
##  [100,] 0.149  18.24962362      1
##  [101,] 0.150  18.15510515      1
##  [102,] 0.151  18.06138264      1
##  [103,] 0.152  17.96844304      1
##  [104,] 0.153  17.87627360      1
##  [105,] 0.154  17.78486185      1
##  [106,] 0.155  17.69419561      1
##  [107,] 0.156  17.60426295      1
```

```
## [108,] 0.157  17.51505224      1
## [109,] 0.158  17.42655207      1
## [110,] 0.159  17.33875128      1
## [111,] 0.160  17.25163898      1
## [112,] 0.161  17.16520449      1
## [113,] 0.162  17.07943736      1
## [114,] 0.163  16.99432737      1
## [115,] 0.164  16.90986450      1
## [116,] 0.165  16.82603896      1
## [117,] 0.166  16.74284115      1
## [118,] 0.167  16.66026168      1
## [119,] 0.168  16.57829134      1
## [120,] 0.169  16.49692111      1
## [121,] 0.170  16.41614217      1
## [122,] 0.171  16.33594585      1
## [123,] 0.172  16.25632369      1
## [124,] 0.173  16.17726736      1
## [125,] 0.174  16.09876872      1
## [126,] 0.175  16.02081979      1
## [127,] 0.176  15.94341273      1
## [128,] 0.177  15.86653988      1
## [129,] 0.178  15.79019369      1
## [130,] 0.179  15.71436680      1
## [131,] 0.180  15.63905195      1
## [132,] 0.181  15.56424204      1
## [133,] 0.182  15.48993011      1
## [134,] 0.183  15.41610932      1
## [135,] 0.184  15.34277296      1
## [136,] 0.185  15.26991443      1
## [137,] 0.186  15.19752729      1
## [138,] 0.187  15.12560519      1
## [139,] 0.188  15.05414189      1
## [140,] 0.189  14.98313128      1
## [141,] 0.190  14.91256736      1
## [142,] 0.191  14.84244424      1
## [143,] 0.192  14.77275612      1
## [144,] 0.193  14.70349732      1
## [145,] 0.194  14.63466225      1
## [146,] 0.195  14.56624542      1
## [147,] 0.196  14.49824144      1
## [148,] 0.197  14.43064502      1
## [149,] 0.198  14.36345095      1
## [150,] 0.199  14.29665411      1
## [151,] 0.200  14.23024947      1
## [152,] 0.201  14.16423210      1
## [153,] 0.202  14.09859713      1
## [154,] 0.203  14.03333979      1
## [155,] 0.204  13.96845538      1
## [156,] 0.205  13.90393928      1
## [157,] 0.206  13.83978696      1
## [158,] 0.207  13.77599395      1
## [159,] 0.208  13.71255585      1
## [160,] 0.209  13.64946836      1
## [161,] 0.210  13.58672720      1
```

```
## [162,] 0.211  13.52432822      1
## [163,] 0.212  13.46226729      1
## [164,] 0.213  13.40054036      1
## [165,] 0.214  13.33914346      1
## [166,] 0.215  13.27807267      1
## [167,] 0.216  13.21732412      1
## [168,] 0.217  13.15689402      1
## [169,] 0.218  13.09677864      1
## [170,] 0.219  13.03697429      1
## [171,] 0.220  12.97747735      1
## [172,] 0.221  12.91828426      1
## [173,] 0.222  12.85939151      1
## [174,] 0.223  12.80079564      1
## [175,] 0.224  12.74249324      1
## [176,] 0.225  12.68448096      1
## [177,] 0.226  12.62675551      1
## [178,] 0.227  12.56931361      1
## [179,] 0.228  12.51215208      1
## [180,] 0.229  12.45526775      1
## [181,] 0.230  12.39865751      1
## [182,] 0.231  12.34231830      1
## [183,] 0.232  12.28624710      1
## [184,] 0.233  12.23044093      1
## [185,] 0.234  12.17489686      1
## [186,] 0.235  12.11961200      1
## [187,] 0.236  12.06458351      1
## [188,] 0.237  12.00980856      1
## [189,] 0.238  11.95528440      1
## [190,] 0.239  11.90100829      1
## [191,] 0.240  11.84697756      1
## [192,] 0.241  11.79318953      1
## [193,] 0.242  11.73964160      1
## [194,] 0.243  11.68633119      1
## [195,] 0.244  11.63325575      1
## [196,] 0.245  11.58041278      1
## [197,] 0.246  11.52779981      1
## [198,] 0.247  11.47541438      1
## [199,] 0.248  11.42325411      1
## [200,] 