<u>Assignment Questions</u>
<u>DATA DISTRIBUTION</u>

<u>ANSWER = 1</u>

To find the percentage of values that lie between 45 and 55 in a normal distribution with a mean of 50 and a standard deviation of 5, we can use the **empirical rule** (also known as the **68-95-99.7 rule**):

<u>Empirical Rule Summary</u>:

- **68%** of the data falls within **1 standard deviation** of the mean.
- **95%** falls within **2 standard deviations**.
- **99.7%** falls within **3 standard deviations**.

<u>GIVEN:</u>

- Mean (mu) = 50
- Standard deviation (sigma) = 5
- Range: 45 to 55 → This is exactly **1 standard deviation** below and above the mean.

Therefore, **approximately 68%** of the values lie between 45 and 55.

<u>ANSWER = 2</u>

To solve this problem, we'll use the properties of a normal distribution.

<u>Given:</u>

- Mean (μ) = 70
- Standard Deviation (σ) = 10

We want to find the percentage of students who scored above 80.

First, calculate the z-score for X = 80:

$$z = (X - \mu) / \sigma$$

= (80 - 70) / 10

<u>= 1</u>

Using a standard normal distribution (Z-table), we look up the z-score:
$P(Z < 1) \approx$ **0.8413**

We're interested in $P(X > 80)$, which corresponds to $P(Z > 1)$:
$P(Z > 1) = 1 - P(Z < 1)$
$= 1 - 0.8413$
$= 0.1587$

To convert this to a percentage:
$0.1587 \times 100\% \approx 15.87\%$
Therefore, approximately 15.87% of students scored above 80.

ANSWER = 3

Given:

- Mean (μ) = 160 cm
- Standard Deviation (σ) = 8 cm

We want to find P (X < 150).

Calculate the z-score for X = 150:
$z = (X - \mu) / \sigma$
$= (150 - 160) / 8$
$= -10 / 8$
$= -1.25$

Using a standard normal distribution (Z-table), we look up the z-score:
$P(Z < -1.25) \approx 0.1056$
Therefore, the probability that a randomly selected adult is shorter than 150 cm is approximately 0.1056 or 10.56%.

ANSWER = 4

This distribution is positively skewed.

- The majority of individuals earn between $30,000-$50,000 (relatively low to moderate incomes).
- A few individuals earn very high incomes (over $500,000), creating a long tail on the right side of the distribution.

Characteristics of positive skew:
- Mean > Median
- Long right tail
- Few high values pull the mean upward

In this case:
- Most people have moderate incomes.
- Few very high earners stretch the distribution to the right, creating positive skew.

ANSWER = 5

This distribution is negatively skewed.

- Most employees retire between 60-65 years (relatively high ages).
- A small number retire earlier (lower ages), creating a tail on the left side.

Characteristics of negative skew:
- Mean < Median
- Long left tail
- Few low values pull the mean downward

In this case:
- Most retire at older ages (60-65).
- Few early retirees create a tail stretching left, making it negatively skewed.

ANSWER = 6

Leptokurtic distribution (high kurtosis)

Explanation:

1. Kurtosis measures how **"peaked" or "flat"** a distribution is, and how heavy its tails are compared to a normal distribution.
2. **The question says:**

The dataset shows frequent extreme values in both tails.

This means the distribution has more outliers (extreme highs and lows) than a normal distribution.

3. When a distribution has:

- A sharp peak (centered values are tightly packed)
- Heavy tails (more extreme values)

It is called leptokurtic.

ANSWER = 7

Given:

- 2% of products are defective

Therefore, the probability of a product being defective **= 0.02**

The probability of a product NOT being defective **= 1 - Probability(defective)**
= **1 - 0.02**

= 0.98

So, the probability that a randomly selected product is not defective is 0.98 or 98%.

ANSWER = 8

Card from 52-card deck:
a) **A spade?** 13 spades out of 52 → $13/52 = 1/4 = 25\%$.
b) **A red card?** 26 red cards out of 52 → $26/52 = 1/2 = 50\%$.

