

Topic 26

```
3 # First input the matrix that has perfect independence
4 matrix_perfect <- matrix(
5   c( 24, 20, 12, 36, 30, 18, 30, 25, 15, 24, 20, 12),
6   ncol=3, nrow=4, byrow=TRUE)
7 matrix_perfect
```

```
> #
> # First input the matrix that has perfect independence
> matrix_perfect <- matrix(
+   c( 24, 20, 12, 36, 30, 18, 30, 25, 15, 24, 20, 12),
+   ncol=3, nrow=4, byrow=TRUE)
> matrix_perfect
      [,1] [,2] [,3]
[1,]  24  20  12
[2,]  36  30  18
[3,]  30  25  15
[4,]  24  20  12
```

```
8 # Now, generate all the related tables
9 source("../crosstab.R")
10 crosstab( matrix_perfect )
```

```
> # Now, generate all the related tables
:> source("../crosstab.R")
:> crosstab( matrix_perfect )
: chi sq val deg. freedom      attained
```

```
0          6          1
```

topic 26.R × totals × row_percent × col_percent × tot_percent × expected × diff ×

diff × Environment

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, 12),

topic 26.R

totals

row_percent

col_percent

tot_percent

expected

diff

diff_sqr

chisqr_values

| | c 1 | c 2 | c 3 | Total |
|-------|-----|-----|-----|-------|
| r 1 | 24 | 20 | 12 | 56 |
| r 2 | 36 | 30 | 18 | 84 |
| r 3 | 30 | 25 | 15 | 70 |
| r 4 | 24 | 20 | 12 | 56 |
| Total | 114 | 95 | 57 | 266 |

| | c 1 | c 2 | c 3 | Total |
|-------|-----------|-----------|-----------|-------|
| r 1 | 0.4285714 | 0.3571429 | 0.2142857 | 1 |
| r 2 | 0.4285714 | 0.3571429 | 0.2142857 | 1 |
| r 3 | 0.4285714 | 0.3571429 | 0.2142857 | 1 |
| r 4 | 0.4285714 | 0.3571429 | 0.2142857 | 1 |
| Total | 0.4285714 | 0.3571429 | 0.2142857 | 1 |

| | c 1 | c 2 | c 3 | Total |
|-------|-----------|-----------|-----------|-----------|
| r 1 | 0.2105263 | 0.2105263 | 0.2105263 | 0.2105263 |
| r 2 | 0.3157895 | 0.3157895 | 0.3157895 | 0.3157895 |
| r 3 | 0.2631579 | 0.2631579 | 0.2631579 | 0.2631579 |
| r 4 | 0.2105263 | 0.2105263 | 0.2105263 | 0.2105263 |
| Total | 1.0000000 | 1.0000000 | 1.0000000 | 1.0000000 |

| | c 1 | c 2 | c 3 | Total |
|-------|------------|------------|------------|-----------|
| r 1 | 0.09022556 | 0.07518797 | 0.04511278 | 0.2105263 |
| r 2 | 0.13533835 | 0.11278195 | 0.06766917 | 0.3157895 |
| r 3 | 0.11278195 | 0.09398496 | 0.05639098 | 0.2631579 |
| r 4 | 0.09022556 | 0.07518797 | 0.04511278 | 0.2105263 |
| Total | 0.42857143 | 0.35714286 | 0.21428571 | 1.0000000 |

| | c 1 | c 2 | c 3 |
|-----|-----|-----|-----|
| r 1 | 24 | 20 | 12 |
| r 2 | 36 | 30 | 18 |
| r 3 | 30 | 25 | 15 |
| r 4 | 24 | 20 | 12 |

| | c 1 | c 2 | c 3 |
|-----|-----|-----|-----|
| r 1 | 0 | 0 | 0 |
| r 2 | 0 | 0 | 0 |
| r 3 | 0 | 0 | 0 |
| r 4 | 0 | 0 | 0 |

```

12 # Now, repeat the same thing, but change 1 value
13 matrix_perfect <- matrix(
14   c( 25, 20, 12, 36, 30, 18,
15     30, 25, 15, 24, 20, 12),
16   ncol=3, nrow=4, byrow=TRUE)
17 matrix_perfect
18 # and get the new tables
19 crosstab( matrix_perfect )

