Exercise 1: Conduct the quadrat test for complete spatial randomness on the cells data set. Carry out the analysis using a 2x2 grid, a 3x3 grid, and a 4x4 grid. Is there evidence of regularity or clustering on one scale but not the others? Use $\alpha = .05$, and carry out just 2-sided test.
Please summarize your results, including a table of counts for each for each of the grid sizes and data sets.
the cell data is included in the spatstat package.

```
library(spatstat)
data(cells)
```

Sample code, which you'll need to modify:

```
tmp <- quadratcount(cells, nx=2, ny=2 )
tmp
plot(tmp)
quadrat.test(cells, nx=2, ny=2, alternative="two.sided")
```

Solution:
Let's recall a few ideas behind conducting a formal test for CSR using quadrat data. First note that we obtain counts y_i for each of the m quadrats, and remember that as a rule of thumb it is suggested that we have $m > 6$ and $y_i > 5$. Our test statistic, the index of dispersion (or χ^2 goodness of fit) is computed by,

$$I = \frac{(m-1)s^2}{\bar{y}}.$$

Note that I is approximately distributed by a χ^2 with $(m-1)$ degrees of freedom. Computing the p-values for the various tests we get, two-tailed (2x the smaller direction),

$$H_0 : \text{CSR}$$
$$H_a : \text{Not CSR}$$

right-tailed,

$$H_0 : \text{CSR}$$
$$H_a : \text{Clustered}$$

and left-tailed,

$$H_0 : \text{CSR}$$
$$H_a : \text{Regular}$$

Conducting the tests in R we get the following counts, p-values, and test statistics,

	2	3	4
p-value	0.1518	0.3391	0.0007283
test statistic	0.47619	4.2857	2.9524
count			2
	3		
	3		
	2		
	2		
	3		
	4		
	3		
	2		
	2		
	2		
	2		
	3		
	4		
	2		
	3		