Math 159, Spring 2005
Professor Hardin
HW # 4
Solutions

3.4.1
$H_o : P(+) \geq P(-)$
$H_1 : P(+) < P(-)$
T = 1, n=6, $P(Y \leq 1) = 0.1094$
Even though only one person gained weight, because the sample size is so small, we do not have enough evidence to reject the null hypothesis and say that the diet is effective.

3.4.5
You might think this problem is paired, but really, the pairing doesn't make any sense. It makes much more sense to set it up as a binomial in a different way:
Let p = P(give birth between 6pm to 6am)
$H_o : p \leq .5$
$H_1 : p > .5$
T = 60, n = 102
p-value = $P(Y \geq 60|p = .5) = P(Z \geq \frac{59.5-51}{\sqrt{102(.5)(.5)}}) = P(Z \geq 1.683) = 0.046$
There is evidence that more babies are born at night.

3.4.6
Let p = P(insect goes toward the scent)
$H_o : p \leq .5, \text{ or } P(+) \leq P(-)$
$H_1 : p > .5, \text{ or } P(+) > P(-)$
T = 33, n = 49
p-value = $P(Y \geq 33|p = .5) = P(Z \geq \frac{32.5-24.5}{\sqrt{49(.5)(.5)}}) = P(Z \geq 2.29) = 0.011$
There is strong evidence that the scent does in fact attract the insects.

4.8.4
(a) Let p = P(course increases score)
$H_o : p \leq .5, \text{ or } P(+) \leq P(-)$
$H_1 : p > .5, \text{ or } P(+) > P(-)$
T = 8, n=10
p-value = $P(Y \geq 8|p = .5) = 1 - 0.9453 = 0.0547$
There is some evidence that the course increases scores, but the evidence is not strong.

(b) Using the small sample techniques in section 3.1, we use table A4 and find a 95% CI for p to be: (0.444,0.975). That is, we are 95% confident that the true probability of seeing a student's test score improving is between 0.444 and 0.975. (Note that this overlaps 0.5, but we didn't really find significance above, and if we had, the p-value would have had to have been less than 0.025 to be comparable to a two-sided CI.)

(c) Again, using small sample techniques, we find:
$0.0107 = P(Y \leq 1|p = .5) \rightarrow r = 2$
$0.9893 = P(Y \leq 8|p = .5) \rightarrow s = 9$
A 97.86% confidence interval for the median precourse score is $(X^{(2)}, X^{(9)}) = (71, 85)$ points.

(d) p=$P(x_{.75} \leq 75)$
$H_o : p \geq .75$
$H_1 : p < .75$
T = 2, n = 10
p-value = $P(Y \leq 2|n = 10, p = .75) = 0.0563$
There is some evidence that the upper quartile is greater than 75 points.

4.8.21

(a) Let p = P(zip code gets there faster)
$H_o : p \leq .5, \text{ or } P(-) \leq P(+)$
$H_1 : p > .5, \text{ or } P(-) > P(+)$
T = 1, n=8
p-value = $P(Y \leq 1 | n = 8, p = .5) = 0.0352$
There is good evidence that the zip code mail gets there faster.

(b) Again, using the small sample techniques of 3.1, T=7, n=8, we find a 95% confidence interval for the probability that zip code mail gets there faster to be (0.474,0.997). (Again, we would have had to have significance at 0.025 in part (a) in order to compare a one-sided test to a two-sided CI. So, we're not surprised that 0.5 is in the interval.)

(c) p=$P(x_{.75} \leq 3)$
$H_o : p \geq .75$
$H_1 : p < .75$
T = 5, n = 10
p-value = $P(Y \leq 5 | n = 10, p = .75) = 0.0781$
There is some evidence that the 75^{th} quantile is bigger than 3 days, but the evidence is not strong.