```



```
> # Now, repeat the same thing, but change 1 value
> matrix_perfect <- matrix(
+   c( 25, 20, 12, 36, 30, 18,
+     30, 25, 15, 24, 20, 12),
+   ncol=3, nrow=4, byrow=TRUE)
```

```
> matrix_perfect
      [,1] [,2] [,3]
[1,]  25  20  12
[2,]  36  30  18
[3,]  30  25  15
[4,]  24  20  12
```

```
> # and get the new tables
> crosstab( matrix_perfect )
  chi sq val deg. freedom    attained
0.01837546  6.00000000  0.99999987
```

```
20 # rather than look at the small print in the View tabs
21 row_percent
```

```
> # rather than look at the small print in the View tabs
> row_percent
```

| | c 1 | c 2 | c 3 | Total |
|-------|-----------|-----------|-----------|-------|
| r 1 | 0.4385965 | 0.3508772 | 0.2105263 | 1 |
| r 2 | 0.4285714 | 0.3571429 | 0.2142857 | 1 |
| r 3 | 0.4285714 | 0.3571429 | 0.2142857 | 1 |
| r 4 | 0.4285714 | 0.3571429 | 0.2142857 | 1 |
| Total | 0.4307116 | 0.3558052 | 0.2134831 | 1 |

```
23 # Now let us look at the other data on the video
24 matrix_other <- matrix(
25   c( 26, 23, 13, 27, 40, 16, 35, 19, 10, 21, 13, 14),
26   ncol=3, nrow=4, byrow=TRUE)
27 matrix_other
```

```
> # Now let us look at the other data on the video
> matrix_other <- matrix(
+   c( 26, 23, 13, 27, 40, 16, 35, 19, 10, 21, 13, 14),
+   ncol=3, nrow=4, byrow=TRUE)
```

```
> matrix_other
      [,1] [,2] [,3]
[1,]  26  23  13
[2,]  27  40  16
[3,]  35  19  10
[4,]  21  13  14
```

```
28 # and get the new tables
29 crosstab( matrix_other )
```

```
> # and get the new tables
> crosstab( matrix_other )
chi sq val deg. freedom attained
11.77495262 6.00000000 0.06718181
```

| | c 1 | c 2 | c 3 | Total |
|-------|-----|-----|-----|-------|
| r 1 | 26 | 23 | 13 | 62 |
| r 2 | 27 | 40 | 16 | 83 |
| r 3 | 35 | 19 | 10 | 64 |
| r 4 | 21 | 13 | 14 | 48 |
| Total | 109 | 95 | 53 | 257 |

| | c 1 | c 2 | c 3 | Total |
|-------|-----------|-----------|-----------|-------|
| r 1 | 0.4193548 | 0.3709677 | 0.2096774 | 1 |
| r 2 | 0.3253012 | 0.4819277 | 0.1927711 | 1 |
| r 3 | 0.5468750 | 0.2968750 | 0.1562500 | 1 |
| r 4 | 0.4375000 | 0.2708333 | 0.2916667 | 1 |
| Total | 0.4241245 | 0.3696498 | 0.2062257 | 1 |

| | c 1 | c 2 | c 3 | Total |
|-------|-----------|-----------|-----------|-----------|
| r 1 | 0.2385321 | 0.2421053 | 0.2452830 | 0.2412451 |
| r 2 | 0.2477064 | 0.4210526 | 0.3018868 | 0.3229572 |
| r 3 | 0.3211009 | 0.2000000 | 0.1886792 | 0.2490272 |
| r 4 | 0.1926606 | 0.1368421 | 0.2641509 | 0.1867704 |
| Total | 1.0000000 | 1.0000000 | 1.0000000 | 1.0000000 |

| | c 1 | c 2 | c 3 | Total |
|-------|------------|------------|------------|-----------|
| r 1 | 0.10116732 | 0.08949416 | 0.05058366 | 0.2412451 |
| r 2 | 0.10505837 | 0.15564202 | 0.06225681 | 0.3229572 |
| r 3 | 0.13618677 | 0.07392996 | 0.03891051 | 0.2490272 |
| r 4 | 0.08171206 | 0.05058366 | 0.05447471 | 0.1867704 |
| Total | 0.42412451 | 0.36964981 | 0.20622568 | 1.0000000 |

| | c 1 | c 2 | c 3 |
|-----|----------|----------|-----------|
| r 1 | 26.29572 | 22.91829 | 12.785992 |
| r 2 | 35.20233 | 30.68093 | 17.116732 |
| r 3 | 27.14397 | 23.65759 | 13.198444 |
| r 4 | 20.35798 | 17.74319 | 9.898833 |

| | c 1 | c 2 | c 3 |
|-----|------------|-------------|------------|
| r 1 | -0.2957198 | 0.08171206 | 0.2140078 |
| r 2 | -8.2023346 | 9.31906615 | -1.1167315 |
| r 3 | 7.8560311 | -4.65758755 | -3.1984436 |
| r 4 | 0.6420233 | -4.74319066 | 4.1011673 |

| | c 1 | c 2 | c 3 |
|-----|-------------|--------------|-------------|
| r 1 | 0.08745023 | 0.006676861 | 0.04579933 |
| r 2 | 67.27829339 | 86.844993868 | 1.24708928 |
| r 3 | 61.71722509 | 21.693121773 | 10.23004133 |
| r 4 | 0.41219398 | 22.497857651 | 16.81957335 |

| | c 1 | c 2 | c 3 |
|-----|-------------|--------------|-------------|
| r 1 | 0.003325645 | 0.0002913333 | 0.003581993 |
| r 2 | 1.911188394 | 2.8305850887 | 0.072857910 |
| r 3 | 2.273699376 | 0.9169625486 | 0.775094523 |
| r 4 | 0.020247296 | 1.2679713632 | 1.699147150 |

```

32 # And a quick look at the Chi-squared distribution
33 # First verify the last attained result
34 pchisq( 11.77495, 6, lower.tail=FALSE)
35 # Then find the value that has 5% of the area to
36 # the right
37 qchisq( 0.05, 6, lower.tail=FALSE)

