1. In 1908, W.S. Gosset published the article “The Probable Error of a Mean” (Biometrika, Vol. 6, pp. 1 – 25). Gosset used the following data set, which gives the additional sleep in hours obtained by a sample of 10 patients using laevohysocyamine hydrobromide.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 1.9 | 0.8 | 1.1 | 0.1 | -0.1 |
| 4.4 | 5.5 | 1.6 | 4.6 | 3.4 |

For this question you may assume the sample is an SRS and that the normality condition is met.

1. (10 points) Obtain and interpret a 90% confidence interval for the additional sleep that would be obtained on average for all people using laevohysocyamine hydrobromide. (Note:

1. (5 points) Based on your confidence interval in part (a), was the drug effective in increasing sleep? Explain your answer.
2. (10 points) Interpret the confidence interval in context.

2. The operations manager of a large production plant would like to estimate the mean amount of time a worker takes to assemble a new electronic component. After observing 120 randomly selected workers assembling similar devices, the manager determined that the sample average time was 16.2 minutes and the sample standard deviation was 3.75 minutes.

1. (10 points) Construct a 96% confidence interval for the mean assembly time.
2. (5 points) You say you are 96% confident about the confidence interval in part a. What does that mean?
3. (5 points) Using = 3.75 minutes, how many workers should be involved in this study (i.e. determine the necessary sample size) in order to have the mean assembly time estimated up to ± 0.3 minutes with 96% confidence?
4. (5 points) The operations manager claims the mean assembly time is less than 16.75 minutes. With what level of confidence can this statement be made?

3. Fifty specimens of a new computer chip were tested for speed in a certain application, along with 50 specimens of chips with the old design. The average speed, in MHz, for the new chips was 495.6, and the standard deviation was 19.4 MHz. The average speed for the chips having the old design was 481.2 MHz and the standard deviation was 14.3 MHz. Assume the samples are independent.

1. (10 points) Construct a 90% confidence interval for the difference in speed between the new chip design and the old chip design.
2. (10 points) Interpret the confidence interval in part a in context.
3. (5 points) If you were to repeat this process 1000 times, about how many of the intervals obtained would you expect to contain the true mean difference in speed between the new chip design and the old chip design?
4. Suppose a consumer advocacy group would like to conduct a survey to find the proportion *p* of consumers who bought the newest generation of an MP3 player who were happy with their purchase. The advocacy group took a random sample of 1000 consumers who recently purchased this MP3 player and found that 420 were happy with their purchase.
5. (15 points) Find a 92% confidence interval for *p*. In your calculations, round to five decimal places.
6. (10 points) The advocacy group claims that the proportion of consumers who were happy with their purchases is less than 45%. With what level of confidence can this statement be made?