CueStat Student User Manual

Welcome to CueStat! This guide will help you learn how to use CueStat for your statistics assignments and explorations. CueStat is designed to make statistical analysis easy and accessible for everyone.

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Getting Started

What is CueStat?

CueStat is an interactive statistical analysis tool that helps you: - Analyze data without writing code - Create professional charts and tables - Learn statistics through interactive simulations - Perform hypothesis tests and confidence interval calculations

Accessing CueStat

Your instructor will provide you with a link to access CueStat. When you open the link: 1. The app will load in your web browser 2. You'll see "CueStat: STAT C1000 Analysis Tool" at the top 3. A sidebar on the left shows different sections (tabs) 4. The main area is where you'll work with your data and see results

First Steps

1. **Look at the sidebar** on the left side of the screen
2. **Click on "Data"** to start - this is where you'll enter or upload your data
3. Follow along with the sections below to learn each feature

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Understanding the Interface

The Sidebar

The sidebar contains all the main sections (tabs) of CueStat:

- **Data** - Enter or upload your data
- **Descriptive Statistics** - Get summaries of your data (mean, median, standard deviation, etc.)
- **Probability Distributions** - Calculate probabilities for various distributions
- **Tables** - Create frequency tables and cross-tabulations
- **Plots** - Make histograms, boxplots, and other visualizations
- **Confidence Intervals** - Calculate interval estimates

- **Hypothesis Testing** - Perform statistical tests
- **Simulations** - Explore statistical concepts interactively

The Main Area

This is where you'll: - Enter or view your data - See calculation results - View charts and tables - Adjust settings for your analyses

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Working with Data

Option 1: Upload a File

1. Click on **"Data"** in the sidebar
2. Look for the **"Upload Data"** section
3. Click **"Browse files"** or drag and drop your file
4. Supported formats:
   - **CSV files** (.csv)
   - **Excel files** (.xlsx, .xls)

Tips: - Make sure your file has column headers in the first row - Keep column names simple (no special characters) - Each column should contain one variable

Option 2: Manual Data Entry

If you don't have a file, you can type your data directly:

1. Click on **"Data"** in the sidebar
2. Scroll to **"Manual Data Entry"**
3. Click **"Add Column"** to create a new column
4. Type a name for your column (e.g., "Test Scores")
5. Choose the data type:
   - **Numeric** - for numbers (test scores, heights, etc.)
   - **Text** - for categories (gender, major, etc.)
6. Click **"Add rows"** to add more data entry rows
7. Type your data into the cells

Example:

```
Column Name: Test_Scores
Data Type: Numeric
Values: 85, 92, 78, 88, 95, 82
```

Viewing Your Data

Once you've loaded or entered data: - You'll see a preview table showing your data - Column names are shown at the top in bold - You can scroll if you have lots of data

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Descriptive Statistics

Descriptive statistics help you summarize and understand your data.

How to Use

1. Click **"Descriptive Statistics"** in the sidebar
2. You'll see a dropdown menu: **"Select columns to analyze"**

3. Click on the dropdown and select one or more columns
4. The results will appear immediately

What You'll See

For each column you selected, you'll see:

Summary Statistics: - **Count** - Number of data points - **Mean** - Average value - **Median** - Middle value - **Mode** - Most frequent value - **Std** - Standard deviation (how spread out the data is) - **Variance** - Another measure of spread - **Min** - Smallest value - **Max** - Largest value - **Range** - Difference between max and min - **Q1, Q2, Q3** - Quartiles (25th, 50th, 75th percentiles) - **IQR** - Interquartile range (Q3 - Q1) - **Skewness** - Whether data is skewed left or right - **Kurtosis** - How "peaked" the distribution is

Visualizations: - **Histogram** - Shows the distribution of your data - **Box Plot** - Shows median, quartiles, and outliers

Understanding the Results

Example: If you're analyzing test scores: - **Mean = 85** means the average score is 85 - **Median = 87** means half the scores are below 87 - **Std = 8.5** means most scores are within 8.5 points of the average - **Outliers** - Any unusual values will be flagged

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Probability Distributions

Use this section to calculate probabilities for different statistical distributions.

Normal Distribution

The normal distribution (bell curve) is used for many real-world data.