0.249  11.37131660      1
## [201,] 0.250  11.31959952      1
## [202,] 0.251  11.26810056      1
## [203,] 0.252  11.21681744      1
## [204,] 0.253  11.16574790      1
## [205,] 0.254  11.11488974      1
## [206,] 0.255  11.06424075      1
## [207,] 0.256  11.01379877      1
## [208,] 0.257  10.96356168      1
## [209,] 0.258  10.91352736      1
## [210,] 0.259  10.86369374      1
## [211,] 0.260  10.81405876      1
## [212,] 0.261  10.76462040      1
## [213,] 0.262  10.71537666      1
## [214,] 0.263  10.66632557      1
## [215,] 0.264  10.61746517      1
```

```
## [216,] 0.265  10.56879353      1
## [217,] 0.266  10.52030877      1
## [218,] 0.267  10.47200900      1
## [219,] 0.268  10.42389236      1
## [220,] 0.269  10.37595704      1
## [221,] 0.270  10.32820121      1
## [222,] 0.271  10.28062310      1
## [223,] 0.272  10.23322093      1
## [224,] 0.273  10.18599297      1
## [225,] 0.274  10.13893750      1
## [226,] 0.275  10.09205280      1
## [227,] 0.276  10.04533721      1
## [228,] 0.277   9.99878907      1
## [229,] 0.278   9.95240672      1
## [230,] 0.279   9.90618856      1
## [231,] 0.280   9.86013297      1
## [232,] 0.281   9.81423838      1
## [233,] 0.282   9.76850322      1
## [234,] 0.283   9.72292594      1
## [235,] 0.284   9.67750502      1
## [236,] 0.285   9.63223894      1
## [237,] 0.286   9.58712621      1
## [238,] 0.287   9.54216535      1
## [239,] 0.288   9.49735491      1
## [240,] 0.289   9.45269344      1
## [241,] 0.290   9.40817951      1
## [242,] 0.291   9.36381171      1
## [243,] 0.292   9.31958865      1
## [244,] 0.293   9.27550895      1
## [245,] 0.294   9.23157123      1
## [246,] 0.295   9.18777417      1
## [247,] 0.296   9.14411641      1
## [248,] 0.297   9.10059664      1
## [249,] 0.298   9.05721355      1
## [250,] 0.299   9.01396585      1
## [251,] 0.300   8.97085227      1
## [252,] 0.301   8.92787154      1
## [253,] 0.302   8.88502241      1
## [254,] 0.303   8.84230364      1
## [255,] 0.304   8.79971401      1
## [256,] 0.305   8.75725231      1
## [257,] 0.306   8.71491735      1
## [258,] 0.307   8.67270792      1
## [259,] 0.308   8.63062287      1
## [260,] 0.309   8.58866102      1
## [261,] 0.310   8.54682124      1
## [262,] 0.311   8.50510238      1
## [263,] 0.312   8.46350332      1
## [264,] 0.313   8.42202295      1
## [265,] 0.314   8.38066015      1
## [266,] 0.315   8.33941384      1
## [267,] 0.316   8.29828294      1
## [268,] 0.317   8.25726638      1
## [269,] 0.318   8.21636309      1
```

```
## [270,] 0.319   8.17557203      1
## [271,] 0.320   8.13489217      1
## [272,] 0.321   8.09432246      1
## [273,] 0.322   8.05386190      1
## [274,] 0.323   8.01350948      1
## [275,] 0.324   7.97326419      1
## [276,] 0.325   7.93312504      1
## [277,] 0.326   7.89309107      1
## [278,] 0.327   7.85316129      1
## [279,] 0.328   7.81333474      1
## [280,] 0.329   7.77361048      1
## [281,] 0.330   7.73398756      1
## [282,] 0.331   7.69446504      1
## [283,] 0.332   7.65504201      1
## [284,] 0.333   7.61571754      1
## [285,] 0.334   7.57649072      1
## [286,] 0.335   7.53736065      1
## [287,] 0.336   7.49832645      1
## [288,] 0.337   7.45938723      1
## [289,] 0.338   7.42054211      1
## [290,] 0.339   7.38179022      1
## [291,] 0.340   7.34313071      1
## [292,] 0.341   7.30456272      1
## [293,] 0.342   7.26608540      1
## [294,] 0.343   7.22769793      1
## [295,] 0.344   7.18939946      1
## [296,] 0.345   7.15118917      1
## [297,] 0.346   7.11306626      1
## [298,] 0.347   7.07502990      1
## [299,] 0.348   7.03707931      1
## [300,] 0.349   6.99921367      