**ChE 320\_Spr\_17\_HW 7 Solution**

**4- 58**



The normality assumption appears to be satisfied because the data fall along a straight line.

a) 1) The parameter of interest is the true mean level of polyunsaturated fatty acid, μ.

2) H0: μ = 17

3) H1: μ ≠ 17

4) Test statistic is t0 = 

5) Reject H0  if t0 > tα/2,n-1  where t0.025,5 = 2.571

6) = 16.98 s = 0.319 n = 6

t0 = 

7) P-value = 2P(t > 0.154): for degrees of freedom of 5 we obtain 2(0.40) < P-value = 0.80 < P-value. Because the P-value is greater than 0.05, we fail to reject the null hypothesis.

b) Using the OC curves on Chart v (b), with d = 1.567, when β ≅ 0.1, n = 10. Therefore, the current sample size of 6 is not adequate.

c) For α = 0.01, tα/2,n-1 = t0.005,5 = 4.032





16.455 ≤ μ ≤ 17.505

With 99% confidence, the true mean level of polyunsaturated fatty acid is between 16.455% and 17.505%.

**4- 66**

a) P-value = P(> 22.35): for degrees of freedom of 14 we obtain 0.05 < P-value < 0.1

b) P-value = P(> 23.50): for degrees of freedom of 14 we obtain 0.05 < P-value < 0.1

c) P-value = P(> 25.00): for degrees of freedom of 14 we obtain 0.025 < P-value < 0.05

d) P-value = P(> 28.55): for degrees of freedom of 14 we obtain 0.01 < P-value < 0.025

**4- 70**

a) In order to use χ2 statistic in hypothesis testing and confidence interval construction we need to assume that the underlying distribution is normal.

1) The parameter of interest is the true standard deviation of Izod strength, σ. However, the answer can be found from a hypothesis test on σ2.

2) H0: σ2 = 0.1

3) H1: σ2 ≠ 0.1

4) = 

5) Reject H0 if where  6.84 or where 38.58

6) n = 20, s = 0.328

= 

7) Because 6.84 < 20.441 < 38.58 we fail to reject H0. There is not sufficient evidence to conclude that the true variance of Izod strength is differs from 0.10 ft-lb/in at α = 0.01.

b) P-value = 2P(χ2 > 20.441) for 19 degrees of freedom: 0.20 < 2P(χ2 > 20.441) < 1

c) 99% confidence interval for σ2 :

For α = 0.01 and n = 20,38.58 and6.84



0.053 ≤ σ2 ≤ 0.299

With 99% confidence, the true variance of Izod strength is between 0.053 (ft-lb/in)2 and 0.299

(ft-lb/in)2.

d) Because the hypothesized value falls within this confident interval, we fail to reject the null hypothesis.

**4- 102**

The value of p must be estimated. Let the estimate be denoted by 

sample mean = [0(21) + 1(30) + 2(22) + 3(6) + 4(1)]/80 = 1.2, 

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Value | 0 | 1 | 2 | 3 | 4 |
| Observed | 21 | 30 | 22 | 6 | 1 |
| Expected | 22.59436 | 30.12582 | 18.41022 | 6.818601 | 1.70465 |

Because value 4 has an expected frequency less than 3, combine this category with that of value 3:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Value | 0 | 1 | 2 | 3-4 |
| Observed | 21 | 30 | 22 | 7 |
| Expected | 22.59436 | 30.12582 | 18.41022 | 8.523251 |

The degrees of freedom are k − p − 1 = 4 − 1 − 1 = 2

a) 1) The variable of interest is the form of the distribution for the number of underfilled cartons, X.

2) H0: The form of the distribution is binomial

3) H1: The form of the distribution is not binomial

4) The test statistic is



5) Reject H0 if 

6) = 1.2026

7) Because 1.2026 < 4.61 fail to reject H0. There is not sufficient evidence to reject the null hypothesis that the distribution of the number of underfilled cartons is binomial at α = 0.10.

b) P-value = 0.5481 with d.f. = 2 (found using Minitab)

**4- 105**

Symmetric confidence interval: , because z0.025 = 1.96

The length of this interval is

Asymmetric confidence interval: , because −z0.01 = −2.325 and z0.04 = 1.75

The length of this interval is 

The symmetric confidence interval is the narrower of the two. An advantage of a symmetric confidence interval is that in general it is narrower than an asymmetric confidence interval.

**4- 108**

a) The data appear to follow a normal distribution based on the normal probability plot because the data fall along a straight line.

b) It is important to check for normality of the distribution underlying the sample data because the confidence intervals are based on the assumption of normality (especially for smaller sample sizes were the central limit theorem does not apply).

c) No, it is not reasonable to infer that the true mean is 14. 5 because this value is not contained within the given 95% confidence interval.

d) As with part b), to construct a confidence interval on the variance, the normality assumption must hold for the results to be reliable.

e) Yes, it is reasonable to infer that the variance could be 0.35 because the 95% confidence interval on the variance contains this value.

f) i) & ii) No, doctors and children would represent two completely different populations not represented by the population of Canadian Olympic hockey players. Because neither doctors nor children were the target of this study or part of the sample taken, the results should not be extended to these groups.

**4- 128**

v

According to the normal probability plot, the assumption that the underlying distribution is normal is reasonable. The data fall along a straight line. The assumption of normality should be satisfied in order to perform a hypothesis test using a χ2 test statistic.

1) The parameter of interest is the standard deviation, σ.

2) H0: σ2 = 16

3) H1: σ2 < 16

4) The test statistic is: 

5) Because no critical value is given, we calculate the P-value

6) 





P-value = P-value < 0.005

7) A P-value less than 0.005 is significant evidence to reject the null hypothesis and conclude the standard deviation is less than 4 g/l.

**4- 136**

a) H0: μ = 5000, H1: μ > 5000 Upper-tailed

b) H0: μ = 60,000, H1: μ > 60,000 Upper-tailed

c) H0: σ = 2, H1: σ < 2, Lower-tailed

d) H0: p = 0.60, H1: p > 0.60 Upper-tailed

e) H0: μ = 42,000, H1: μ > 42,000 Upper-tailed

f) H0: σ = 0.02, H1: σ < 0.02, Lower-tailed

g) H0: σ2 = 0.05, H1: σ2 < 0.05, Lower-tailed