KING FAHD UNIVERSITY OF PETROLEUM & MINERALS
DEPARTMENT OF MATHEMATICS AND STATISTICS
Term 161

STAT 213 STATISTICS METHODS FOR ACTUARIES

Wednesday December . 29, 2016

Name: ____ ID #:___________________________

Important Note:

- Show all your work including formulas, intermediate steps and final answer

Question No	Full Marks	Marks Obtained
1	11	
2	25	
3	14	
4	10	
Total	60	

Q1: The manager of a paint supply store wants to estimate the actual amount of paint contained in 1-gallon cans purchased from a nationally known manufacturer. The manufacturer's specifications state that the standard deviation of the amount of paint is equal to .021 gallon. A random sample of 50 cans is selected. A 99% confidence interval estimate of the population mean amount of paint included in a 1-gallon can given by $(0.9863, 1.0017)$.

1. On the basis of these results, do you think the manager has a right to complain to the manufacturer? Why? (*2 pts*)

2. Find the point estimate for the mean amount of paint included in 1-gallon can. (*2 pts*)

3. Must you assume the population amount of paint per can is normally distributed? Explain. (*2 pts*)

4. By how much must the sample size be increased if the length of the given confidence interval to be halved? (*5 pts*)

Q2: An auditor for a government agency needs to evaluate payments by Medicare in a particular zip code during the month of June. A total of 25,068 visits occurred during June in this area. The audit was conducted on a sample of 29 of the reimbursements, with the following results:

- In 12 of the office visits, there was an incorrect amount of reimbursement.
- The amount of reimbursement has mean equal to $93.7 and standard deviation equal to $34.55

On the basis of past experience, the audit believes standard deviation is approximately $25.

1. Do you think that the standard deviation is approximately $25? Test using a 5% level of significant. (*6 pts*)

2. At the .05 level of significance, is there evidence that the mean reimbursement was less than $100? Discuss the underlying assumptions of the test used. (*8 pts*)

3. Construct a 90% confidence interval estimate of the population proportion of reimbursements that contain errors. (*4 pts*)

4. On the basis of the results in part 3 above, is there an evidence that the proportion of incorrect reimbursements in the population was 10 percent? (*2 pts*)

5. Construct a 95% confidence interval estimate of the population total amount of reimbursement for this geographic area in June. (*5 pts*)

Q3: In a packing plant, a machine packs cartons with jars. It is supposed that a new machine will pack faster on the average than the machine currently used. To test that hypothesis, the times it takes each machine to pack ten cartons are recorded. The results, in seconds, are shown in the following table

	Old Machine	New Machine
sample mean	43.23	42.14
Sample standard deviation	0.75	0.683

1. Is it reasonable to assume that the two machines have equal population variances? Test at 5% level of significant. (*6 pts*)

2. Do the data provide sufficient evidence to conclude that, on the average, the new machine packs faster? Perform the required hypothesis test at the 5% level of significance. (*8 pts*)

Q4: We Care Auto Insurance had its staff of actuaries conduct a study to see of vehicle type and loss claim are independent. A random sample of auto claims over six months gives the information in the table:

Type of vehicle	Total Loss Claims per Year per Vehicle			
	SR0 – 999	SR1000 – 2999	SR3000 – 5999	SR6000 or more
Sport car	20	15	15	20
Truck	20	25	35	10
Family Sedan	40	70	20	15
Compact	55	75	50	15

Test the claim that car type and loss claim are independent (*10 pts*)

Formula Sheet

- $\bar{x} \pm z_{\frac{\alpha}{2}} \frac{\sigma}{\sqrt{n}}$, or $\bar{x} \pm z_{\frac{\alpha}{2}} \frac{s}{\sqrt{n}}$, or $\bar{x} \pm t_{\frac{\alpha}{2}, n-1} \frac{s}{\sqrt{n}}$, or $\bar{p} \pm z_{\frac{\alpha}{2}} \sqrt{\frac{\bar{p}(1-\bar{p})}{n}}$
- $n \geq \left(\frac{z_{\frac{\alpha}{2}} \sigma}{e}\right)^2$, or $n \geq \left(\frac{z_{\frac{\alpha}{2}} s}{e}\right)^2$, or $n \geq \left(\frac{z_{\frac{\alpha}{2}}}{e}\right)^2 \pi(1-\pi)$
- $Z_{cal} = \frac{(\bar{x}-\mu_0)\sqrt{n}}{\sigma}$, or $Z_{cal} = \frac{(\bar{x}-\mu_0)\sqrt{n}}{s}$, or $T_{cal} = \frac{(\bar{x}-\mu_0)\sqrt{n}}{s}$, or $Z_{cal} = \frac{(\bar{p}-\pi_0)}{\sqrt{\frac{\pi_0(1-\pi_0)}{n}}}$
- $Z_{cal} = \frac{(\bar{x}_1-\bar{x}_2)-\mu_0}{\sqrt{\frac{\sigma_1^2}{n_1}+\frac{\sigma_2^2}{n_2}}}$ and $(\bar{x}_1 - \bar{x}_2) \pm z_{\frac{\alpha}{2}} \sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}$
- $Z_{cal} = \frac{(\bar{x}_1-\bar{x}_2)-\mu_0}{\sqrt{\frac{s_1^2}{n_1}+\frac{s_2^2}{n_2}}}$ and $(\bar{x}_1 - \bar{x}_2) \pm z_{\frac{\alpha}{2}} \sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}$
- $T_{cal} = \frac{(\bar{x}_1-\bar{x}_2)-\mu_0}{s_p\sqrt{\frac{1}{n_1}+\frac{1}{n_2}}}$ and $(\bar{x}_1 - \bar{x}_2) \pm t_{\frac{\alpha}{2}} s_p \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}$ where $s_p = \sqrt{\frac{(n_1-1)s_1^2+(n_2-1)s_2^2}{n_1+n_2-2}}$
- $T_{cal} = \frac{(\bar{x}_1-\bar{x}_2)-\mu_0}{\sqrt{\frac{s_1^2}{n_1}+\frac{s_2^2}{n_2}}}$ $(\bar{x}_1 - \bar{x}_2) \pm t_{\frac{\alpha}{2}} \sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}$ where $f.d = \frac{\left(\frac{s_1^2}{n_1}+\frac{s_2^2}{n_2}\right)^2}{\frac{\left(\frac{s_1^2}{n_1}\right)^2}{n_1-1}+\frac{\left(\frac{s_2^2}{n_2}\right)^2}{n_2-1}}$
- $Z_{cal} = \frac{(\bar{p}_1-\bar{p}_2)}{\sqrt{\bar{p}(1-\bar{p})\left(\frac{1}{n_1}+\frac{1}{n_2}\right)}}$ and $(\bar{p}_1 - \bar{p}_2) \pm z_{\frac{\alpha}{2}} \sqrt{\frac{\bar{p}_1(1-\bar{p}_1)}{n_1} + \frac{\bar{p}_2(1-\bar{p}_2)}{n_2}}$