

AP Statistics Practice Free Response Test – Chapter 10: Estimating with Confidence

1. A steel mill's milling machine produces steel rods that are supposed to be 5 cm in diameter. When the machine is in statistical control, the rod diameters vary according to a normal distribution with mean $\mu = 5$ cm and standard deviation $\sigma = 0.02$ cm. A large sample of 150 produced by the machine yields a sample mean diameter of 5.005 cm.
 - (a) Construct a 95% confidence interval for the true mean diameter of the rods produced by the milling machine.
 - (b) Does the interval in (a) give you reason to suspect that the machine is not producing rods of the correct diameter? Explain.
 - (c) If the rod diameters did not already have a normal distribution, would it still be acceptable to construct the confidence interval in part (a)? Explain.
2. Automotive researchers wish to determine whether gas mileage is higher when using name brand gas versus discount gas. To test this hypotheses, 10 identical model vehicles drive the same 100 mile course twice; once with each type of gas. The amount of fuel used (in gallons) for each type of gas is shown in the table below.

Fuel / Car #	1	2	3	4	5	6	7	8	9	10
Name Brand	5.94	5.74	5.24	5.34	5.43	5.84	5.42	5.84	5.87	5.66
Discount	5.82	5.59	5.59	5.64	5.47	5.48	5.50	5.96	5.73	5.75

- (a) Find a 90% confidence interval for the difference in fuel used (*discount* – *name brand*).
 - (b) What does the interval suggest about mileage differences for the two fuel types?
3. A random sample of 1100 teenagers (ages 12 to 17) was asked whether they played games online; 775 said that they did.
 - (a) Verify that the conditions are met here for inference about a population proportion p .
 - (b) Construct and interpret a 99% confidence interval for the population proportion p .
 - (c) How large a sample would you need to take to estimate p within 2% at a 99% confidence level? Use \hat{p} for the value of p^* . Show your work.

AP Statistics Practice Free Response Test – Chapter 10: ANSWERS

1 – (a): 5.0018 to 5.0082: $5.005 \pm 1.96(0.02/\sqrt{150})$

1 – (b): Since the number 5 is not contained in the interval, we should be concerned that the machine is off.

1 – (c): Yes, because the sample size is so large ($150 > 30$)

2 – (a): First compute the differences:

Car #	1	2	3	4	5	6	7	8	9	10
Diff	-0.12	-0.15	0.35	0.3	0.04	-0.36	0.08	0.12	-0.14	0.09

$\bar{x} = .021$ and $s = .217$, With $df=9$ and 90% confidence $t^*=1.833$, so the interval is

$$.021 \pm 1.833 \left(\frac{.217}{\sqrt{10}} \right) = -.1049 \text{ to } .1469$$

2 – (b): They may be equal since 0 is in the interval. Since the interval is partly negative, it is also possible that the mileage with the discount gas is better.

3 – (a): SRS – sample was random

Normality – 775 successes and 325 failures; both are easily greater than 10

Independence – Population of teenagers is much greater than 10 times the sample size

$$3 – (b): .705 \pm 2.576 \sqrt{\frac{(.705)(.295)}{1100}} = .66911 \text{ to } .73998$$

3 – (c): $n = (.705)(.295)(2.576/.02)^2 = 3450.189$, so round up to **3451**.