**Activity 7.4.6 – Inference Problems on Population Means**

**Confidence Intervals for a Population Mean**

For problems 1 – 4:

1. Determine the sample mean.
2. Determine the approximate standard error. Recall that:

$Approximate Standard Error=\frac{s}{\sqrt{n}}$ , where *s* is the sample standard deviation and *n* is the sample size.

1. Calculate the margin of error for a 95% confidence interval.
2. Construct a 95% confidence interval for the population mean.
3. Interpret the confidence interval.
4. In a random sample of 100 high school seniors in Connecticut, the mean commute time to school was 23.5 minutes with a standard deviation of 8.4 minutes. Construct a 95% confidence interval for the mean commute time to school of all high school seniors in the Connecticut.
5. In a random sample of 400 6th graders in the US, the mean amount of time spent online per week was 14.2 hours with a standard deviation of 4.7 hours. Construct a 95% confidence interval for the mean amount of time spent online per week for all 6th graders in the US.
6. A driving safety researcher is interested in the maximum speed that teenage drivers in Connecticut traveled in the past week. He surveyed 14 teenage drivers and found the following results (in miles per hour).



Use the sample to construct a 95% confidence interval for the mean maximum speed traveled by all teenagers in Connecticut in the past week.

1. A random sample of 9 students at a high school was asked, “How many times per week do you watch music videos online?” The responses are shown below.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 5 | 8 | 3 | 9 | 12 | 6 | 20 | 5 | 4 |

Construct a 95% confidence interval for the mean number of online videos watched per week by all students at the high school.

**Testing a Claim about a Population Mean**

For problems 5– 6:

1. State the assumed value for the population mean.
2. Construct a randomization distribution of sample means (using Statkey).
3. Determine the mean and standard error of the simulated distribution of sample means.
4. Calculate the observed sample mean.
5. Find the probability of observing a sample mean as extreme as the one found.
6. State whether the sample mean is statistically significant.
7. State a conclusion about the population mean.
8. Were gas prices in your town in December 2015 higher than the state average? In December 2015 the mean cost of a gallon of regular gasoline in Connecticut was $2.24. Suppose that to assess whether the mean cost of regular gasoline in your town was higher, you randomly sampled *n* = 10 gas stations in December 2015 and found the regular gas prices below.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 2.31 | 2.28 | 2.32 | 2.22 | 2.25 | 2.29 | 2.24 | 2.28 | 2.25 | 2.40 |

Does this sample data provide evidence that the mean cost of regular gasoline in this town in December 2015 was higher than the state average?

1. A student claims that high school juniors in Connecticut send out, on average, more than 50 text messages per week. Suppose we test this claim by collecting data from a random sample of 14 juniors. The number of text messages they sent out last week is shown below.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 0 | 68 | 60 | 108 | 12 | 36 | 35 |
| 25 | 115 | 74 | 98 | 65 | 48 | 82 |

Does this sample data provide evidence that the mean number of text messages high school juniors in Connecticut send out last week is greater than 50?

**Testing a Claim about a Difference in Population Means**

For problem 7:

1. State the assumption about the population means
2. Construct a randomization distribution of differences in sample means (using Statkey).
3. Determine the mean and standard error of the simulated distribution of differences in sample means.
4. Calculate the observed sample means and the difference in the observed sample means.
5. Find the probability of observing a difference in sample means as extreme as the one found.
6. State whether the difference in sample means is statistically significant.
7. State a conclusion about the randomization test.
8. Will providing college students an incentive to complete online mathematics tutorials increase students’ final exam scores in an economics class? A researcher examined this question by conducting a randomized experiment. Students were randomly assigned to two classes: (1) a class that provided students an incentive to complete a graded online math tutorial, and (2) a class that provided students an opportunity, but no incentive, to complete the same online tutorial. At the end of the semester, the researcher compared students’ final exam scores. The final exam scores of each class are shown below.

Final Exam Scores for Students in Class with Incentive, *n* = 12

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 76 | 95 | 78 | 87 | 80 | 84 | 85 | 78 | 85 | 92 |

Final Exam Scores for Students in Class without Incentive, *n* = 12

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 90 | 80 | 78 | 82 | 60 | 78 | 90 | 56 | 78 | 67 |

Does this experimental data show that providing college students in economics classes an incentive to complete online mathematics tutorials will positively impact exam scores?