```

```

> # And a quick look at the Chi-squared distribution
> # First verify the last attained result
> pchisq( 11.77495, 6, lower.tail=FALSE)

```

```
[1] 0.06718188
```

```

> # Then find the value that has 5% of the area to
> # the right

```

```
> qchisq( 0.05, 6, lower.tail=FALSE)
```

```
[1] 12.59159
```

```
> # Finally, let us generate a new matrix
```

```
> source("../gnrnd4.R")
```

```
> gnrnd4( key1=895863908, key2=75864894754 )
```

```
style= 8 size= 40 seed= 89586 num digits= 0 alt_sign= 1
```

```
[1] "DONE "
```

```
> matrix_A
```

```

      [,1] [,2] [,3] [,4] [,5]
[1,]  27  48  58  34  61
[2,]  18  15  24  18  26
[3,]  30  41  77  49  59
[4,]  26  48  62  37  42

```

```

> # See if the rows and columns of this are independent,
> # that is the null hypothesis, versus that they are
> # not independent, that is the alternative hypothesis,
> # and do this test at the 0.05 level of significance.

```

```
> crosstab( matrix_A )
```

```

chi sq val deg. freedom attained
11.9465775 12.0000000 0.4499796

```

```

> # This was such fun, let us generate a new matrix
> gnrnd4( key1=114863908, key2=75864894754 )
style= 8 size= 40 seed= 11486 num digits= 0 alt_sign= 1
[1] "DONE "
> matrix_A
      [,1] [,2] [,3] [,4] [,5]
[1,]  19  32  61  32  35
[2,]   9  38  22  17  24
[3,]  36  47  72  34  78
[4,]  36  41  63  46  58
> crosstab( matrix_A )
  chi sq val deg. freedom      attained
30.934297277 12.000000000 0.002015966

```

| | c 1 | c 2 | c 3 | c 4 | c 5 | Total |
|-------|-----|-----|-----|-----|-----|-------|
| r 1 | 19 | 32 | 61 | 32 | 35 | 179 |
| r 2 | 9 | 38 | 22 | 17 | 24 | 110 |
| r 3 | 36 | 47 | 72 | 34 | 78 | 267 |
| r 4 | 36 | 41 | 63 | 46 | 58 | 244 |
| Total | 100 | 158 | 218 | 129 | 195 | 800 |

| | c 1 | c 2 | c 3 | c 4 | c 5 |
|-----|--------|---------|---------|----------|----------|
| r 1 | 22.375 | 35.3525 | 48.7775 | 28.86375 | 43.63125 |
| r 2 | 13.750 | 21.7250 | 29.9750 | 17.73750 | 26.81250 |
| r 3 | 33.375 | 52.7325 | 72.7575 | 43.05375 | 65.08125 |
| r 4 | 30.500 | 48.1900 | 66.4900 | 39.34500 | 59.47500 |

| | c 1 | c 2 | c 3 | c 4 | c 5 |
|-----|--------|---------|---------|----------|----------|
| r 1 | -3.375 | -3.3525 | 12.2225 | 3.13625 | -8.63125 |
| r 2 | -4.750 | 16.2750 | -7.9750 | -0.73750 | -2.81250 |
| r 3 | 2.625 | -5.7325 | -0.7575 | -9.05375 | 12.91875 |
| r 4 | 5.500 | -7.1900 | -3.4900 | 6.65500 | -1.47500 |

| | c 1 | c 2 | c 3 | c 4 | c 5 |
|-----|-----------|-----------|-------------|------------|------------|
| r 1 | 11.390625 | 11.23926 | 149.3895062 | 9.8360641 | 74.498477 |
| r 2 | 22.562500 | 264.87562 | 63.6006250 | 0.5439063 | 7.910156 |
| r 3 | 6.890625 | 32.86156 | 0.5738062 | 81.9703891 | 166.894102 |
| r 4 | 30.250000 | 51.69610 | 12.1801000 | 44.2890250 | 2.175625 |

| | c 1 | c 2 | c 3 | c 4 | c 5 |
|-----|-----------|------------|-------------|-----------|-----------|
| r 1 | 0.5090782 | 0.3179197 | 3.062672467 | 0.3407757 | 1.7074568 |
| r 2 | 1.6409091 | 12.1922037 | 2.121788991 | 0.0306642 | 0.2950175 |
| r 3 | 0.2064607 | 0.6231746 | 0.007886558 | 1.9039082 | 2.5643961 |
| r 4 | 0.9918033 | 1.0727558 | 0.183186945 | 1.1256583 | 0.0365805 |