What you can calculate: 1. **Probability from Z-score** - "What's the probability of getting a z-score less than 1.5?" 2. **Z-score from Probability** - "What z-score corresponds to the 95th percentile?" 3. **Probability between two Z-scores** - "What's the probability between z = -1 and z = 1?"

How to use: 1. Click **"Probability Distributions"** in sidebar 2. Select **"Normal Distribution"** 3. Choose what you want to calculate 4. Enter your values 5. Click **"Calculate"** 6. See the result and a visual representation

Example: Finding the probability of $z < 1.96$: - Select "$P(Z < z)$" - Enter $z = 1.96$ - Result: 0.975 (97.5%)

t-Distribution

Used when working with small samples or when population standard deviation is unknown.

Options: - Calculate probabilities for specific t-values - Find critical t-values for confidence intervals - Requires degrees of freedom (usually n - 1)

Chi-Square Distribution

Used for categorical data analysis and variance tests.

F-Distribution

Used for ANOVA and comparing variances.

Binomial Distribution

Used when counting successes in a fixed number of trials.

Example: Coin flips - n = 10 (number of flips) - p = 0.5 (probability of heads) - x = 7 (number of heads) - Calculate: Probability of getting exactly 7 heads

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Creating Tables

Frequency Tables (One-Way)

Shows how often each value appears in your data.

How to create: 1. Click **"Tables"** in sidebar 2. Select **"Frequency Tables"** 3. Choose a column from your data 4. You'll see: - Each unique value - How many times it appears (Count) - What percentage it represents

Example: Survey of favorite colors

```
Color    | Count | Percent
---------|-------|--------
Blue     | 15    | 30%
Red      | 12    | 24%
Green    | 23    | 46%
```

Two-Way Tables (Cross-Tabulation)

Shows the relationship between two categorical variables.

How to create: 1. Click **"Tables"** in sidebar 2. Select **"Two-Way Tables"** 3. Choose: - **Row variable** (e.g., Gender) - **Column variable** (e.g., Major) 4. Select what to display: - **Counts** - Raw numbers - **Row %** - Percentages within each row - **Column %** - Percentages within each column - **Total %** - Percentage of grand total

Example: Gender vs Major

```
           | Science | Arts | Business | Total
-----------|---------|------|----------|------
Male       | 45      | 20   | 35       | 100
Female     | 38      | 42   | 20       | 100
Total      | 83      | 62   | 55       | 200
```

Contingency Tables with Chi-Square Test

Tests if two categorical variables are independent.

How to use: 1. Create a two-way table (as above) 2. Look for the **Chi-Square Test Results**: - **Chi-square statistic** - Measure of association - **p-value** - If less than 0.05, variables are related - **Degrees of freedom** - Depends on table size

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Making Plots

Visualizations help you see patterns in your data.

Histograms

Shows the distribution of numerical data.

How to create: 1. Click **"Plots"** in sidebar 2. Select **"Histogram"** 3. Choose a numeric column 4. Adjust the number of bins (bars) if needed 5. The histogram appears below

What to look for: - **Shape** - Is it bell-shaped, skewed, or uniform? - **Center** - Where is the middle of the data? - **Spread** - How wide is the distribution? - **Outliers** - Any bars far from the rest?

Box Plots

Shows median, quartiles, and outliers.

How to create: 1. Click **"Plots"** in sidebar 2. Select **"Box Plot"** 3. Choose a numeric column 4. The box plot appears

Understanding the box plot: - **Box** - Contains middle 50% of data (Q1 to Q3) - **Line in box** - Median - **Whiskers** - Extend to min/max (within 1.5×IQR) - **Dots** - Outliers beyond whiskers

Scatter Plots

Shows relationship between two numeric variables.

How to create: 1. Choose "Scatter Plot" 2. Select X-axis variable 3. Select Y-axis variable 4. Look for patterns (linear, curved, no pattern)

Confidence Intervals

Confidence intervals give you a range where the true population parameter likely falls.

One-Sample t-Interval

Estimates the population mean from your sample.

