Math 106 Exam 2 Solutions

Fall 2008 - Hartlaub

\# 1. (a) $H_0: \mu \geq 3$ lbs

vs $H_1: \mu < 3$ lbs

Test Stat:

$$t = \frac{\bar{x}-\mu_0}{s/\sqrt{n}} = \frac{2.9808-3}{.00943} = -2.04$$

P-value: .026

$H_0: \eta \geq 3$ lbs.

$H_1: \eta < 3$ lbs

Sign Test Stat

Below	Above
15	7

.0669

Conclusion: (Depends on which test is used)

Since .026 < .05, we reject H_0 and conclude that the mean weight of the hamburger packages in the freezer is significantly lower than 3 pounds. [Since .0669 > .05, we cannot reject H_0 with the sign test.]

* The 68-95-99.7 rule, graphical displays, or a normal probability plot should be used to check the normal assumption. A normal probability plot shows clear departures from linear trend so I would recommend the sign test. The dat are clearly not symmetric.

(b) Without an adjustment, the 99% confidence interval can not be used to conduct the one sided test in part (a). The 99% CI could be used to conduct a 2-sided test.

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\# 2. $p = .48$ = probability that a grocery shopper uses coupons; $n = 700$

Using $\hat{p}$:

$$P(\hat{p} \geq .5) \simeq P\left(Z \geq \frac{.5 - .48}{\underbrace{\sqrt{\frac{.48(.52)}{700}}}_{.0182}}\right)$$

$$= P(Z > 1.0591) \underset{MTB}{=} 1 - .8552 = .1448$$

Using Count: $P(X \geq 351) \underset{MTB}{=} .128$ $\quad X \sim b(n=700, p=.48)$

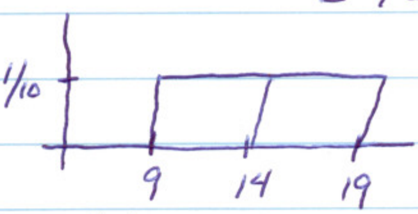
or $X \simeq N(336, 13.2182)$ $\quad \mu_X = np = 700(.48) = 336$

$\sigma_X = \sqrt{np(1-p)} = \sqrt{700(.48)(.52)} = 13.2182$

$$P(X \geq 351) \simeq 1 - P\left(Z \leq \frac{350 - 336}{13.2182}\right)$$

$$= 1 - .8552 = .1448$$

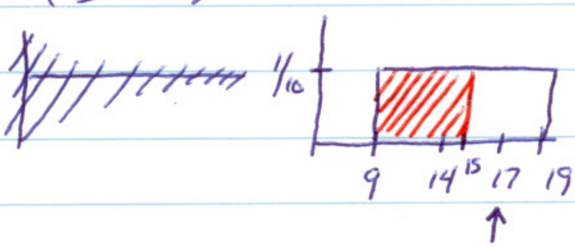
\# 3. a.



Let X = mile marker location of an accident or another problem.

b. $P(X = 13) = 0$

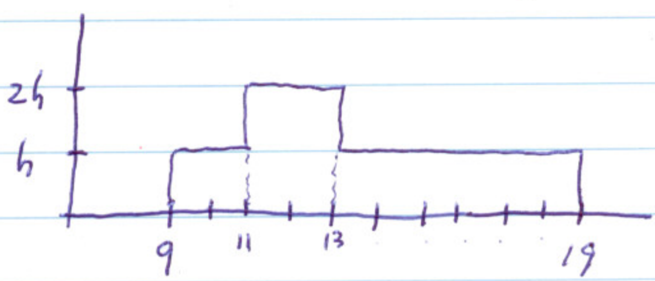
c.



$P(9 \leq X \leq 15) = 6 \cdot \frac{1}{10} = \frac{6}{10}$

$= \boxed{.6}$

d.



$2h + 2(2h) + 6h = 1$

$\Leftrightarrow 12h = 1$

$\Leftrightarrow \boxed{h = 1/12 = .0833}$

e.