1
## [301,] 0.350   6.96143221      1
## [302,] 0.351   6.92373415      1
## [303,] 0.352   6.88611870      1
## [304,] 0.353   6.84858510      1
## [305,] 0.354   6.81113259      1
## [306,] 0.355   6.77376041      1
## [307,] 0.356   6.73646781      1
## [308,] 0.357   6.69925405      1
## [309,] 0.358   6.66211839      1
## [310,] 0.359   6.62506011      1
## [311,] 0.360   6.58807846      1
## [312,] 0.361   6.55117274      1
## [313,] 0.362   6.51434222      1
## [314,] 0.363   6.47758621      1
## [315,] 0.364   6.44090400      1
## [316,] 0.365   6.40429489      1
## [317,] 0.366   6.36775818      1
## [318,] 0.367   6.33129320      1
## [319,] 0.368   6.29489926      1
## [320,] 0.369   6.25857569      1
## [321,] 0.370   6.22232181      1
## [322,] 0.371   6.18613696      1
## [323,] 0.372   6.15002048      1
```

```
## [324,] 0.373   6.11397171      1
## [325,] 0.374   6.07798999      1
## [326,] 0.375   6.04207470      1
## [327,] 0.376   6.00622518      1
## [328,] 0.377   5.97044079      1
## [329,] 0.378   5.93472091      1
## [330,] 0.379   5.89906490      1
## [331,] 0.380   5.86347215      1
## [332,] 0.381   5.82794203      1
## [333,] 0.382   5.79247393      1
## [334,] 0.383   5.75706724      1
## [335,] 0.384   5.72172135      1
## [336,] 0.385   5.68643567      1
## [337,] 0.386   5.65120959      1
## [338,] 0.387   5.61604253      1
## [339,] 0.388   5.58093388      1
## [340,] 0.389   5.54588307      1
## [341,] 0.390   5.51088952      1
## [342,] 0.391   5.47595265      1
## [343,] 0.392   5.44107188      1
## [344,] 0.393   5.40624664      1
## [345,] 0.394   5.37147637      1
## [346,] 0.395   5.33676050      1
## [347,] 0.396   5.30209848      1
## [348,] 0.397   5.26748975      1
## [349,] 0.398   5.23293376      1
## [350,] 0.399   5.19842995      1
## [351,] 0.400   5.16397779      1
## [352,] 0.401   5.12957674      1
## [353,] 0.402   5.09522624      1
## [354,] 0.403   5.06092578      1
## [355,] 0.404   5.02667481      1
## [356,] 0.405   4.99247281      1
## [357,] 0.406   4.95831925      1
## [358,] 0.407   4.92421361      1
## [359,] 0.408   4.89015537      1
## [360,] 0.409   4.85614401      1
## [361,] 0.410   4.82217902      1
## [362,] 0.411   4.78825989      1
## [363,] 0.412   4.75438611      1
## [364,] 0.413   4.72055718      1
## [365,] 0.414   4.68677259      1
## [366,] 0.415   4.65303185      1
## [367,] 0.416   4.61933445      1
## [368,] 0.417   4.58567991      1
## [369,] 0.418   4.55206773      1
## [370,] 0.419   4.51849743      1
## [371,] 0.420   4.48496851      1
## [372,] 0.421   4.45148050      1
## [373,] 0.422   4.41803290      1
## [374,] 0.423   4.38462526      1
## [375,] 0.424   4.35125708      1
## [376,] 0.425   4.31792789      1
## [377,] 0.426   4.28463723      1
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## [378,] 0.427   4.25138462      1
## [379,] 0.428   4.21816959      1
## [380,] 0.429   4.18499169      1
## [381,] 0.430   4.15185044      1
## [382,] 0.431   4.11874539      1
## [383,] 0.432   4.08567609      1
## [384,] 0.433   4.05264206      1
## [385,] 0.434   4.01964287      1
## [386,] 0.435   3.98667805      1
## [387,] 0.436   3.95374716      1
## [388,] 0.437   3.92084975      1
## [389,] 0.438   3.88798537      1
## [390,] 0.439   3.85515358      1
## [391,] 0.440   3.82235394      1
## [392,] 0.441   3.78958600      1
## [393,] 0.442   3.75684933      1
## [394,] 0.443   3.72414349      1
## [395,] 0.444   3.69146804      1
## [396,] 0.445   3.65882255      1
## [397,] 0.446   3.62620660      1
## [398,] 0.447   3.59361974      1
## [399,] 0.448   3.56106156      1
## [400,] 