1. In a bag of marbles, there are two disjoint events: A represents selecting a red marble, and B represents selecting a blue marble. The probability of selecting a red marble is $P(A) = \frac{1}{4}$, and the probability of selecting a blue marble is $P(B) = \frac{1}{3}$.

1 / 1 point

What is the probability of selecting either a red or a blue marble, $P(A \cup B)$, from the bag?

- ○ $P(A \cup B) = \frac{5}{12}$
- ○ $P(A \cup B) = \frac{1}{12}$
- ○ $P(A \cup B) = \frac{2}{3}$
- ◉ $P(A \cup B) = \frac{7}{12}$

Correct
The probability of the union of disjoint events is the sum of their individual probabilities.
$P(A \cup B) = P(A) + P(B) = \frac{1}{4} + \frac{1}{3} = \frac{7}{12}$

2. You throw 10 fair coins, what is the probability that coins **do not result in all heads**?

1 / 1 point

- ○ $$\frac{10^2 - 1}{10^2}$$
- ○ $$\frac{1}{2^{10}}$$
- ○ $$\frac{1}{10^2}$$
- ◉ $$\frac{2^{10} - 1}{2^{10}}$$

Correct
By throwing 10 fair coins, there are 2^{10} possible outcomes and only one outcome results in HHHHHHHHHH or all heads. This means the

$$P(\text{not all heads}) = 1 - P(\text{all heads}) = 1 - \frac{1}{2^{10}} = \frac{2^{10} - 1}{2^{10}}$$

3. In a room, there are 200 people: 30 people only like soccer, 100 people only like basketball, and 70 people like **both** soccer and basketball.

1 / 1 point

What is the probability that a randomly selected person likes **basketball given they like soccer?**

Hint: Find $P(B|S)$, where B is the event of liking basketball and S is the event of liking soccer.

- ○ $\frac{3}{7}$
- ◉ $\frac{7}{10}$
- ○ $\frac{1}{2}$
- ○ $\frac{7}{20}$

Correct

Let S represent the number of people who like soccer and B represent the number of people who like basketball. Therefore, $P(B|S) = \frac{P(B \cap S)}{P(S)}$.

4. Imagine there is a disease that impacts 1% of the population. Researchers devised a test so that people with the disease test positive 95% of the time. People who do not have the disease test negative 90% of the time. If an individual receives a positive test result for the disease, what is the probability that they truly have the disease or $P(\text{sick}|\text{test}_{\text{pos}})$)?

1 / 1 point

Hint: In the description above, you were given $P(\text{sick})$, probability for true positive (or $P(\text{test}_{\text{pos}}|\text{sick})$), and probability for true negative (or $P(\text{test}_{\text{neg}}|\text{not sick})$). Use this information to find $P(\text{not sick})$ and $P(\text{test}_{\text{pos}}|\text{not sick})$.

Remember that Bayes' Theorem is $P(A|B) = \frac{P(B|A) \cdot P(A)}{P(B)}$. Also, remember that you may write $P(B) = P(B|E) \cdot P(E) + P(B|\text{not } E) \cdot P(\text{not } E)$, where E is any event and $\text{not } E = E$'.

- ○ 90%
- ◉ 8.76%
- ○ 15.58%
- ○ 42.76%

Correct

According to Bayes' Theorem,

$$P(\text{sick}|\text{test}_{\text{pos}}) = \frac{P(\text{test}_{\text{pos}}|\text{sick}) \cdot P(\text{sick})}{P(\text{sick}) \cdot P(\text{test}_{\text{pos}}|\text{sick})) + P(\text{not sick}) \cdot P(\text{test}_{\text{pos}}|\text{not sick})}$$

.

From the problem description, you know that $P(\text{sick}) = 0.01$, $P(\text{test}_{\text{pos}}|\text{sick}) = 0.95$, and $P(\text{test}_{\text{neg}}|\text{not sick}) = 0.9$. You can use the complement rule to find $P(\text{test}_{\text{pos}}|\text{not sick}) = 1 - P(\text{test}_{\text{neg}}|\text{not sick}) = 1 - 0.9 = 0.1$.

Using these numbers, we get:

$$\frac{0.01 \cdot 0.95}{0.01 \cdot 0.95 + 0.99 \cdot 0.1} \approx 0.0876$$

5. Which of the following are examples of continuous random variables? Select all that apply.

1 / 1 point

- [ ] Number of cars passing through a toll booth in an hour.
- [x] Weight of a package.

