
STATISTICS & PROBABILITY

Complete Unit Resource

Grade Level: 8 - 10	Duration: 4 Weeks
Focus: Data Analysis, Probability, & Inference	Format: Print-Ready Workbook

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Unit Overview

This 4-week unit introduces students to the foundational concepts of statistics and probability, bridging the gap between basic data representation and inferential statistics. Through real-world contexts, students will learn to analyze data, calculate probabilities, and make data-driven decisions.

4-Week Pacing Guide

Week	Focus Topics	Key Assessments
Week 1	Measures of Centre & Spread	Real-World Data Set #1 & #2
Week 2	Data Displays & Compound Probability	Probability Lab #1 & #2
Week 3	Permutations, Combinations, Normal Dist	Probability Lab #3, Data #5 & #6
Week 4	Hypothesis Testing & Unit Review	Probability Lab #4, Unit Test

Week 1: Measures of Centre & Spread

Visual Guided Notes: Measures of Centre

Concept	Definition & Formula	When to Use
Mean	Sum of values / Number of values. Formula: $\bar{x} = \text{Sum}(x) / n$	Best for symmetrical data without outliers.
Median	Middle value when data is ordered. Rule: Average two middle if n is even.	Best for skewed data or data with outliers.
Mode	Value that appears most frequently.	Best for categorical data.

Visual Guided Notes: Measures of Spread

Concept	Definition / Calculation	Interpretation
Range	Max Value - Min Value	Total spread. Highly affected by outliers.
IQR	$Q3 - Q1$ (25th to 75th percentile)	Spread of the middle 50%. Resistant to outliers.
MAD	Average distance of each point from the mean.	Average deviation from center.
Std Dev	Square root of average squared deviations. Formula: $s = \sqrt{\text{Sum}(x - \bar{x})^2 / (n-1)}$	Most common measure; weights outliers heavily.

Workbook: Measures of Centre & Spread Practice

Directions: Calculate the mean, median, mode, range, and IQR for the data sets. Show your work.

1. Standard Data Set

Data: 12, 15, 14, 19, 18, 14, 13, 21, 14

Measure	Value / Calculation
Mean	
Median	
Mode	
Range	
Q1	
Q3	
IQR	

2. Skewed Data Set (Outlier Impact)

Data: 45, 48, 42, 50, 43, 125

Measure	Value / Calculation
Mean	
Median	
Mode	
Range	
IQR	

Reflection: Which measure of centre is more appropriate for Data Set 2? Explain your reasoning based on the presence of an outlier.

Real-World Data Analysis Activity #1

Tech Startup Salaries

A tech startup has 10 employees. The CEO claims that the average salary at the company is over \$85,000. As a data analyst, you need to verify this claim and analyze the spread of the salaries.

Data Set:

Emp	Role	Salary (\$)
1	CEO	210,000
2	CTO	155,000
3	Lead Dev	95,000
4	Developer	78,000
5	Developer	78,000
6	Developer	74,000
7	UX Design	72,000
8	Marketing	68,000
9	Admin	45,000
10	Intern	35,000

Analysis Tasks:

1. Calculate the mean, median, and mode of the salaries.
2. Is the CEO's claim that the 'average' is over \$85,000 mathematically correct? Explain which average they are using.
3. Calculate the IQR and Range. What does the difference tell you about the salary distribution?
4. Which measure of centre best represents the typical experience of an employee? Justify your answer.

Week 2: Data Displays & Probability

Visual Guided Notes: Data Displays

Display Type	Key Features	Best Used For...
Box Plot	Displays 5-Number Summary. Box is IQR. Whiskers extend to Min/Max.	Comparing distributions, identifying skewness, and seeing spread.
Histogram	Continuous intervals (bins) on x-axis. No gaps. y-axis is frequency.	Showing the shape/center of large continuous data sets.

Workbook: Interpreting Box Plots

Directions: Two cities recorded daily high temperatures for July. Use the box plot summaries to answer the questions.

City	Min	Q1	Med	Q3	Max
City A (Coastal)	65	70	75	78	85
City B (Desert)	85	92	98	104	112

1. Which city has the higher median temperature? What is the difference in the medians?
2. Calculate the IQR for both cities. Which city has more variability in its July temperatures?
3. A tourist wants a city consistently in the 90s. Which city is better, or is neither appropriate?

Real-World Data Analysis Activity #2

Climate Comparison: Coastal vs. Desert

You are provided with the raw daily high temperature data (in F) for 10 random summer days for both City A and City B. Your task is to construct a parallel box plot and compare the climates.

Data Set:

Day	City A (F)	City B (F)
1	68	95
2	72	102
3	70	98
4	75	108
5	74	99
6	69	91
7	73	105
8	76	100
9	71	94
10	75	101

Analysis Tasks:

1. Calculate the 5-number summary for both cities.
2. Draw a parallel box plot for the two cities on the same number line below.
3. Write a 2-3 sentence summary comparing the center and spread of the two cities' temperatures.

Parallel Box Plot Workspace:

Probability Experiment Lab Guide #4

The Monty Hall Problem: Conditional Probability

Objective: To explore conditional probability and counter-intuitive logic through the famous Monty Hall Problem.

Background: You are on a game show. There are 3 doors. Behind one is a car; behind the other two are goats. You pick Door 1. The host opens Door 3, revealing a goat. The host asks: 'Do you want to switch to Door 2?'

Pre-Lab Prediction:

Does switching increase your chances, decrease them, or not matter? Why?

Experiment Procedure:

1. Work in pairs. One is Host, the other is Contestant.
2. Play 20 rounds where Contestant ALWAYS STAYS.
3. Play 20 rounds where Contestant ALWAYS SWITCHES.

Strategy	Rounds	Wins (Car)	Win %
Always Stay	20		
Always Switch	20		

Analysis Questions:

1. Based on your data, which strategy resulted in a higher win percentage?
2. Explain mathematically WHY switching gives you a $\frac{2}{3}$ probability of winning, while staying gives you only $\frac{1}{3}$.

Unit Project Options

Choose **ONE** of the following projects to demonstrate your mastery of Statistics and Probability. Each project requires a final product and a brief presentation.

Project Option 1: The Statistical Infographic

Task: Select a real-world topic. Find/collect a data set of at least 30 points. Create an infographic with a histogram, a box plot, the mean/median/mode, standard deviation, and a written analysis.

Project Option 2: Probability Carnival Game

Task: Design a playable carnival game. Calculate theoretical probability. Have 30 classmates play to find experimental probability. Write a report comparing theoretical vs. experimental probability and determine if the game is 'fair'.

Project Option 3: Data Journalism Report

Task: Find a claim made by a company/ad. Conduct research to find raw data. Perform a hypothesis test. Write a 2-page news article exposing the truth, using normal distributions and p-values to justify your conclusion.

Project Grading Rubric

100 Points Total

Criteria	Exemplary (25)	Proficient (20)	Developing (15)	Beginning (10)
Math Accuracy	All calculations correct. Flawless application.	1-2 minor errors, concepts correct.	Several errors, some concepts misapplied.	Major errors; fundamental misunderstanding.
Data Analysis	Deeply analyzed. Conclusions logical and supported.	Analyzed. Conclusions mostly logical.	Superficial analysis. Loose connections.	Little to no analysis. Conclusions missing.
Visuals	Neat, professional, clearly communicate data.	Neat and accurate, lack professional polish.	Messy, incomplete, or hard to read.	Missing or entirely illegible.
Writing	Clear, concise, uses statistical vocabulary.	Clear, lacks consistent vocabulary.	Unclear or misuses terms.	Confusing; statistical terms absent.

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