0.449   3.52853162      1
## [401,] 0.450   3.49602949      1
## [402,] 0.451   3.46355477      1
## [403,] 0.452   3.43110701      1
## [404,] 0.453   3.39868581      1
## [405,] 0.454   3.36629074      1
## [406,] 0.455   3.33392138      1
## [407,] 0.456   3.30157732      1
## [408,] 0.457   3.26925814      1
## [409,] 0.458   3.23696344      1
## [410,] 0.459   3.20469279      1
## [411,] 0.460   3.17244578      1
## [412,] 0.461   3.14022201      1
## [413,] 0.462   3.10802107      1
## [414,] 0.463   3.07584255      1
## [415,] 0.464   3.04368604      1
## [416,] 0.465   3.01155114      1
## [417,] 0.466   2.97943744      1
## [418,] 0.467   2.94734455      1
## [419,] 0.468   2.91527205      1
## [420,] 0.469   2.88321955      1
## [421,] 0.470   2.85118666      1
## [422,] 0.471   2.81917296      1
## [423,] 0.472   2.78717807      1
## [424,] 0.473   2.75520158      1
## [425,] 0.474   2.72324310      1
## [426,] 0.475   2.69130224      1
## [427,] 0.476   2.65937861      1
## [428,] 0.477   2.62747180      1
## [429,] 0.478   2.59558142      1
## [430,] 0.479   2.56370709      1
## [431,] 0.480   2.53184842      1
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## [432,] 0.481   2.50000501      1
## [433,] 0.482   2.46817647      1
## [434,] 0.483   2.43636242      1
## [435,] 0.484   2.40456247      1
## [436,] 0.485   2.37277623      1
## [437,] 0.486   2.34100332      1
## [438,] 0.487   2.30924335      1
## [439,] 0.488   2.27749593      1
## [440,] 0.489   2.24576068      1
## [441,] 0.490   2.21403721      1
## [442,] 0.491   2.18232515      1
## [443,] 0.492   2.15062411      1
## [444,] 0.493   2.11893370      1
## [445,] 0.494   2.08725354      1
## [446,] 0.495   2.05558326      1
## [447,] 0.496   2.02392247      1
## [448,] 0.497   1.99227079      1
## [449,] 0.498   1.96062783      1
## [450,] 0.499   1.92899323      0
## [451,] 0.500   1.89736660      0
## [452,] 0.501   1.86574755      0
## [453,] 0.502   1.83413572      0
## [454,] 0.503   1.80253071      0
## [455,] 0.504   1.77093216      0
## [456,] 0.505   1.73933968      0
## [457,] 0.506   1.70775290      0
## [458,] 0.507   1.67617143      0
## [459,] 0.508   1.64459490      0
## [460,] 0.509   1.61302294      0
## [461,] 0.510   1.58145515      0
## [462,] 0.511   1.54989117      0
## [463,] 0.512   1.51833062      0
## [464,] 0.513   1.48677311      0
## [465,] 0.514   1.45521828      0
## [466,] 0.515   1.42366574      0
## [467,] 0.516   1.39211512      0
## [468,] 0.517   1.36056603      0
## [469,] 0.518   1.32901810      0
## [470,] 0.519   1.29747095      0
## [471,] 0.520   1.26592421      0
## [472,] 0.521   1.23437749      0
## [473,] 0.522   1.20283041      0
## [474,] 0.523   1.17128261      0
## [475,] 0.524   1.13973369      0
## [476,] 0.525   1.10818328      0
## [477,] 0.526   1.07663099      0
## [478,] 0.527   1.04507646      0
## [479,] 0.528   1.01351930      0
## [480,] 0.529   0.98195912      0
## [481,] 0.530   0.95039555      0
## [482,] 0.531   0.91882821      0
## [483,] 0.532   0.88725671      0
## [484,] 0.533   0.85568067      0
## [485,] 0.534   0.82409972      0
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## [486,] 0.535   0.79251346      0
