

1. A laboratory blood test is 95% effective in detecting a certain disease when it is in fact present. However, the test also yields a false positive result for 1% of the healthy persons test. If 0.5% of the population has the disease, what is the probability a person has the disease given that the test result is positive?

A) 0.452 B) 0.116 C) 0.231 D) 0.323

2. In answering a question on a multiple-choice test, a student either knows the answer or guesses. The probability that the student knows the answer is $1/2$. Assume that a student who guesses at the answer will be correct with probability $1/5$. What is the probability that a student knew the answer to a question, given that he or she answered it correctly?

A) $5/6$ B) $1/2$ C) $2/5$ D) $1/6$

3. When coin A is flipped it comes up head with probability $\frac{1}{4}$, whereas when coin B is flipped it comes up head with probability $\frac{3}{4}$. Suppose that one of these coins is randomly chosen and is flipped twice. If both flips land heads, what is the probability that coin B was the one flipped?

A) $\frac{9}{16}$ ~~B) $\frac{1}{16}$~~ C) $\frac{1}{10}$ D) $\frac{9}{10}$

4. Three balls are to be randomly selected without replacement from the box containing 20 balls numbered 1 through 20. If we bet that at least one of the drawn balls has a number as large as or larger than 18, what is the probability that we win the bet?

A) 0.508 B) 0.403 C) 0.284 D) 0.150

5. Three balls are randomly chosen from the box containing 3 white, 3 red, and 5 black balls. Suppose that we win \$1 for each white ball selected and lose \$1 for each red selected. What is the probability that we win money?

A) $\frac{1}{3}$ B) $\frac{2}{3}$ C) $\frac{13}{55}$ D) $\frac{1}{11}$

6. An infinite sequence of independent trials is to be performed. Each trial results in a success with probability p and a failure with probability $1 - p$. What is the probability that

i) at least 1 success occurs in the first n trials

A) $(1 - p)^n$ B) p^n C) $1 - (1 - p)^n$ D) $1 - p^n$

ii) exactly 5 successes occur in the first 10 trials if $p = 0.4$

A) 0.031 B) 0.001 C) 0.200 D) 0.313

7. The probability mass function (PMF) of a discrete random variable X is given by

$$p(x) = \frac{c\alpha^x}{x!}, \quad x = 0, 1, 2, \dots$$

where α is some positive value.

i) What is the constant c ?

A) $c = \frac{2!}{\alpha^2}$ B) $c = \frac{1}{\alpha}$ C) $c = e^\alpha$ D) $c = e^{-\alpha}$

ii) Find $P(X > 1)$.

A) $P(X > 1) = \alpha e^{-\alpha}$

B) $P(X > 1) = (1 + \alpha)e^{\alpha}$

C) $P(X > 1) = 1 - (1 + \alpha)e^{-\alpha}$

D) $P(X > 1) = 1 - \alpha e^{\alpha}$

8. Given the cumulative distribution function

$$F(x) = \begin{cases} 0, & x < -2 \\ 0.2, & -2 \leq x < 0 \\ 0.7, & 0 \leq x < 2 \\ 1, & 2 \leq \end{cases}$$

Find the probability $P(X = 0)$.

A) 0.2

B) 0.5

C) 0.7

D) 0.45