STAT 371 Discussion #9

1. 2x2 Table (Summary of Lecture notes)

Unpaired data: Apply a virus to 40 mice from groups A and B, and observe infected # of rats in each group.

	N	Y	
A	18	2	20
B	11	9	20
	29	11	40

N: Not infected
Y: Infected

Question: Are the infected rates in the two groups the same?

Paired data: Apply two viruses (A and B to 100 rats and determine whether they are infected.

	I-B	NI-B	
I-A	9	9	18
NI-A	20	62	82
	29	71	100

I-A: Infected with A
NI-A: Not infected with A

Question: Is infection with virus A independent of infection with virus B?

The two questions use the same tests: chi-square test and fisher's exact test.

2. Chi-square test (suggested in exam)

		B: 0	B: 1	
A	0	n_{00}	n_{01}	n_{0+}
	1	n_{10}	n_{11}	n_{1+}
		n_{+0}	n_{+1}	n

		B: 0	B: 1	
A	0	e_{00}	e_{01}	n_{0+}
	1	e_{10}	e_{11}	n_{1+}
		n_{+0}	n_{+1}	n

Use 0 and 1 to represent the levels of rows and columns, respectively.

2.1 By hand

Step 1. Find the expected counts e_{ij} in each cell.

$$e_{ij} = = (n_{i+} \times n_{+j})/n$$

Step 2. Calculate the X^2_{obs} statistics

$$X^2 = \sum \frac{(\text{observed} - \text{expected})^2}{\text{expected}}$$

$$= (n_{00} - e_{00})^2/e_{00} + (n_{01} - e_{01})^2/e_{01} + (n_{10} - e_{10})^2/e_{10} + (n_{11} - e_{11})^2/e_{11}$$

Step 3. Find p-value, p-value = $Pr(X^2 > X^2_{obs})$
Method I: Use chi-square table, $X^2 \sim \chi^2(df=1)$
Method II: 1-pchisq(X^2_{obs},1)

2.2 Use R

Example:

	N	Y	
A	18	2	20
B	11	9	20
	29	11	40

Step 1. Create the data x that R can use
x <- rbind(c(18, 2), c(11, 9))
Step 2: chisq.test(x, correct=FALSE)

3. Fisher's exact test

Example:

	N	Y	
A	18	2	20
B	11	9	20
	29	11	40

Step 1. Create the data table x
x <- rbind(c(18, 2), c(11, 9))
Step 2: **fisher.test(x)**