Congratulations! You passed!

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1. In a room, there are 200 people. 1 / 1 point

- 30 of them like only soccer
- 100 of them like only basketball
- 70 of them like both soccer and basketball

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

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

Correct
Correct! In this case, if they already like soccer, then they must either only like soccer or like basccketball and soccer. The latter is 70 of the total. Therefore the result is $\frac{70}{100} = \frac{7}{10}$.

2. Consider the following experiment: 1 / 1 point

You roll a dice. If the result is less than 4 (excluding 4), you roll two dice and sum the result of the second two dice throw. If the result is greater than 3, you roll only one dice and use the result of this new throw.

An example of one round:

- You throw a dice and gets 3. Then you throw two dice and get 4 and 1. Therefore the result you get is 5.
- You throw a dice and gets 6. Then you throw again only one dice and gets 3. Therefore the result you get is 3.

What is the probability of getting a final result of 6 after this experiment?

- ◉ $\frac{11}{72}$
- ○ $\frac{5}{36}$
- ○ $\frac{5}{72}$
- ○ $\frac{1}{6}$

Correct
Correct! If we define $E_{<4}$ as the event of getting a number less than 4 in the first throw and $E_{\geq 4}$ the event of getting a number greater or equal to 4 in the first throw, then

$$P(\text{getting a } 6) = P(\text{getting a } 6 \mid E_{<4}) + P(\text{getting a } 6 \mid E_{\geq 4})$$

If the first dice is less than 4, we throw two dice, thus the probability of getting a 6 is $\frac{5}{36}$, because the possible values for the dice are $(1,5), (2,4), (3,3), (4,2), (5,1)$. The probability of getting a number less than 4 is $\frac{3}{6}$. If the first dice is greater or equal to 4, then we just throw a new dice and get the result, therefore to get 6, there is a chance of $\frac{1}{6}$.

Therefore

$$P(\text{getting a } 6) = \frac{5}{36} \cdot \frac{3}{6} + \frac{1}{6} \cdot \frac{3}{6} = \frac{11}{72}$$

3. Suppose there is a disease that affects 1% of the population. Researchers developed a diagnostic test for this disease. The test has a sensitivity of 95% (meaning it correctly identifies 95% of people with the disease) and a specificity of 90% (meaning it correctly identifies 90% of people without the disease). If a person tests positive for the disease, what is the probability that they actually have the disease, according to Bayes Theorem?

1 / 1 point

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

Correct

Correct! According to Bayes Theorem, the probability of a person actually having the disease given a positive test result is equal to the probability of having the disease (1%) multiplied by the sensitivity of the test (95%), divided by the overall probability of testing positive (which is equal to the sum of the probability of having the disease and testing positive, and the probability of not having the disease and testing positive). Using these numbers, we get:

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

4. Consider the following experiment:

1 / 1 point

You flip a coin 10 times.

What is the probability of getting at least 2 heads?

Hint: You can use the Binomial Distribution to model this experiment. Also, in this case, it might be easier to use the complement rule $P(X \geq 2) = 1 - P(X < 2) = 1 - (P(X = 0) + P(X = 1))$.

- ○ $\frac{1}{2^{10}}$
- ○ $\frac{2^{10} - 1}{2^{10}}$
- ○ $\frac{2^{10} - 10}{2^{10}}$
- ◉ $\frac{2^{10} - 11}{2^{10}}$

Correct

Correct! If X is the number of heads when flipping a coin 10 times, then we know that $X \sim Bin(10, \frac{1}{2})$. What the question asks is

$$P(X \geq 2) \overset{\text{complement rule}}{=} 1 - P(X < 2)$$

And

$$P(X < 2) = P(X = 0) + P(X = 1)$$

$$P(X = 0) = \binom{10}{0} \left(\frac{1}{2}\right)^0 \left(\frac{1}{2}\right)^{10} = \frac{1}{2^{10}}$$

$$P(X = 1) = \binom{10}{1} \left(\frac{1}{2}\right)^1 \left(\frac{1}{2}\right)^9 = 10 \cdot \frac{1}{2^{10}}$$

Therefore,

$$P(X \geq 2) = 1 - P(X < 2) = 1 - \frac{11}{2^{10}} = \frac{2^{10} - 11}{2^{10}}$$

5. Suppose a random variable X is such that $X \sim Uniform(0, 1)$.

1 / 1 point

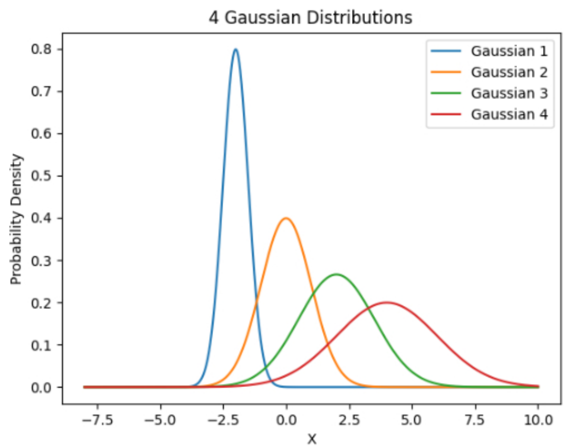
The value for $P(X \leq \frac{1}{2})$ is:

- ○ 1
- ○ 0
- ◉ $\frac{1}{2}$
- ○ $\frac{1}{3}$

Correct
Correct! Since X is equally likely to have any value between 0 and 1, it has a probability of $\frac{1}{2}$ of being less than or equal to $\frac{1}{2}$.

6.

1 / 1 point



About the 4 Gaussians in the graph above, it is correct to say (check all that apply).

- [x] $\sigma_{\text{Gaussian 4}} > \sigma_{\text{Gaussian 1}}$

Correct
Correct! The parameter σ controls the spread of the distribution, therefore the higher the σ, more spread the graph is around the center.

- [ ] $\mu_{\text{Gaussian 1}} > \mu_{\text{Gaussian 2}}$
- [x] $\mu_{\text{Gaussian 4}} > \mu_{\text{Gaussian 3}}$

Correct
Correct! The parameter μ controls the center of the distribution, therefore the higher the μ, the farther the center is from the origin.

- [x] $\sigma_{\text{Gaussian 3}} > \sigma_{\text{Gaussian 2}}$

Correct
Correct! The parameter σ controls the spread of the distribution, therefore the higher the σ, more spread the graph is around the center.

- [ ] $\sigma_{\text{Gaussian 1}} > \sigma_{\text{Gaussian 2}}$

7. You roll a dice 20 times and count how many times the number 4 appears.

1 / 1 point

If X is the number of times the number 4 appears, then$X \sim Binomial(n, p)$, where n and p are:

- [x] $$n = 20, p = \frac{1}{6}$$

Correct

Correct! Since the count is only if the number 4 appears or not, it can be modeled as a Binomial with parameters $n = 20$ and p the probability of appearing 4 in a dice roll, which is $\frac{1}{6}$.

- [ ] $$n = \frac{1}{2}, p = 4$$
- [ ] $$n = \frac{1}{6}, p = 20$$
- [ ] $$n = 4, p = \frac{1}{2}$$

8. You have to work with the following random variable: the height of people in a country. What is the best distribution to model this random variable from the options below?

1 / 1 point

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

Correct

Correct! In this case it is reasonable to suppose that the random variable follows a normal distribution!