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MC 3020: Probability and Statistics

Tutorial: 04 **May 2023**

1) A random sample of 400 workers at a new manufacturing plant showed 120 favoured representations by a union. Find a 90% confidence interval for the proportion of workers that prefer union representation.

2) The production employees at a garment factory have been surveyed several times to determine the proportion of employees who are opposed to a union. The estimates of this proportion ranged from 60% to 80%. The management agrees that they want a 90% confidence interval estimate with a halfwidth of 2%. What sample size should they use?

3) As part of his thesis, Adam needs an estimate of the proportion of full-time undergraduate students who, in addition to their schoolwork, had a wage-paying job of at least 20 hours per week. He wishes to estimate p within ±0.025 at the 90% confidence level. What should the sample size be if, being well acquainted with a large number of undergrads, he believes very strongly that p is no more than 0.25?

4) A utility company wants to know how billing dates affect the response time to within one day with a 95% confidence coefficient. From a previous study, they estimate the standard deviation to be three days. How large a random sample should they send out on each billing date they are studying?

5) An electric company received a shipment of several thousand resistors with 100 ohm ratings. A sample of nine resistors was measured with a standard laboratory instrument and gave the following measurements (assuming that the population distribution of the measurements is normal):

   102.0103.9 101.4 103.7 102.6 102.2 104.2 101.9 100.6

   a) Get the 95% confidence interval for the mean rating in ohms of this shipment of resistors.
   b) Get the 95% confidence interval for the variance of the ratings in ohms of this shipment of resistors.
   c) Get the 95% confidence interval for the standard deviation of the ratings in ohms of this shipment of resistors.

6) A Fortune 500 Company is concerned about the lengths of phone calls made by employees. The lengths of phone calls ranged from zero to 10 minutes. Find the sample size needed to obtain a 97% confidence interval estimate of the mean call time with a half-width of 0.5 minutes.

7) A consumer magazine counts the number of tissues per box in a random sample of 15 boxes of No-Rasp facial tissues. While the mean obtained in the sample gives them no basis for concluding that the mean number of tissues differs from the advertised amount, the sample standard deviation of the number of tissues per box is 97. What is the 90% confidence interval for the population standard deviation of the number of tissues per box? What is the 90% confidence interval for the population variance of the number of tissues per box? Assume that the population is normally distributed.

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8) A grocery supermarket chain is considering an outlet near a new middle-income housing development. They want to be certain that the average income is above $42,000 per year. A random sample of 36 families from the development gives a mean income of $43,500 per year with a standard deviation of $900 per year. Should they establish the outlet? Justify your answer using a 2% level of significance.

9) A popular candy bar is supposed to weigh 137.5 grams. The distribution of weights is known to be normal, and the standard deviation of the weights of this bar is known to be 24 grams. A sample of 16 bars gave a mean weight of 132 grams. Are the consumers receiving fair measures? Use a 5% level of significance and the P-value method.

10) In a rapid survey of monthly salaries paid by local businesses to college students holding summer jobs, a market researcher took a random sample of 81 such students and found the mean monthly salary was $915 with a standard deviation of $45. Is this result compatible with a published report that the average monthly salary for such students employed in the city is $950? Use a 0.06 level of significance.

11) A bath soap manufacturing process is designed to produce a mean of 120 bars of soap per batch and a standard deviation of 2 bars of soap per batch. Quantities above or below the standard are undesirable. A sample of 10 batches shows the following numbers of bars of soap.

108, 118, 120, 122, 119, 113, 124, 122, 120, 123

Test whether the sample results indicate that the manufacturing process is functioning properly. Assume that the sample is from a normal population. Use a 5% level of significance.

This tutorial will be updated later on!