1. Billy Bob recently purchased a brand new car. In order to estimate his average gas mileage, over several months Billy Bob has recorded the following $n = 15$ mileages between each fill-up:

30.38, 28.29, 29.83, 28.79, 30.16, 28.45, 27.77, 26.69, 36.8, 28.73, 31.23, 22.69, 29.8, 27.72, 32.65

The manufacturer of the vehicle Billy Bob purchased reports that the average gas mileage is 30.4 MPG with a standard deviation of $\sigma = 3.5$ MPG. However, Billy Bob suspects that the true mean gas mileage μ of his car is not the same as the one reported by the manufacturer. To test his suspicion, Billy Bob carries out a test of significance on his data assuming the values of the mean and standard deviation reported by the manufacturer.

At the $\alpha = 0.1$ level of significance, what is the conclusion?

A. We reject the null hypothesis.

B. We keep the null hypothesis.

2. The following are a random sample of $n = 27$ IQ scores of seventh-grade girls from a school district in the Midwest:

93, 98, 91, 74, 104, 114, 112, 107, 103, 100, 118, 86, 132, 120, 112, 108, 105, 112, 103, 103, 96, 114, 72, 89, 111, 119, 102

Assume that the IQ scores in this population has a normal distribution with standard deviation $\sigma = 15$.

Suppose that a previous estimate of the mean IQ μ of 7th-grade girls from this school district is 97. We suspect that the true value may actually be higher. To test our suspicion, we carry out a test of significance on the data we collected above.

State the null hypothesis.

A. The null hypothesis is $H_0 : \mu = 97$.

B. The null hypothesis is $H_0 : \mu < 97$.

C. The null hypothesis is $H_0 : \mu \neq 103.63$.

D. The null hypothesis is $H_0 : \mu > 103.63$.

E. The null hypothesis is $H_0 : \mu > 97$.

F. The null hypothesis is $H_0 : \mu \neq 97$.

G. The null hypothesis is $H_0 : \mu < 103.63$.

H. The null hypothesis is $H_0 : \mu = 103.63$.

3. Billy Bob recently purchased a brand new car. In order to estimate his average gas mileage, over several months Billy Bob has recorded the following $n = 23$ mileages between each fill-up:

30.38, 28.73, 30.16, 28.36, 31.23, 25.71, 28.79, 27.77, 27.72, 26.69, 25.09, 22.69, 36.8, 28.29, 24.27, 25.95, 29.41, 32.65, 29.83, 28.45, 27.18, 32.67, 30.88

The manufacturer of the vehicle Billy Bob purchased reports that the average gas mileage is 26.5 MPG with a standard deviation of $\sigma = 3.5$ MPG. However, Billy Bob suspects that the true mean gas mileage μ of his car is not the same as the one reported by the manufacturer. To test his suspicion, Billy Bob carries out a test of significance on his data assuming the values of the mean and standard deviation reported by the manufacturer.

At the $\alpha = 0.05$ level of significance, what is the conclusion?

A. There is significant evidence that the gas mileage of Billy Bob's new car is greater than 26.5.

B. There is no significant evidence that the gas mileage of Billy Bob's new car is greater than 26.5.

C. There is significant evidence that the gas mileage of Billy Bob's new car is not equal to 26.5.

D. There is no significant evidence that the gas mileage of Billy Bob's new car is less than 26.5.

E. There is significant evidence that the gas mileage of Billy Bob's new car is less than 26.5.

F. There is no significant evidence that the gas mileage of Billy Bob's new car is not equal to 26.5.

4. Suppose we are testing the hypotheses

$$H_0 : \mu = 1.55$$
$$H_a : \mu < 1.55$$

This is an example of a:

A. 2-sided test.

B. 1-sided test.

5. Breast-feeding mothers secrete calcium into their milk, and researchers suspect that some of that calcium comes from their bones. The percent change in mineral content of the spines of a random sample of $n = 29$ mothers during three months of breast-feeding is:

$0.3\%,\ -4.9\%,\ -6.5\%,\ -5.1\%,\ -4.7\%,\ -1\%,\ -1\%,\ -5.6\%,\ -6.8\%,\ -6.8\%,\ 1.7\%,\ -3.1\%,\ -4\%,\ -3.3\%,$
$-5.3\%,\ -8\%,\ -6.5\%,\ -4.4\%,\ -2.1\%,\ -6.2\%,\ -4.9\%,\ 2.2\%,\ -3.8\%,\ -3.6\%,\ -7\%,\ -2.7\%,\ -7.8\%,\ -2.3\%,$
-3%

Suppose that the percent change in this population has a normal distribution with standard deviation $\sigma = 2.5\%$.