Correct
Weight is a **continuous** variable with infinitely many values within a range.

- [ ] Number of students in a classroom.
- [x] Height of students in a class.

Correct
Height is a **continuous** variable with infinitely many values within a range.

- [ ] Number of goals scored in a soccer match.
- [x] Time taken to run a 100-meter race.

Correct
Time is a **continuous** variable with infinitely many values within a range.

- [x] Temperature in degrees Celsius.

Correct
Temperature is a **continuous** variable with infinitely many values within a range.

6. You roll a six-sided die 20 times and want to find the probability that the number 4 appears exactly 7 times. Which of the following equations correctly represents the probability distribution for this scenario?

1 / 1 point

○ $$P(X=7)=\binom{20}{7}\cdot\left(\frac{1}{6}\right)^{13}\cdot\left(\frac{5}{6}\right)^{7}$$

◉ $$P(X=7)=\binom{20}{7}\cdot\left(\frac{1}{6}\right)^{7}\cdot\left(\frac{5}{6}\right)^{13}$$

○ $$P(X=4)=\binom{20}{4}\cdot\left(\frac{1}{6}\right)^{4}\cdot\left(\frac{5}{6}\right)^{16}$$

○ $$P(X=7)=\binom{20}{7}\cdot\left(\frac{1}{6}\right)^{7}\cdot\left(\frac{5}{6}\right)^{7}$$

Correct
In this case, let $n=\text{total number of tosses}=20, k=\text{number times 4 is rolled}=7,$ $p=\text{probability of rolling 4}=\frac{1}{6}$, and $q=\text{probability of not rolling 4}=\frac{5}{6}$.

7. Imagine you are tasked with modeling the heights of individuals in a diverse country. Which probability distribution would be most suitable for capturing the patterns in the heights of the population?

1 / 1 point

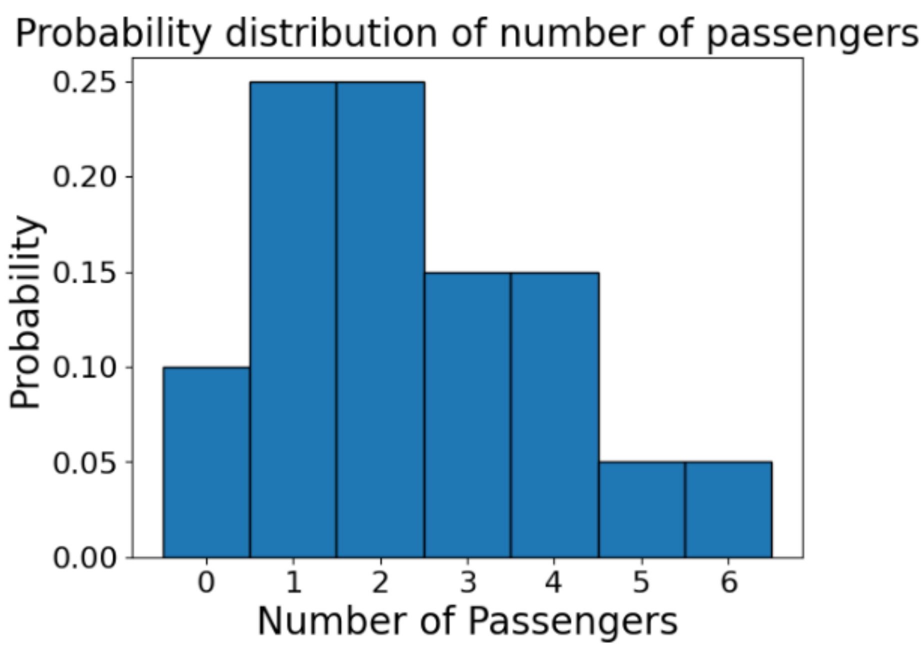
- (●) Normal Distribution
- ( ) Binomial Distribution
- ( ) Uniform Distribution

Correct
The normal distribution, often likened to a bell curve, is a fitting choice for modeling height variations in a country. It beautifully represents the natural diversity observed in the heights of individuals.

8. A taxi cab service analyzes the number of passengers in its daily rides. The table and graph below show the number of passengers, X, in a single taxi cab and the observed probabilities at a randomly selected time.