How to calculate: 1. Click **"Confidence Intervals"** in sidebar 2. Select **"One-Sample t-Interval"** 3. Choose: - **Column** with your data - **Confidence level** (usually 95%) 4. Click **"Calculate"**

Results you'll see: - **Sample mean** - Average of your data - **Confidence interval** - Range (e.g., 82.5 to 87.5) - **Margin of error** - Half the width of interval - **Interpretation** - What it means in plain language

Example:

```
Sample Mean: 85
95% Confidence Interval: (82.3, 87.7)
Interpretation: We are 95% confident that the true
population mean is between 82.3 and 87.7.
```

Two-Sample t-Interval

Estimates the difference between two population means.

When to use: Comparing two groups (e.g., male vs female test scores)

Proportion Confidence Interval

For categorical data (yes/no, success/failure).

Example: Estimating the proportion of students who prefer online classes

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Hypothesis Testing

Tests claims about populations using sample data.

One-Sample t-Test

Tests whether a population mean equals a specific value.

Steps: 1. Click **"Hypothesis Testing"** in sidebar 2. Select **"One-Sample t-Test"** 3. Enter: - **Column** with your data - **Null hypothesis value** ( ) - the claimed value - **Alternative hypothesis**: - **Two-sided**: (different from) - **Left-tailed**: $<$ (less than) - **Right-tailed**: $>$ (greater than) - **Significance level** (usually $= 0.05$) 4. Click **"Run Test"**

Results: - **t-statistic** - How many standard errors away from null value - **p-value** - Probability of getting these results if null is true - **Decision**: - If p-value $<$: **Reject null hypothesis** (significant difference) - If p-value : **Fail to reject null** (not enough evidence)

Example:

```
Question: Is the average test score different from 80?
Null:   = 80
Alternative:    80
Results:
  t = 2.34
  p-value = 0.023
  Decision: Reject null (p < 0.05)
Conclusion: The average score is significantly different from 80.
```

Two-Sample t-Test

Compares means of two independent groups.

Example: Do males and females have different average test scores?

Steps: 1. Select "Two-Sample t-Test" 2. Choose: - **Group 1** column - **Group 2** column 3. Select alternative hypothesis 4. Run test

Paired t-Test

Compares means of paired observations (before/after, matched pairs).

Example: Test scores before and after tutoring for the same students

Proportion Tests

Tests claims about population proportions (percentages).

Example: Is the proportion of students who pass greater than 70%?

Chi-Square Test for Independence

Already covered in the Tables section - tests if two categorical variables are independent.

Interactive Simulations

Simulations help you understand statistical concepts by letting you experiment and see what happens.

Central Limit Theorem

Shows how sample means form a normal distribution, even if the original data isn't normal.

How to use: 1. Click **"Simulations"** in sidebar 2. Select **"Central Limit Theorem"** 3. Adjust sliders: - **Population distribution** - Shape of original data - **Sample size** (n) - How many observations per sample - **Number of samples** - How many samples to take 4. Watch the animation: - **Top plot** - Original population - **Bottom plot** - Distribution of sample means

What to observe: - As sample size increases, distribution becomes more normal - Larger samples = less variability in sample means

Confidence Interval Simulation

Shows what "95% confidence" really means.

How to use: 1. Select "Confidence Intervals Simulation" 2. Set parameters: - Population mean ( ) - Population standard deviation ( ) - Sample size (n) - Number of intervals to create 3. Click **"Run Simulation"**

What you'll see: - Multiple confidence intervals plotted - About 95% will contain the true mean (shown in different colors) - About 5% will miss the true mean

Key learning: "95% confidence" means that 95% of intervals will capture the true parameter, not that there's a 95% chance for any specific interval.

Binomial Distribution Explorer

Visualizes probabilities for binomial experiments.

How to use: 1. Select "Binomial Distribution" 2. Adjust: - **n** - Number of trials (e.g., 10 coin flips) - **p** - Probability of success (e.g., 0.5 for fair coin) 3. See the probability for each possible number of successes

Example: 10 coin flips - See probability of 0 heads, 1 head, 2 heads, ..., 10 heads - Most likely outcome is around 5 heads

t vs Normal Distribution

Compares t-distribution to normal distribution.