## [487,] 0.536   0.76092151      0
## [488,] 0.537   0.72932349      0
## [489,] 0.538   0.69771902      0
## [490,] 0.539   0.66610770      0
## [491,] 0.540   0.63448916      0
## [492,] 0.541   0.60286300      0
## [493,] 0.542   0.57122884      0
## [494,] 0.543   0.53958630      0
## [495,] 0.544   0.50793497      0
## [496,] 0.545   0.47627448      0
## [497,] 0.546   0.44460444      0
## [498,] 0.547   0.41292444      0
## [499,] 0.548   0.38123411      0
## [500,] 0.549   0.34953305      0
## [501,] 0.550   0.31782086      0
## [502,] 0.551   0.28609716      0
## [503,] 0.552   0.25436154      0
## [504,] 0.553   0.22261361      0
## [505,] 0.554   0.19085298      0
## [506,] 0.555   0.15907924      0
## [507,] 0.556   0.12729200      0
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## [510,] 0.559   0.03184526      0
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## [515,] 0.564  -0.12754023      0
## [516,] 0.565  -0.15946712      0
## [517,] 0.566  -0.19141157      0
## [518,] 0.567  -0.22337397      0
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## [521,] 0.570  -0.31937311      0
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## [524,] 0.573  -0.41554887      0
## [525,] 0.574  -0.44764867      0
## [526,] 0.575  -0.47976977      0
## [527,] 0.576  -0.51191260      0
## [528,] 0.577  -0.54407759      0
## [529,] 0.578  -0.57626516      0
## [530,] 0.579  -0.60847575      0
## [531,] 0.580  -0.64070979      0
## [532,] 0.581  -0.67296770      0
## [533,] 0.582  -0.70524993      0
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## [536,] 0.585  -0.80224687      0
## [537,] 0.586  -0.83463074      0
## [538,] 0.587  -0.86704111      0
## [539,] 0.588  -0.89947845      0
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## [540,] 0.589  -0.93194320      0
## [541,] 0.590  -0.96443580      0
## [542,] 0.591  -0.99695672      0
## [543,] 0.592  -1.02950639      0
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## [549,] 0.598  -1.22543416      0
## [550,] 0.599  -1.25819807      0
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## [554,] 0.603  -1.38958319      0
## [555,] 0.604  -1.42251423      0
## [556,] 0.605  -1.45548014      0
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## [559,] 0.608  -1.55459196      0
## [560,] 0.609  -1.58770225      0
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## [567,] 0.616  -1.82054770      0
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## [570,] 0.619  -1.92094179      0
## [571,] 0.620  -1.95449072      0
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## [573,] 0.622  -2.02171811      1
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## [581,] 0.630  -2.29243435      1
## [582,] 0.631  -2.32648625      1
## [583,] 0.632  -2.36058722      1
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## [585,] 0.634  -2.42893869      1
## [586,] 0.635  -2.46319034      1
## [587,] 0.636  -2.49749339      1
## [588,] 0.637  -2.53184842      1
## [589,] 0.638  -2.56625603      1
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## [593,] 0.642  -2.70442430      1
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## [594,] 0.643  -2.73910387      1
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## [599,] 0.648  -2.91335791      1
## [600,] 0.649  -2.94838440      1
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## [602,] 0.651  -3.01861822      1
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## [604,] 0.653  -3.08909756      1
## [605,] 0.654  -3.12443097      1
## [606,] 0.655  -3.15982777      1
## [607,] 0.656  -3.19528865      1
## [608,] 0.657  -3.23081428      1
## [609,] 0.658  -3.26640536      1
## [610,] 0.659  -3.30206260      1
## [611,] 0.660  -3.33778669      1
## [612,] 0.661  -3.37357834      1
## [613,] 0.662  -3.40943827      1
## [614,] 0.663  -3.44536720      1
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## [616,] 0.665  -3.51743497      1
## [617,] 0.666  -3.55357529      1
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## [620,] 0.669  -3.66243096      1