1 / 1 point

Number of passengers xi	0	1	2	3	4	5	6
Probability, pi	0.10	0.25	0.25	0.15	0.15	0.05	0.05



What is the probability that a randomly selected taxi ride will have **less than or equal to 3 passengers**?

- $P(X \leq 3) = 0$
- $P(X \leq 3) = 0.25$
- $P(X \leq 3) = 0.40$
- $P(X \leq 3) = 0.60$
- (selected) $P(X \leq 3) = 0.75$

Correct
To find the probability that a randomly selected taxi ride will have **less than 3 passengers** means that you can *add* up the probabilities when $P(X=3) + P(X=2) + P(X=1) + P(X=0)$.

9. A taxi cab service analyzes the number of passengers in its daily rides. The table and graph below show the number of passengers, X, in a single taxi cab and the observed probabilities at a randomly selected time.

1 / 1 point

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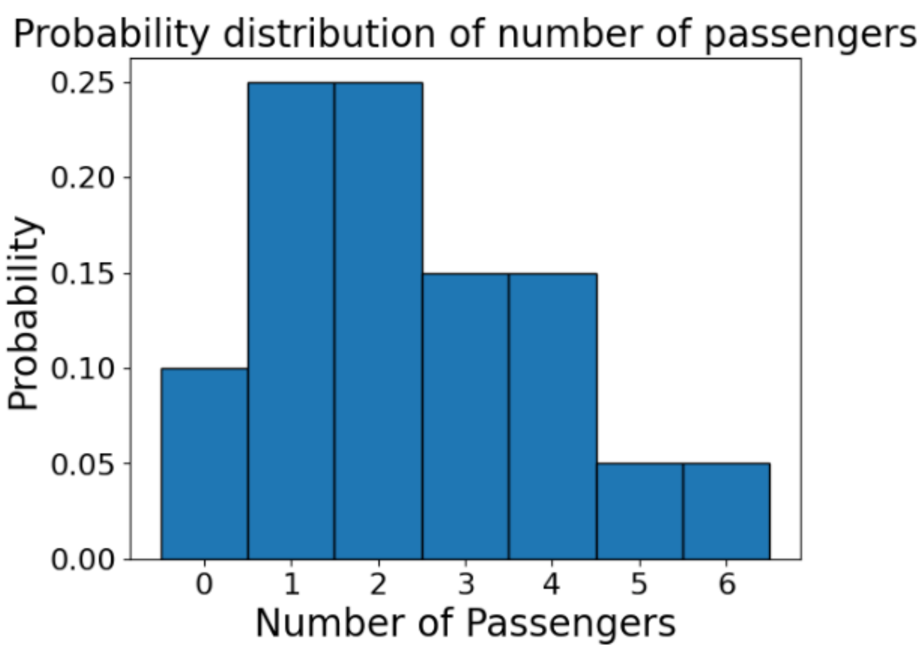
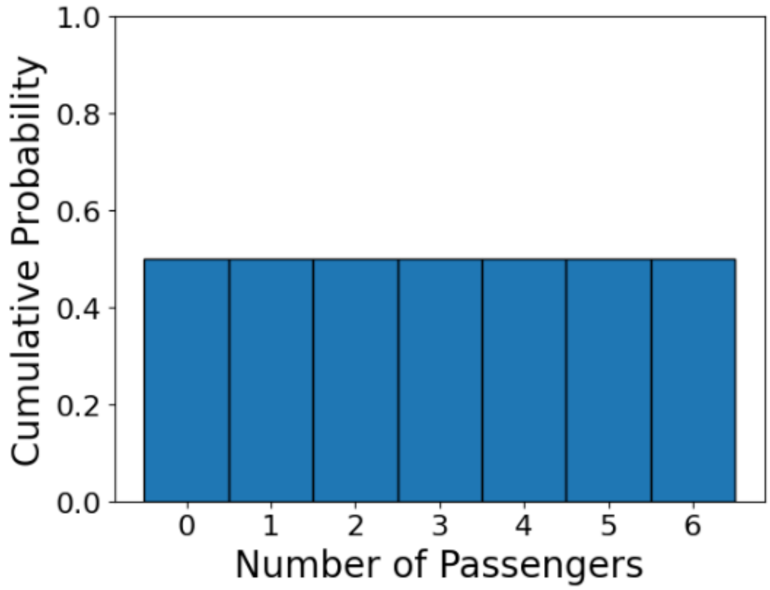
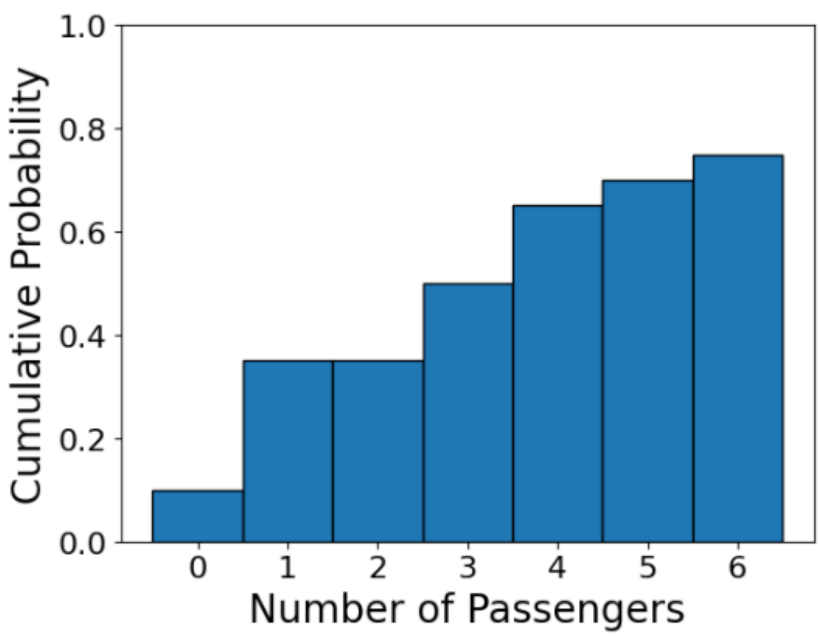