ANSWER = 9

Assuming two fair six-sided dice, there are 36 equally likely outcomes (6 × 6).

a) Probability of Rolling a Sum of 7

- Possible outcomes: (1,6), (2,5), (3,4), (4,3), (5,2), (6,1) — 6 favorable outcomes.
- Probability: 6 / 36 = 1/6 ≈ 0.1667 (or 16.67%).
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b) Probability of Rolling a Double

- Possible outcomes: (1,1), (2,2), (3,3), (4,4), (5,5), (6,6) — 6 favorable outcomes.
- Probability: 6 / 36 = 1/6 ≈ **0.1667 (or 16.67%).**

ANSWER = 10

Probability Calculations for Rain on Two Days

Assuming the events are independent (no information suggesting otherwise), we can use the multiplication rule for independent events.

(a) Probability it Rains on Both Days

- P(Both) = P(Monday) × P(Tuesday) = 0.40 × 0.50 = 0.20 (or 20%).

b) Probability it Rains on At Least One Day

- P (At least one) = 1 - P(Neither) = 1 - (P (No rain Monday) × P(No rain Tuesday)) = 1 - (0.60 × 0.50) = 1 - 0.30 = **0.70 (or 70%).**

ANSWER = 11

Assuming the events are independent (no information suggesting otherwise), we can use the multiplication rule for independent events.

a) Probability Both Have the Disease

- P(Both) = P(Patient 1) × P(Patient 2) = 0.10 × 0.10 = 0.01 (or 1%).

b) Neither Has the Disease

- P(Neither) = P(No disease in Patient 1) × P(No disease in Patient 2) = 0.90 × 0.90 = **0.81 (or 81%)**

ANSWER = 12

Calculation

- Probability a single employee prefers remote work: $\frac{3}{10}$
- Probability all three do: $(\frac{3}{10})^3 = \frac{27}{1000}$

However, since we are selecting without replacement, we must adjust for dependent events:

1. Probability the first employee prefers remote work: $\frac{3}{10}$
2. Probability the second also does (one less preferred in the pool): $\frac{2}{9}$
3. Third employee: $\frac{1}{8}$

So, the combined probability is:

$$P = \frac{3}{10} \times \frac{2}{9} \times \frac{1}{8} = \frac{6}{720} = \frac{1}{120}$$

Final Answer

The probability that all three selected employees prefer remote work is $\mathbf{\frac{1}{120}}$.

ANSWER = 13

The totals number of balls in the bag is $\mathbf{4 + 5 + 6 = 15}$.

a) **Probability of picking a red ball**

- Number of red balls: 4
- Total balls: 15
- Probability = $\frac{4}{15}$

b) **Probability of picking a ball that is not green**

- Number of green balls: 6
- Number of non-green balls: $15 - 6 = 9$
- Probability $= \frac{9}{15} = \frac{3}{5}$

Final Answers

a) The probability of picking a red ball is $\frac{4}{15}$.

b) b) The probability of picking a ball that is not green is $\frac{3}{5}$

ANSWER = 14

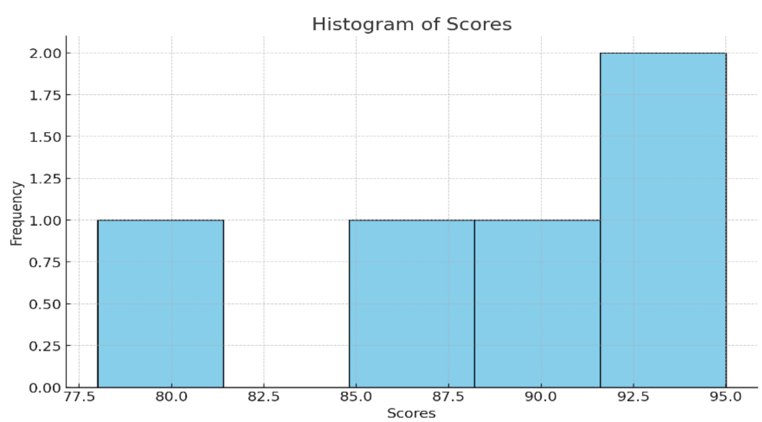
The histogram shows that most scores are clustered toward the higher end (85–95), with fewer scores on the lower end (78).

Conclusion:

The distribution is negatively skewed (left-skewed) because:

- **The tail extends to the left (lower scores).**
- **Most values are high, close to the maximum.**

So, this dataset's distribution is negatively skewed.



ANSWER = 15

mean = 75, SD = 5
65 and 85 are 75 ± 10, i.e. ± 2standard deviations (since $10/5 = 2$).

Approximately 95% of scores lie within $\pm 2\sigma$.
Answer: ≈ 95%.