## [621,] 0.670  -3.69886361      1
## [622,] 0.671  -3.73537127      1
## [623,] 0.672  -3.77195470      1
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## [637,] 0.686  -4.29253325      1
## [638,] 0.687  -4.33035188      1
## [639,] 0.688  -4.36825978      1
## [640,] 0.689  -4.40625786      1
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## [643,] 0.692  -4.52080245      1
## [644,] 0.693  -4.55917057      1
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## [648,] 0.697  -4.71360155      1
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## [675,] 0.724  -5.80082853      1
## [676,] 0.725  -5.84276741      1
## [677,] 0.726  -5.88483785      1
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## [683,] 0.732  -6.14010098      1
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## [689,] 0.738  -6.40045989      1
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## [707,] 0.756  -7.21556370      1
## [708,] 0.757  -7.26248342      1
## [709,] 0.758  -7.30958817      1
## [710,] 0.759  -7.35687999      1
## [711,] 0.760  -7.40436097      1
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## [713,] 0.762  -7.49989891      1
## [714,] 0.763  -7.54796018      1
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## [721,] 0.770  -7.89005478      1
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## [723,] 0.772  -7.98968747      1
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## [726,] 0.775  -8.14078629      1
## [727,] 0.776  -8.19160280      1
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## [734,] 0.783  -8.55389903      1
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## [738,] 0.787  -8.76634773      1
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## [752,] 0.801  -9.54430371      1
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## [771,] 0.820 -10.70040396      1
## [772,] 0.821 -10.76495993      1
## [773,] 0.822 -10.82992342      1
## [774,] 0.823 -10.89530023      1
## [775,] 0.824 -10.96109625      1
## [776,] 0.825 -11.02731752      1
## [777,] 0.826 -11.09397015      1
## [778,] 0.827 -11.16106042      1
## [779,] 0.828 -11.22859471      1
## [780,] 0.829 -11.29657952      1
## [781,] 0.830 -11.36502150      1
## [782,] 0.831 -11.43392742      1
## [783,] 0.832 -11.50330419      1
## [784,] 0.833 -11.57315887      1
## [785,] 0.834 -11.64349867      1
## [786,] 0.835 -11.71433092      1
## [787,] 0.836 -11.78566313      1
## [788,] 0.837 -11.85750297      1
## [789,] 0.838 -11.92985826      1
## [790,] 0.839 -12.00273697      1
## [791,] 0.840 -12.07614729      1
## [792,] 0.841 -12.15009753      1
## [793,] 0.842 -12.22459623      1
## [794,] 0.843 -12.29965207      1
## [795,] 0.844 -12.37527396      1
## [796,] 0.845 -12.45147098      1
## [797,] 0.846 -12.52825244      1
## [798,] 0.847 -12.60562782      1
## [799,] 0.848 -12.68360685      1
## [800,] 0.849 -12.76219947      1
## [801,] 0.850 -12.84141584      1
## [802,] 0.851 -12.92126636      1
## [803,] 0.852 -13.00176166      1
## [804,] 0.853 -13.08291265      1
## [805,] 0.854 -13.16473046      1
## [806,] 0.855 -13.24722650      1
## [807,] 0.856 -13.33041245      1
## [808,] 0.857 -13.41430028      1
## [809,] 0.858 -13.49890224      1
```

```