Select the correct Cumulative Distribution Function (CDF) based on the observed probabilities.

Number of passengers(x)	0	1	2	3	4	5	6
Cumulative probability (Fx)	0.5	0.5	0.5	0.5	0.5	0.5	0.5

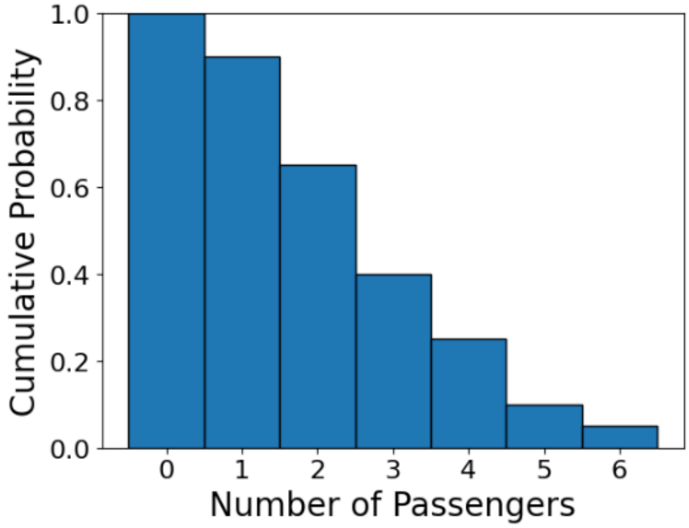


Number of passengers(x)	0	1	2	3	4	5	6
Cumulative probability (Fx)	0.10	0.35	0.35	0.5	0.65	0.7	0.75



