

### Discrete v. Continuous Random Variables

- Previously, we saw that Discrete Random Variables...
  - Considers X as a countable number of outcomes
  - The probability was a set rate or proportion (Successes (p) / total (n))
- Moving on with Continuous Random Variables...
  - Considers X as an uncountable number of outcomes because it looks at the overall interval
  - The probability is the area under the curve
    - With the total area under the curve equal to 1
  - Anytime an exact point is mentioned, the answer is automatically 0

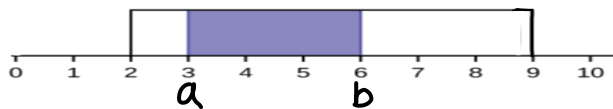
### Uniform Distribution

- Unlike what we see after this, uniform distribution has a rectangular shaped curve.  
Typically, we will see a bell shaped curve moving forward
- When we solve these questions, we use specific formulas:

○ When  $P(a \leq x \leq b) \rightarrow f(x) = \frac{1}{b-a}$

○ When  $P(x_1 \leq X \leq x_2) \rightarrow f(x) = \frac{x_2 - x_1}{\max - \min}$

1. Using the table below, answer the following questions.



- a. What is the probability (i.e. area) of the shaded region?

$$P(3 \leq x \leq 6) = \frac{1}{b-a} = \frac{1}{6-3} = \frac{1}{3}$$

b. What would the probability of more than 2 (but less than 7)?

$$P(2 < x < 7) = P(2 \leq x \leq 7)$$

$$P(2 \leq x \leq 7) = \frac{x_2 - x_1}{\text{max} - \text{min}} = \frac{7 - 2}{9 - 2} = \frac{5}{7}$$

c. What is the probability of exactly 5?

$$P(x = 5) = 0$$

d. What would be the probability of less than 4 or at least 8?

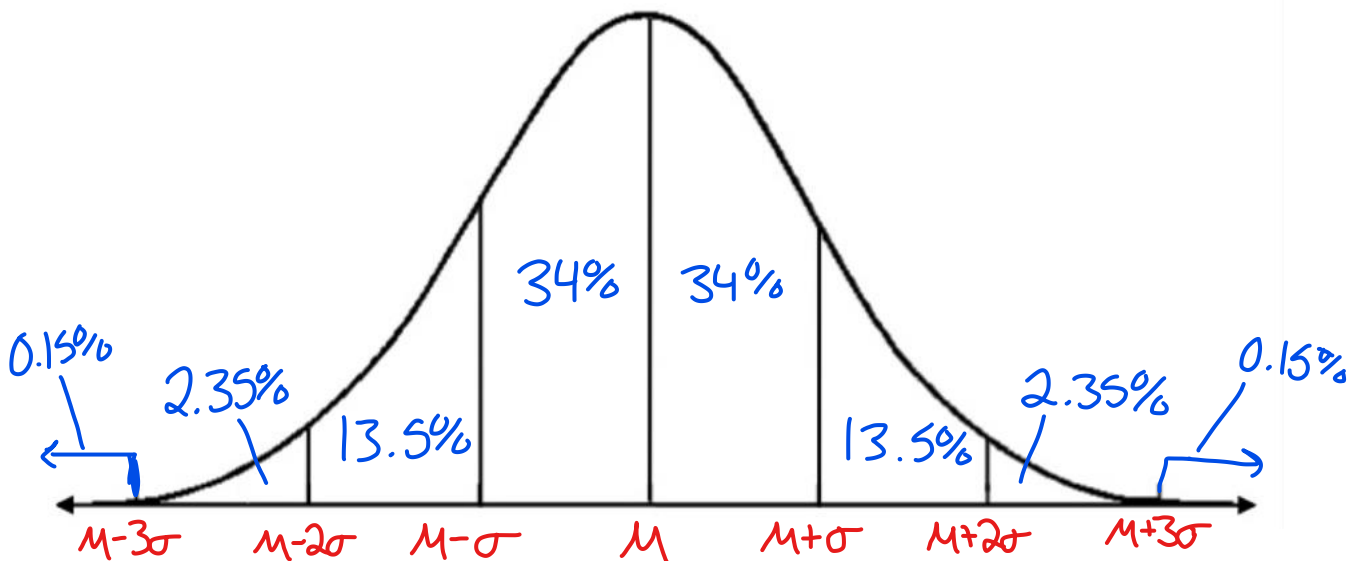
$$P(x < 4 \text{ or } x \geq 8) = P(2 \leq x \leq 4) + P(8 \leq x \leq 9)$$

$$= \frac{4 - 2}{9 - 2} + \frac{9 - 8}{9 - 2}$$

$$P(x < 4 \text{ or } x \geq 8) = \frac{3}{7}$$

Empirical Rule

- Under empirical rule, the area under the curve is still 1
- The only thing to remember for empirical rule is what the graph below tells us!