## [810,] 0.859 -13.58423088      1
## [811,] 0.860 -13.67029906      1
## [812,] 0.861 -13.75711995      1
## [813,] 0.862 -13.84470707      1
## [814,] 0.863 -13.93307425      1
## [815,] 0.864 -14.02223569      1
## [816,] 0.865 -14.11220595      1
## [817,] 0.866 -14.20299995      1
## [818,] 0.867 -14.29463303      1
## [819,] 0.868 -14.38712088      1
## [820,] 0.869 -14.48047965      1
## [821,] 0.870 -14.57472589      1
## [822,] 0.871 -14.66987660      1
## [823,] 0.872 -14.76594924      1
## [824,] 0.873 -14.86296173      1
## [825,] 0.874 -14.96093250      1
## [826,] 0.875 -15.05988048      1
## [827,] 0.876 -15.15982512      1
## [828,] 0.877 -15.26078642      1
## [829,] 0.878 -15.36278494      1
## [830,] 0.879 -15.46584184      1
## [831,] 0.880 -15.56997888      1
## [832,] 0.881 -15.67521845      1
## [833,] 0.882 -15.78158358      1
## [834,] 0.883 -15.88909801      1
## [835,] 0.884 -15.99778616      1
## [836,] 0.885 -16.10767320      1
## [837,] 0.886 -16.21878504      1
## [838,] 0.887 -16.33114840      1
## [839,] 0.888 -16.44479083      1
## [840,] 0.889 -16.55974071      1
## [841,] 0.890 -16.67602733      1
## [842,] 0.891 -16.79368091      1
## [843,] 0.892 -16.91273262      1
## [844,] 0.893 -17.03321466      1
## [845,] 0.894 -17.15516024      1
## [846,] 0.895 -17.27860371      1
## [847,] 0.896 -17.40358053      1
## [848,] 0.897 -17.53012736      1
## [849,] 0.898 -17.65828209      1
## [850,] 0.899 -17.78808392      1
## [851,] 0.900 -17.91957341      1
## [852,] 0.901 -18.05279251      1
## [853,] 0.902 -18.18778467      1
## [854,] 0.903 -18.32459488      1
## [855,] 0.904 -18.46326976      1
## [856,] 0.905 -18.60385762      1
## [857,] 0.906 -18.74640855      1
## [858,] 0.907 -18.89097448      1
## [859,] 0.908 -19.03760933      1
## [860,] 0.909 -19.18636903      1
## [861,] 0.910 -19.33731170      1
## [862,] 0.911 -19.49049769      1
## [863,] 0.912 -19.64598973      1
```

```
## [864,] 0.913 -19.80385303      1
## [865,] 0.914 -19.96415545      1
## [866,] 0.915 -20.12696760      1
## [867,] 0.916 -20.29236299      1
## [868,] 0.917 -20.46041821      1
## [869,] 0.918 -20.63121307      1
## [870,] 0.919 -20.80483078      1
## [871,] 0.920 -20.98135819      1
## [872,] 0.921 -21.16088590      1
## [873,] 0.922 -21.34350858      1
## [874,] 0.923 -21.52932512      1
## [875,] 0.924 -21.71843894      1
## [876,] 0.925 -21.91095822      1
## [877,] 0.926 -22.10699620      1
## [878,] 0.927 -22.30667149      1
## [879,] 0.928 -22.51010841      1
## [880,] 0.929 -22.71743736      1
## [881,] 0.930 -22.92879514      1
## [882,] 0.931 -23.14432547      1
## [883,] 0.932 -23.36417937      1
## [884,] 0.933 -23.58851565      1
## [885,] 0.934 -23.81750147      1
## [886,] 0.935 -24.05131290      1
## [887,] 0.936 -24.29013552      1
## [888,] 0.937 -24.53416515      1
## [889,] 0.938 -24.78360851      1
## [890,] 0.939 -25.03868408      1
## [891,] 0.940 -25.29962296      1
## [892,] 0.941 -25.56666980      1
## [893,] 0.942 -25.84008388      1
## [894,] 0.943 -26.12014022      1
## [895,] 0.944 -26.40713089      1
## [896,] 0.945 -26.70136631      1
## [897,] 0.946 -27.00317686      1
## [898,] 0.947 -27.31291449      1
## [899,] 0.948 -27.63095461      1
## [900,] 0.949 -27.95769813      1
## [901,] 0.950 -28.29357375      1
```

8.2.0.2 Exercise

```
x=140
n=250
p0=seq(0.05,0.95,0.001)
z_cv = pnorm(0.95)
z=(x - n*p0)/sqrt(n*p0*(1-p0))
reject=abs(z)>z_cv
a = cbind(p0,z,reject)
# c(0.534, 0.585)
```

8.2.1.3 Exercise

```
X = c(983, 1041, 1026, 1025, 1033, 968, 1028)
mu0 = 950:1050
sigma = 25
n = length(X)
Z = (mean(X) - mu0)/(sigma/n**0.5)
Z_cv = qnorm(0.975)
rej = abs(Z) > Z_cv
test = as.data.frame(cbind(mu0, Z, rej))
test$mu0[test$rej == 0]
```

```
##  [1]  997  998  999 1000 1001 1002 1003 1004 1005 1006 1007 1008 1009 1010 1011
## [16] 1012 1013 1014 1015 1016 1017 1018 1019 1020 1021 1022 1023 1024 1025 1026
## [31] 1027 1028 1029 1030 1031 1032 1033
```