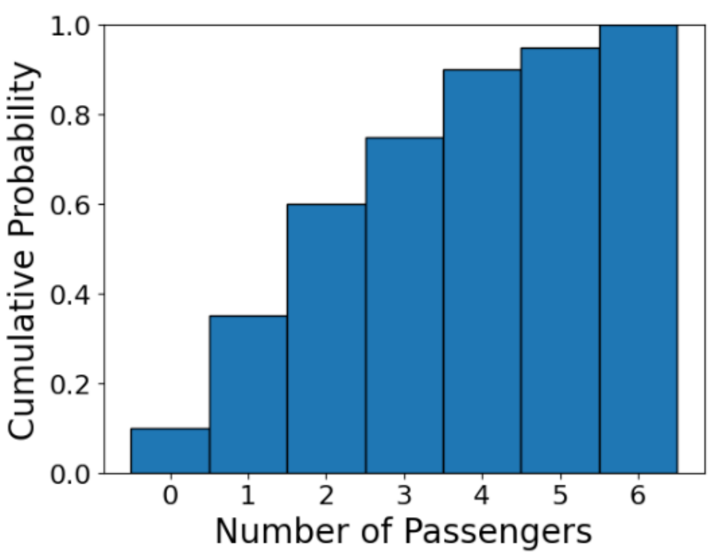
○

Number of passengers(x)	0	1	2	3	4	5	6
Cumulative probability (Fx)	1	0.90	0.65	0.4	0.25	0.1	0.05



◉

Number of passengers(x)	0	1	2	3	4	5	6
Cumulative probability (Fx)	0.1	0.35	0.6	0.75	0.9	0.95	1

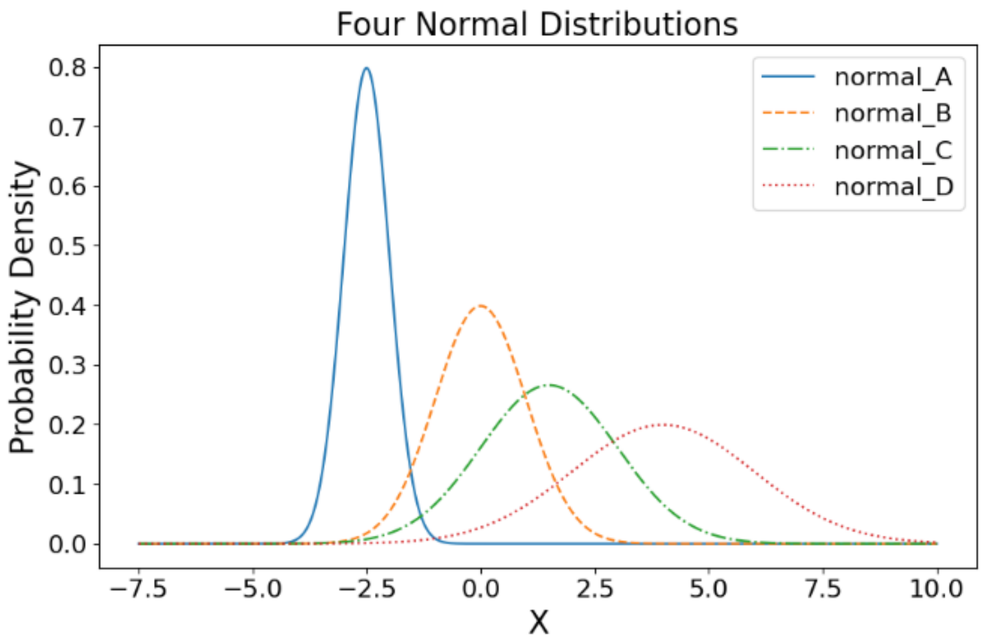


Correct

A CDF calculates the probability of a random variable being **less than or equal to a specific point**. It accumulates probabilities such that its values are non-decreasing, starting at 0 and ending at

10. Consider the graph below, depicting four normal, or Gaussian, distributions labeled *normal_A* in blue, *normal_B* in orange, *normal_C* in green, and *normal_D* in red.

1 / 1 point



Select all statements that are true based on the provided graph.

- [ ] $\mu_{\text{normal\_A}} > \mu_{\text{normal\_B}}$
- [ ] $\sigma_{\text{normal\_A}} > \sigma_{\text{normal\_B}}$
- [x] $\sigma_{\text{normal\_D}} > \sigma_{\text{normal\_A}}$

Correct
The parameter σ, or standard deviation, controls the spread of the distribution. Therefore, the higher the σ, the wider (more spread) the graph is around the center.

- [x] $\mu_{\text{normal\_D}} > \mu_{\text{normal\_C}}$

Correct
The parameter μ, or mean, controls the center of the distribution. Therefore the higher the μ, the farther the center is from the origin.

- [x] $\sigma_{\text{normal\_C}} > \sigma_{\text{normal\_B}}$

Correct
The parameter σ, or standard deviation, controls the spread of the distribution. Therefore, the higher the σ, the wider (more spread) the graph is around the center.