We would like to understand the extent that mothers overall lose bone mineral when breast-feeding.

Suppose that previous research suggests that the mean mineral loss μ in breast-feeding mothers is -2.5% with a standard deviation of $\sigma = 2.5\%$. However, we suspect that the true value of the mean mineral loss μ may actually be lower. To test our suspicion, we carry out a test of significance assuming that the population standard deviation is $\sigma = 2.5\%$.

At the $\alpha = 0.05$ level of significance, what is the conclusion?

A. There is significant evidence that the mean bone mineral loss in breast-feeding mothers is not equal to -2.5%.

B. There is no significant evidence that the mean bone mineral loss in breast-feeding mothers is not equal to -2.5%.

C. There is no significant evidence that the mean bone mineral loss in breast-feeding mothers is below -2.5%.

D. There is no significant evidence that the mean bone mineral loss in breast-feeding mothers is above -2.5%.

E. There is significant evidence that the mean bone mineral loss in breast-feeding mothers is above -2.5%.

F. There is significant evidence that the mean bone mineral loss in breast-feeding mothers is below -2.5%.

6. The following are a random sample of $n = 14$ IQ scores of seventh-grade girls from a school district in the Midwest:

120, 91, 128, 102, 98, 112, 130, 89, 104, 103, 105, 72, 132, 96

Assume that the IQ scores in this population has a normal distribution with standard deviation $\sigma = 15$.

Suppose that a previous estimate of the mean IQ μ of 7th-grade girls from this school district is 101. We suspect that the true value may actually be higher. To test our suspicion, we carry out a test of significance on the data we collected above.

Compute the z-statistic for the test of significance described above.

A. The z-statistic is 0.31.

B. The z-statistic is 0.71.

C. The z-statistic is 2.01.

D. The z-statistic is 1.81.

E. The z-statistic is 1.51.

F. The z-statistic is 1.21.

G. The z-statistic is 1.71.

H. The z-statistic is 0.41.

7. The following are a random sample of $n = 17$ IQ scores of seventh-grade girls from a school district in the Midwest:

132, 102, 104, 91, 108, 89, 96, 86, 112, 100, 98, 130, 112, 128, 111, 114, 74

Assume that the IQ scores in this population has a normal distribution with standard deviation $\sigma = 15$.

Suppose that a previous estimate of the mean IQ μ of 7th-grade girls from this school district is 105. We suspect that the true value may actually be higher. To test our suspicion, we carry out a test of significance on the data we collected above.

State the alternative hypothesis.

A. The alternative hypothesis is $H_a : \mu = 105$.

B. The alternative hypothesis is $H_a : \mu > 105.12$.

C. The alternative hypothesis is $H_a : \mu \neq 105.12$.

D. The alternative hypothesis is $H_a : \mu < 105.12$.

E. The alternative hypothesis is $H_a : \mu > 105$.

F. The alternative hypothesis is $H_a : \mu = 105.12$.

G. The alternative hypothesis is $H_a : \mu \neq 105$.

H. The alternative hypothesis is $H_a : \mu < 105$.

8. Billy Bob recently purchased a brand new car. In order to estimate his average gas mileage, over several months Billy Bob has recorded the following $n = 22$ mileages between each fill-up:

32.65, 31.23, 28.73, 27.18, 32.67, 27.77, 28.29, 28.79, 22.69, 29.8, 30.88, 29.41, 25.09, 25.71, 24.27, 29.83, 36.8, 28.45, 30.16, 30.38, 28.36, 25.95

The manufacturer of the vehicle Billy Bob purchased reports that the average gas mileage is 28.3 MPG with a standard deviation of $\sigma = 3.5$ MPG. However, Billy Bob suspects that the true mean gas mileage μ of his car is not the same as the one reported by the manufacturer. To test his suspicion, Billy Bob carries out a test of significance on his data assuming the values of the mean and standard deviation reported by the manufacturer.

Compute the z-statistic for the test of significance described above.

A. The z-statistic is 0.76.

B. The z-statistic is 1.56.

C. The z-statistic is 0.36.

D. The z-statistic is 0.26.

E. The z-statistic is -0.04.

F. The z-statistic is 0.46.

G. The z-statistic is 1.16.

H. The z-statistic is 1.66.