1. Suppose that in your city 29% of the voters are registered as Democrats, 26% as Republicans, and 12% as members of other parties. Voters not aligned with any official party are termed “Independent.” You are conducting a poll by calling registered voters at random. In your make three calls, what is the probability that you talk to at least one Independent?

\[ p(\text{Indep}) = 1 - 0.29 - 0.12 - 0.16 = 0.43 \]

\[ p(N \geq 1) = 1 - p(N = 0) \]

\[ = 1 - (0.67) \times 0.67 \times 0.67 \approx 0.699 \]

(a) 0.964

(b) 0.889

(c) 0.333

(d) 0.699

Use the following information to answer questions 2 and 3

Let \( X \) denote a random variable that has a geometric distribution with probability of success \( p = 0.15 \) on any trial. (Hint: \( X \) is the number of failures prior a success)

2. Find \( P(X=1) \).

\[ q^n \cdot p = 0.85 \times 0.15 = \]

(a) 0.1225

(b) 0.568

(c) 0.26

(d) 0.3333

3. What's the expected number of failures before the first success? [Round up your answer to the nearest integer]

\[ E(X) = \frac{q}{p} = \frac{0.85}{0.15} \approx 5.67 = 6 \]

(a) 3

(b) 10

(c) 6

(d) 5

\[ P(S | X=5) = 0.2 \]

\[ P(NS | X=0) = 0.13 \]

4. Suppose that 20% of adults smoke cigarettes. It is know that 57% of smokers and 13% of nonsmokers develop a certain lung condition by age 60. What is the probability that a 60-year old chosen at random smokes and have the lung condition?

\[ P(\text{Smoker} \& \text{Lung}) = P(\text{Lung} | \text{Smoker}) \cdot P(\text{Smoker}) \]

\[ P(\text{Lung} | \text{Smoker}) = 0.57 \times 0.2 = 0.114 \]

\[ P(\text{Lung} | \text{NS}) = 0.13 \]

\[ P(Lung | NS) = P(Lung) \cdot P(NS) \]

(a) 0.57

(b) 0.114

(c) 0.13

(d) 0.60
8. A company buys parts from 2 suppliers. Supplier 1 has a record of delivering parts that contain 2% defectives. Supplier 2 has a defective rate of 4%. Suppose that 35% of a shipment came from supplier 1. If a part from this is defective, what's the probability it came from supplier 1?

\[ P(D|S1) = 0.02 \]
\[ P(D|S2) = 0.04 \]
\[ P(S1) = 0.35 \]
\[ P(S2) = 0.65 \]

\[ P(S1|D) = \frac{P(D|S1) \cdot P(S1)}{P(D|S1) \cdot P(S1) + P(D|S2) \cdot P(S2)} \]
\[ = \frac{0.02 \times 0.35}{0.02 \times 0.35 + 0.04 \times 0.65} \]
\[ = \frac{2}{7 + 22} \]
\[ = 0.2059 \]

9. Let A, B, C be events in a sample space. Are the following statements true?

Notation: A^c is the complement of A.

I) \( P(AB) = P(AB \cap C^c) + P(ABC) \)

II) \( P(BC) = 1 - P(CB) \)

a) I and II are true
b) Only I is true

c) None is true
d) Only II is true

10. The following table shows the distribution of X, compute \( E(X) \)

<table>
<thead>
<tr>
<th>X</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>P(X=x)</td>
<td>0.53</td>
<td>0.249</td>
<td>0.221</td>
</tr>
</tbody>
</table>

Answer choices:

a) 1.691
b) 0.593
c) 0.656
d) 0.810
Extra credit!!

Instructions: Solve only two of the following 3 problems! If you solve more than 2, only the first and second problem will be graded. Justify your answer to receive full credit.

1. A firm places three orders for supplies among five different distributors. Each order is randomly assigned to one of the distributors, and a distributor may receive multiple orders. What is the probability that all orders go to different distributors? (2.55)

\[ \frac{60}{3^5} \]

2. Nine impact wrenches are to be divided evenly among three assembly lines. In how many ways can this be done? (2.57)

\[ \frac{9!}{3!3!3!} \]

3. Consider two mutually exclusive events A and B such that \( P(A) > 0 \) and \( P(B) > 0 \). Are A and B independent?

**No.**

\[ P(A \cap B) = 0 \]

\[ \text{but} \quad P(A) \cdot P(B) > 0. \]
A proficiency examination for a certain skill was given to 100 employees of a firm. Forty of the employees were men. Sixty of the employees passed the examination (by scoring above a preset level for satisfactory performance). The breakdown of the test results among men and women is shown in the accompanying diagram.

<table>
<thead>
<tr>
<th></th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pass</td>
<td>24</td>
<td>36</td>
<td>60</td>
</tr>
<tr>
<td>Fail</td>
<td>16</td>
<td>24</td>
<td>40</td>
</tr>
<tr>
<td>Total</td>
<td>40</td>
<td>60</td>
<td>100</td>
</tr>
</tbody>
</table>

Suppose that an employee is selected at random from among the 100 who took the examination.

5. Find the probability that the employee passed, given that she was a female.
   a) 0.3
   b) 0.6
   c) 0.4
   d) 0.7

Use the following information to answer problems 6 and 7. Suppose a game is played by rolling three fair 6-sided dice:

6. What's the probability of rolling a 3-of-a-kind (All the dice have the same number)
   a) 0.028
   b) 0.280
   c) 0.986
   d) 0.326

\[
\begin{align*}
\frac{1}{6} \times \frac{1}{6} \times \frac{1}{6} \times 6 &= \frac{1}{216} = 0.004722222222222222
\end{align*}
\]

7. What's the probability that two of the dice show a 1 and one die shows a 5?
   a) 0.986
   b) 0.333
   c) 0.562
   d) 0.014
11. Find $F(2)$.
   a) 0.249
   b) 0.53
   c) 0.779
   d) 0.47

12. Let $X$ be a random variable with variance 9 ($V(X) = 9$). Let $Y = 3X + 2$. What's the variance of $Y$?
   a) 81
   b) 83
   c) 9
   d) 27

13. If $X$ is Bernoulli random variable with $p=0.35$, what is $E(X)$?
   a) 3.5
   b) 0.65
   c) 0.35
   d) 1

14. Let $Y$ be a Binomial random variable with parameters $n=10$ and $p=0.23$. What is $E(Y)$?
   a) 5
   b) 10
   c) 0.23
   d) 2.3