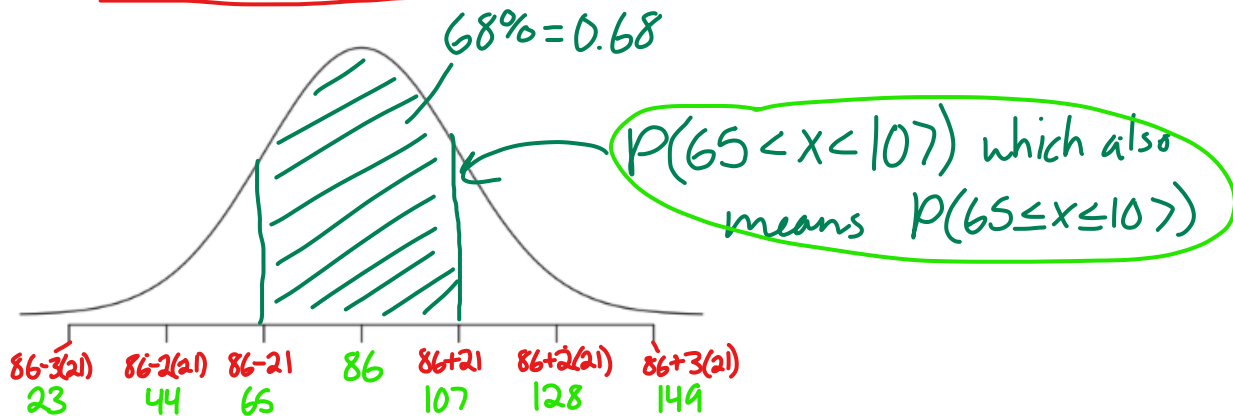


$\mu$  = mean &  $\sigma$  = standard deviation

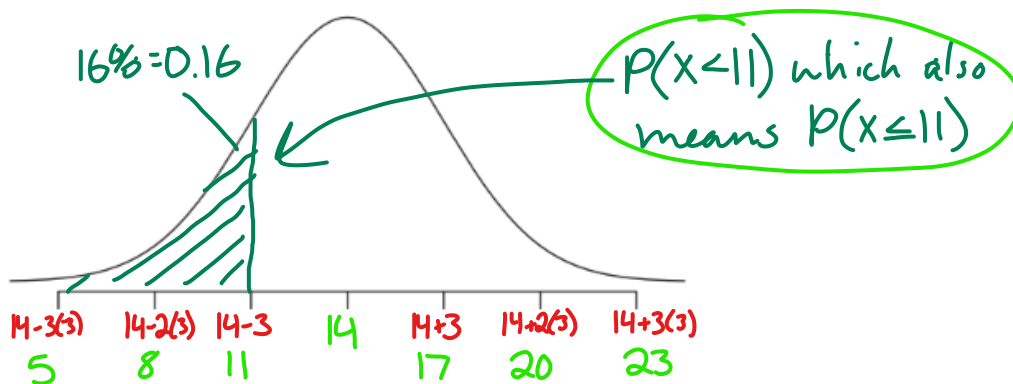
- In short, the graph above tells us...
  - $P(\mu - \sigma < X < \mu + \sigma) \approx 68\%$
  - $P(\mu - 2\sigma < X < \mu + 2\sigma) \approx 95\%$
  - $P(\mu - 3\sigma < X < \mu + 3\sigma) \approx 97.5\%$

Using Empirical Rule, answer the following questions.

- Sketch a graph in which the area (centered) is 68% while the mean is 86 and the standard deviation is 21. Write the Probability (P) statement for the shaded area.



- Sketch a graph in which the area (from the left) is 16% while the mean is 14 and the standard deviation is 3. Write the Probability (P) statement for the shaded area.



- Sketch a graph in which the area (from the right) is 97.5% while the mean is 190 and the standard deviation is 33. Write the Probability (P) statement for the shaded area.

