Test 10B AP Statistics Name: _____

**Directions:** Work on these sheets. Answer completely, but be concise. *A normal probability table is attached.*

**Part 1: Multiple Choice.** *Circle the letter corresponding to the best answer.*

1. The value of z* required for a 70% confidence interval is
   (a) -0.5244
   (b) 1.036
   (c) 0.5244
   (d) 0.6179
   (e) The answer can't be determined from the information given.
   (f) None of the above. The answer is _____.

2. A significance test allows you to reject a hypothesis $H_0$ in favor of an alternative $H_a$ at the 5% level of significance. What can you say about significance at the 1% level?
   (a) $H_0$ can be rejected at the 1% level of significance.
   (b) There is insufficient evidence to reject $H_0$ at the 1% level of significance.
   (c) There is sufficient evidence to accept $H_0$ at the 1% level of significance.
   (d) $H_a$ can be rejected at the 1% level of significance.
   (e) The answer can't be determined from the information given.

3. A 95% confidence interval for the mean $\mu$ of a population is computed from a random sample and found to be $9 \pm 3$. We may conclude that
   (a) There is a 95% probability that $\mu$ is between 6 and 12.
   (b) There is a 95% probability that the true mean is 9 and a 95% chance the true margin of error is 3.
   (c) If we took many, many additional random samples and from each computed a 95% confidence interval for $\mu$, approximately 95% of these intervals would contain $\mu$.
   (d) If we took many, many additional random samples and from each computed a 95% confidence interval for $\mu$, 95% of them would cover the values from 6 to 12.
   (e) All of the above.

4. A 95% confidence interval for the mean reading achievement score for a population of third grade students is (44.2, 54.2). Suppose you compute a 99% confidence interval using the same information. Which of the following statements is correct?
   (a) The intervals have the same width.
   (b) The 99% interval is shorter.
   (c) The 99% interval is longer.
   (d) The answer can't be determined from the information given.
   (e) None of the above. The answer is _____.

5. Which of the following are correct?
   I. The power of a significance test depends on the alternative value of the parameter.
   II. The probability of a Type II error is equal to the significance level of the test.
   III. Type I and Type II errors only make sense when a significance level has been chosen in advance.
   (a) I and II only
   (b) I and III only
   (c) II and III only
   (d) I, II, and III
   (e) None of the above gives the complete set of true responses.

6. In a test of $H_0$: $\mu = 100$ against $H_a$: $\mu \neq 100$, a sample of size 80 produces $z = 0.8$ for the value of the test statistic. The *P*-value of the test is thus equal to:
   (a) 0.20
   (b) 0.40
   (c) 0.29
   (d) 0.42
   (e) 0.21

7. To assess the accuracy of a laboratory scale, a standard weight that is known to weigh 1 gram is repeatedly weighed a total of *n* times and the mean $\bar{x}$ of the weighings is computed. Suppose the scale readings are normally distributed with unknown mean $\mu$ and standard deviation $\sigma = 0.01$ g. How large should *n* be so that a 95% confidence interval for $\mu$ has a margin of error of $\pm$ 0.0001?
   (a) 100
   (b) 196
   (c) 27061
   (d) 10000
   (e) 38416

8. A 95% confidence interval for $\mu$ is calculated to be (1.7, 3.5). It is now decided to test the hypothesis $H_0$: $\mu = 0$ vs. $H_a$: $\mu \neq 0$ at the $\alpha = 0.05$ level, using the same data as was used to construct the confidence interval.
   (a) We cannot test the hypothesis without the original data.
   (b) We cannot test the hypothesis at the$\alpha = 0.05$ level since the $\alpha = 0.05$ test is connected to the 97.5% confidence interval.
   (c) We can only make the connection between hypothesis tests and confidence intervals if the sample sizes are large.
   (d) We would reject $H_0$ at level $\alpha = 0.05$.
   (e) We would accept $H_0$ at level $\alpha = 0.05$.

## Part 2: Free Response

*Communicate your thinking clearly and completely.*

**9.** 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 99% confidence interval for the true mean diameter of the rods produced by the milling machine. Follow the inference toolbox.

(b) Does the interval in (a) give you reason to suspect that the machine is not producing rods of the correct diameter? State appropriate hypotheses and a significance level. Then explain your conclusion.

(c) Describe a Type II error in the context of this problem. How could the manufacturer decrease the probability of a Type II error.

**10.** A pharmaceutical manufacturer does a chemical analysis to check the potency of products. The standard release potency for cephalothin crystals is 910. An assay of 16 lots gives the following potency data:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 897 | 914 | 913 | 906 | 916 | 918 | 905 | 921 |
| 918 | 906 | 895 | 893 | 908 | 906 | 907 | 901 |

Assume a population standard deviation $\sigma = 8.2$.

(a) Construct a 99% confidence interval for the population mean. Follow the Inference Toolbox.

You want to test hypotheses about the mean population potency,

$H_0$: $\mu = 910$

$H_a$: $\mu < 910$

at the 1% level of significance. The z test statistic is $z = (\bar{x} - 910)/(8.2/\sqrt{16})$.

(b) What is the rule for rejecting $H_0$ in terms of z?

(c) What values of $\bar{x}$ would lead you to reject $H_0$?

(d) Describe a Type I error in the context of this problem. What is the probability of a Type I error?

*I pledge that I have neither given nor received aid on this test.*_____