Statistics in Sports (Math 192) - Quiz 4
Spring 2009 - Brad Hartlaub

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Directions: Please answer all of the questions below. The point values for each problem are indicated in parentheses. Partial credit will be awarded if you show your work. Be careful not to spend too much time on any one part. You may not use any notes or the text, but you can use our course web page and Minitab software.

1. The Minitab output below contains the simulated number of hits in 12 at-bats (a weekend of hitting) for true .300 and .400 hitters. Is it possible to distinguish a true 300 hitter from a true .400 hitter on the basis of 12 at-bats? Use the output to answer the questions below.

Tally for Discrete Variables: p300, p400

p300	Count	Percent	CumPct		p400	Count	Percent	CumPct
0	13	1.30	1.30		1	14	1.40	1.40
1	78	7.80	9.10		2	59	5.90	7.30
2	177	17.70	26.80		3	144	14.40	21.70
3	221	22.10	48.90		4	195	19.50	41.20
4	218	21.80	70.70		5	229	22.90	64.10
5	163	16.30	87.00		6	182	18.20	82.30
6	87	8.70	95.70		7	114	11.40	93.70
7	32	3.20	98.90		8	47	4.70	98.40
8	11	1.10	100.00		9	12	1.20	99.60
N=	1000				10	3	0.30	99.90
					11	1	0.10	100.00
					N=	1000		

a. How many weekends of hitting were simulated for each player? (5) $n = 1000$ weekends were simulated for each player.

b. Find the probability that a true .300 hitter will get exactly four hits during a weekend. (5)

$$\hat{p}_4 = \frac{218}{1000} = .218 \text{ or } 21.8\%$$

c. Find the probability that a true .400 hitter will get exactly four hits during a weekend. (5)

$$\hat{p}_4 = \frac{195}{1000} = .195 \text{ or } 19.5\%$$

Trouble

d. Suppose that you don't know the batter's ability—he either could be a .300 or .400 hitter. Given that you observe this batter gets exactly six hits over the weekend, use the output to estimate the probability that the hitter has a .300 true batting average and a .400 true batting average. (10)

$$\hat{p}_{300} = \frac{87}{87+182} = \frac{87}{269} = .323 \qquad \hat{p}_{400} = \frac{182}{87+182} = \frac{182}{269} = .677$$

The player with 6 hits is much more likely to be a true .400 hitter.

e. Can you really learn anything about a batter's ability on the basis of a weekend of hitting (12 at-bats)? Explain. (10)

A weekend of hitting is a very small number of at-bats (only 12). There is no such thing as the Law of small numbers. The law of Large Numbers says that the proportion of hits will converge to his true ability after a large number

2. Career hitting statistics for Babe Ruth and Roger Maris were obtained from MLB.com and are provided in the table below.

Totals	G	AB	R	H	2B	3B	HR	RBI	BB	SO	OBP	AVG
Ruth	2503	8399	2174	2873	506	136	714	2213	2062	1330	.469	.342
Maris	1463	5101	826	1325	195	42	275	851	652	733	.345	~~.476~~

.260

a. Find 95% confidence intervals for Maris and Ruth's true batting averages. (20)

Use stat > Basic Statistics > 1 Proportion $\hat{p} \pm z^* \sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$

95% CI for Babe Ruth: $(.331919, .352210)$ $(.332, .352)$

" " for Roger Maris: $(.247720, .271786)$ $(.248, .272)$

b. Do your intervals in part (a) support the hypothesis that Babe Ruth was a better hitter than Roger Maris? Explain. (10)

Yes, the CI for Babe Ruth contains larger values and does not overlap with the CI for Roger Maris.

c. If 98% confidence intervals were obtained in part (a), they would be wider than your 95% intervals. Explain why. (10)

The margin of error for CIs consists of two components, the critical value and the standard error. The standard error is the same for both intervals, but the critical value is larger for the 98% CI. More confidence => larger critical => wider CI. value

d. Find a 95% confidence interval for the difference in the players' abilities to hit homeruns. Is Roger Maris a significantly better home run hitter? Explain. (20)

10 CI
10 interpretation.

Stat > Basic Statistics > 2 proportions.

$\hat{P}_{Ruth} = .342 .08501$

$\hat{P}_{Maris} = .260 .053911$

A 95% CI for $P_{RUTH} - P_{Maris}$ is

$(.067283, .098689)$ .0224976 .0397007

Notice that 0 is not contained in the CI.

No, Roger Maris is not a better HR hitter, if he was the confidence limits would both be negative. Babe