Stat 3611 Quiz 9
NAME:

1. (5 points) A random sample of 100 automobile owners in Minnesota shows that an automobile is driven on average 23,555 km per year with a standard deviation of 3,900 km (these are sample information). Assume the distribution of automobiles mileage per year in Minnesota is normal.

   (a) Find a 99% confidence interval for the average number of kilometers an automobile driven per year in Minnesota.

   (b) Repeat part (a) if the 3900 km is the standard deviation (i.e., population standard deviation) of the distance driven by ALL automobiles in Minnesotan.

X = mileage per year $\quad X \sim N(\mu, \sigma)$

$\bar{X} = 23555, \quad n = 100, \quad S = 3900, \quad \nu = 99$

(a) $\alpha = 0.01, \quad t_{0.005} \approx 2.627$

99% C.I for μ is $23555 \pm 2.627 \frac{3900}{\sqrt{100}} = 23555 \pm 1016$

[22539, 24571]

(b) $\sigma = 3900 \quad z_{0.005} = 2.575 \quad 23555 \pm 2.575 \cdot \frac{3900}{100} = 23555 \pm 1004$

[22551, 24559]

2. (5 points) A car manufacturer is considering two types of batteries for its car. Sample information on battery life is collected for 20 batteries of type A and type B, respectively. The sample mean and starndard deviation of battery life for type A are 32.91 and 1.57, for type B are 30.47 and 1.74. . Assume the battery life is normally distributed and $\sigma_A = \sigma_B$.

   (a) Find 95% confidence interval of $\mu_A - \mu_B$.

   (b) Decide whether the company should use type A battery or type B battery. Explain your decision.

normal, $\quad \nu = n_A + n_B - 2 = 38 \quad t_{0.025}(38) \approx 2.02$

$n_A = 20, \quad \bar{X}_A = 32.91, \quad S_A = 1.57, \quad n_B = 20, \quad \bar{X}_B = 30.47, \quad S_B = 1.74$

(a) $(\bar{X}_A - \bar{X}_B) \pm t_{0.025} S_p \sqrt{\frac{1}{n_A} + \frac{1}{n_B}} = 2.44 \pm 2.02 \sqrt{\frac{(1.57)^2 + (1.74)^2}{2}} \cdot \sqrt{\frac{1}{20} + \frac{1}{20}}$

$= 2.44 \pm 2.02(0.5240) = 2.44 \pm 1.06$

[1.38, 3.52]

(b) Since $\mu_A - \mu_B \geq 1.38$ with 95% confidence

Type A battery's life is longer $\Rightarrow$ use battery A

3. (5 points) A new rocket-launching system is being considered for deployment of small, short-range rockets. The existing system has $p = 0.8$ as the probability of a successful launch. A sample of 40 experimental launches is made with the new system, and 34 are successful.

   (a) Construct a 95% confidence interval for p. Hint: this is a esimation of proportion.

   (b) Would you conclude that the new system is better? Explain!!!

$\alpha = 0.05$ $\quad z_{\frac{\alpha}{2}} = z_{0.025} = 1.96$ $\quad n = 40$ $\quad x = 34 \Rightarrow \hat{p} = 0.85$

(a) $\hat{p} \pm z_{\frac{\alpha}{2}} \sqrt{\frac{\hat{p}\hat{q}}{n}} = 0.85 \pm 1.96 \sqrt{\frac{(0.85)(0.15)}{40}} = 0.85 \pm 0.11$

$[0.74, 0.96]$

(b) with 95% confidence the probability of a successful launch with the new system is from 74% to 96%. No enough evidence to conclude the new system is better.

SCORE: