**Mathematics:**

**STATISTICS & PROBABILITY**

### Measures of Central Tendency
- **mean:** $\bar{x} = \frac{x_1 + x_2 + ... + x_n}{n}$
- **median:** the middle number
- **mode:** the most common number

### Measures of Spread
- **standard deviation:** $\sigma = \sqrt{\frac{\sum(x-\mu)^2}{n}}$
- **range:** $R = \text{largest value} - \text{smallest value}$
- **interquartile range:** $IQR = Q_3 - Q_1$

### Transforming Data
- Adding $c$ to each term:
  - the mean increases by $c$
  - the standard deviation is unchanged
- Multiplying each term by $c$:
  - both the mean and standard deviation will be multiplied by $c$

### Binomial Probability
$$P = \binom{n}{r} p^r (1-p)^{n-r}$$
- $n$: trials
- $r$: successes
- $p$: probability of success
- $q$: probability of failure

### Probability of a Single Event
$$P(\text{an event}) = \frac{\text{number of favorable outcomes}}{\text{total number of possible outcomes}}$$

### Set Theory
- $A$: all items in $A$
- $A'$: all items not in $A$
- $A \cap B$: items in $A$ and $B$
- $A \cup B$: items in $A$ or $B$

### Permutations & Combinations
- **Permutations:** $\binom{n}{r} = \frac{n!}{(n-r)!}$
  - order matters
- **Combinations:** $\binom{n}{r} = \frac{(n-r)!}{(n-r)!}$
  - order doesn’t matter

### Probability of Multiple Events
- **Intersection:** $P(A \cap B) = P(A) \times P(B)$
- **Union:** $P(A \cup B) = P(A) + P(B) - P(A \cap B)$
- **Conditional:** $P(B|A) = \frac{P(A \cap B)}{P(A)}$

### Graphs and Charts
- **Pie chart:** shows parts of a whole
- **Scatter plot:** shows relationships between two continuous variables
- **Line graph:** shows relationships between two variables and emphasizes change
- **Bar graph:** shows relationship between a continuous variable and data in categories
- **Histogram:** shows frequency of data in category or ranges
- **Stem and leaf plot:** shows the general distribution and shape of a data set

#### Stem and Leaf Plot Example

<table>
<thead>
<tr>
<th>Stem</th>
<th>Leaf</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>1</td>
<td>6, 7</td>
</tr>
<tr>
<td>2</td>
<td>8, 3, 6</td>
</tr>
<tr>
<td>3</td>
<td>4, 5, 9, 5, 5, 8, 5</td>
</tr>
<tr>
<td>4</td>
<td>7, 7, 7, 8</td>
</tr>
<tr>
<td>5</td>
<td>12 = 512</td>
</tr>
</tbody>
</table>