$P(10 \leq X \leq 11) = 1/12 = \boxed{.0833}$

Math 106 Exam 2 Solutions

Fall 2008 - Hartlaub

#4. Let X = # of patients with lower back pain caused by weak trunk muscles.

$X \sim B(n=15,\ p=.8)$

a. $P(X=10) = \binom{15}{10}(.8)^{10}(.2)^{5} \underset{MTB}{=} \boxed{.1032}$

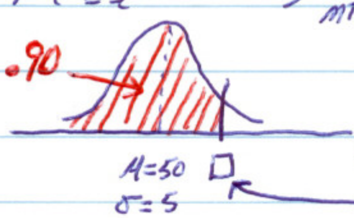
b. $P(X \le 9) \underset{\text{MTB cumulative}}{=} \boxed{.0611}$

c. $P(X>8) = 1 - P(X \le 8) \underset{MTB}{=} 1 - .0181 = \boxed{.9819}$

#5. Let X_i = weekly collections $\sim N(\$50, \$5)$

a. $P(X_i < 42.5) \underset{\text{MTB cumulative}}{=} \boxed{.0668}$

b.

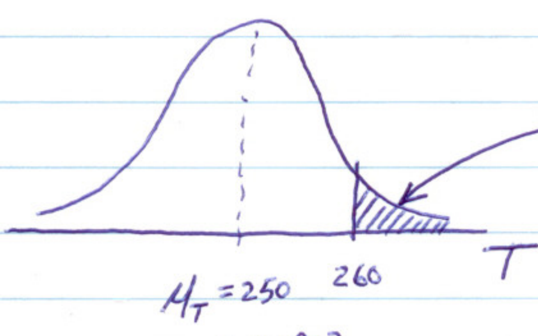


MTB inverse cumulative $\boxed{56.4078}$

c. $T = X_1 + X_2 + X_3 + X_4 + X_5;\ \mu_T = 5\mu_{X_1} = 5(50) = \boxed{250}$

d. $\sigma_T^2 = n\sigma_{X_1}^2 = 5(5)^2 = 125$, so $\sigma_T = \sqrt{125} = \boxed{11.1803}$

e.



$P(T>260) \underset{\text{MTB cumulative}}{=} 1 - .8145 = \boxed{.1855}$

f. $E[T] = \mu_T = n\mu = n(50)$ for n weeks.

We want $50n = 1000 \Rightarrow n = \frac{1000}{50} = \boxed{20 \text{ Sundays}}$

Math 106 Exam 2 Solutions
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#6. a. The outliers are 6.75, 9.75, 10.17

b. The plot shows some slight departures from linear trend, but overall it appears as if the normal distribution would provide a reasonable model for the commuting times.

#7. a. Stat > Basic Stat > 1-Prop.

- Summarized Data 48 Trials 15 Successes
- Options → Use test and interval Based on the normal dist. (# of successes & # of failures are both > 10)

$\hat{p} = \frac{15}{48} = .3125$

95% CI for p (π) is

$$\hat{p} \pm K\sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$$

$(.181374, .443626)$

b. Since $p = .2$ is in the 95% C.I., I agree with the Mars, Inc. claim. We don't have evidence to refute their claim. We are 95% confident that the proportion of red peanut M&M's is between .18 and .44.

#8. a. $\hat{p}$ is the midpoint of the CI, so $\hat{p} = \frac{.1788 + .3212}{2} = \boxed{.25}$

b. Margin of error $= K\sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$

90% CI $\Rightarrow K = 1.6449$

2× Margin of error $= .3212 - .1788 = .1424$

Margin of error $= .0712$

$1.6449\sqrt{\frac{.25(.75)}{n}} = .0712$

$\Leftrightarrow \sqrt{\frac{.25(.75)}{n}} = \frac{.0712}{1.6449} \Leftrightarrow \frac{.25(.75)}{.0019} = n \Leftrightarrow$ $n = 100.0738$ $\boxed{n = 100}$