

Homework 4 Solutions

Answer the following short-response questions:

1. What is a population?

The total group we are trying to gather information on

2. What is a sample?

An observable subset of the population

3. Which arises from a population, a parameter or a statistic?

Parameter

4. Can we make inference from an entire population?

No, an entire possible is impossible to observe, thus inference is impossible

5. What is the primary goal of statistics?

To make inference about a population's parameters, using statistics computed from samples

6. The waiting time at a bus stop for the next bus to arrive is uniformly distributed between 0 and 12 minutes.

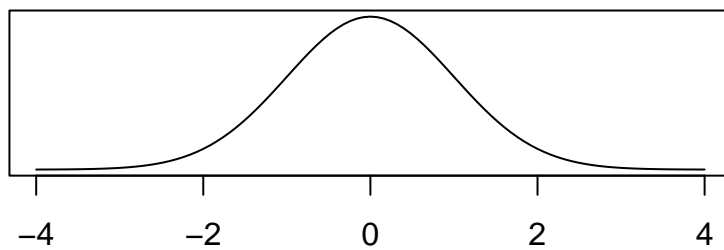
- a. Find the probability that the waiting time is less than 4 minutes.

5/13

- b. Find the probability that the waiting time is between 5 and 10 minutes.

$$6/13$$

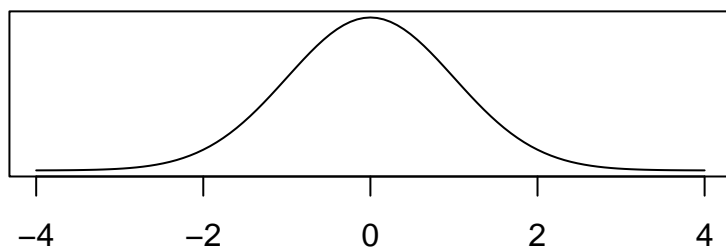
7. $P(Z < 1.26)$ (i.e., area to the left of $z = 1.26$);



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$$0.896165$$

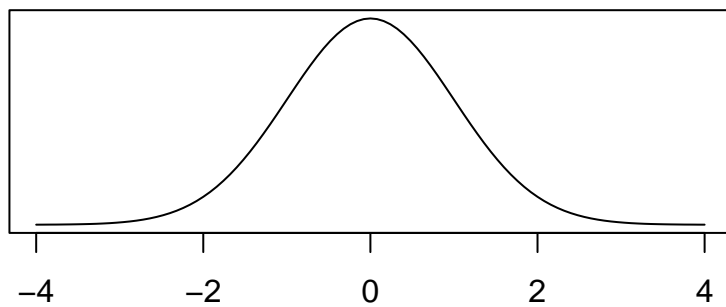
8. $P(Z > -0.58)$ (i.e., area to the right of $z = -0.58$);



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0.7190427

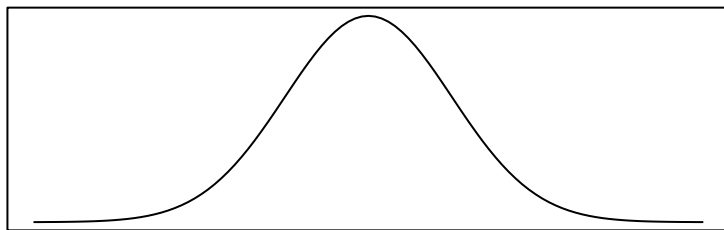
9. $P(-0.58 < Z < 1.26)$ (i.e., area between $z = -0.58$ and $z = 1.26$);



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0.615208

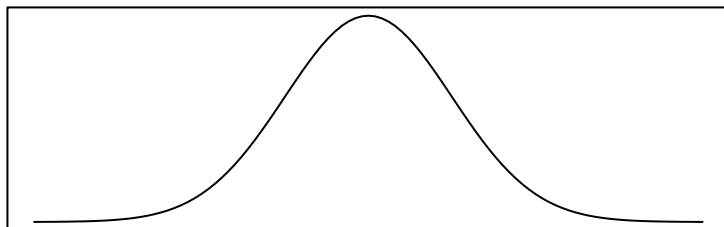
10. The life expectancy of a certain type of lightbulb is normally distributed with a mean of 1000 hours and a standard deviation of 100 hours.
- a. What proportion of lightbulbs last longer than 1100 hours?



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0.1586

- b. What proportion of lightbulbs last between 900 and 1200 hours?



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$$0.8186$$

- c. What proportion of lightbulbs last less than 800 hours?

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$$0.0227$$

11. The height of a specific plant species has a population mean of $\mu = 17$ cm with a standard deviation of $\sigma = 20$ cm. If a random sample of $n = 100$ plants is selected:

- a. Find the mean of the sample mean, $\mu_{\bar{x}}$.

$$\mu_{\bar{x}} = 17$$

- b. Find the standard deviation of the sample mean, $\sigma_{\bar{x}}$.

$$\sigma_{\bar{x}} = \frac{20}{\sqrt{100}} = \frac{20}{10} = 2$$

- c. Express the distribution of the sample mean \bar{x} in proper notation.

$$\bar{x} \sim N(17, 2^2)$$

12. Fill in the blank spots in the table below, and provide an example data source for each distribution:

Distribution	Use-Case	Example Data Source
Binomial	Summation of many binary events	number of patients sick after a vaccine
Poisson	Positive, discrete counts	number of birds seen at a specific lake
Normal	Continuous \pm data, centered around the average	Average difference between test scores
Beta	Continuous proportion/probability between 0 and 1	Proportions of voter registrations
Gamma	Continuous, strictly positive data	Marathon run times