How to use: 1. Select "t vs Normal" 2. Adjust **degrees of freedom** slider 3. Observe how t-distribution changes

What to learn: - With few degrees of freedom, t-distribution has fatter tails - As df increases, t-distribution approaches normal distribution - At df 30, they're nearly identical

F-Statistic Explorer

Shows how ANOVA works by comparing within-group and between-group variation.

How to use: 1. Select "F-Statistic Explorer" 2. Adjust: - **Between-group variance** - How different the group means are - **Within-group variance** - How spread out data is within each group 3. Observe the F-statistic

What to learn: - Large F-value = groups are different - Small F-value = groups are similar - F = (Between-group variation) / (Within-group variation)

Tips & Troubleshooting

Common Issues and Solutions

Problem: "No data loaded" - **Solution:** Go to the Data tab and upload a file or enter data manually

Problem: "Column not found" - **Solution:** Make sure you've selected a column from the dropdown menu

Problem: "Not enough data" - **Solution:** Some tests require minimum sample sizes (usually at least 3-5 data points)

Problem: Numbers are showing as text - **Solution:** In manual entry, make sure you selected "Numeric" as the data type

Problem: Can't see my plot - **Solution:** Scroll down - plots appear below the settings

Best Practices

1. **Save your data file** - Keep a backup of your data on your computer
2. **Use clear column names** - "Test_Score" is better than "X1"
3. **Check your data** - Look at the preview table to make sure data uploaded correctly
4. **Start simple** - Try descriptive statistics before advanced tests
5. **Read error messages** - They often tell you exactly what's wrong
6. **Ask for help** - If stuck, ask your instructor or classmates

Keyboard Shortcuts

- **Tab** - Move to next field
- **Shift+Tab** - Move to previous field
- **Enter** - Submit a form or run a calculation
- **Arrow keys** - Navigate through dropdown menus

Accessibility Features

CueStat is designed to be accessible to everyone.

For Keyboard Users

- **Navigate without a mouse:** Use Tab to move between elements
- **Activate buttons:** Press Enter or Space
- **Navigate dropdowns:** Use arrow keys
- **Focus indicators:** Blue outline shows where you are

For Screen Reader Users

- **All images have descriptions:** Charts and plots include text descriptions
- **Form labels:** Every input has a clear label
- **Landmarks:** Use headings to navigate sections
- **Alt text:** All important visual content has alternative text

Compatible with: - JAWS - NVDA - VoiceOver - Other major screen readers

Visual Accessibility

- **High contrast mode:** Works with your browser's high contrast settings
- **Resizable text:** Use browser zoom (Ctrl/Cmd + Plus)
- **Clear fonts:** Easy-to-read typography
- **Color-blind friendly:** Charts don't rely solely on color

Need Help?

If you encounter any accessibility barriers: 1. Contact your instructor 2. Report issues on GitHub 3. Include details about what's not working

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Example Workflow

Here's a complete example of analyzing data:

Scenario: Analyzing Test Scores

Step 1: Load Data - Go to Data tab - Upload your "test_scores.csv" file - Verify data appears correctly

Step 2: Descriptive Statistics - Go to Descriptive Statistics tab - Select "Test_Score" column - Note: Mean = 85, Std = 8.5, Median = 87

Step 3: Visualize - Go to Plots tab - Create a histogram - Observation: Data is roughly bell-shaped

Step 4: Hypothesis Test - Question: Is average score different from 80? - Go to Hypothesis Testing - Select One-Sample t-Test - Enter = 80 - Choose two-sided alternative - Results: p = 0.023, reject null - Conclusion: Average score is significantly different from 80

Step 5: Confidence Interval - Go to Confidence Intervals - Calculate 95% CI for mean - Result: (82.3, 87.7) - Interpretation: We're 95% confident the true average is between 82.3 and 87.7

Learning Resources

Statistical Concepts to Review

Before using CueStat, make sure you understand: - **Descriptive statistics:** Mean, median, standard deviation - **Hypothesis testing:** Null/alternative hypotheses, p-values, significance levels - **Confidence intervals:** Margin of error, confidence level - **Distributions:** Normal, t, chi-square, binomial

Getting More Help

- **Your textbook** - Review relevant chapters
- **Instructor** - Ask questions in class or office hours
- **Study groups** - Work through problems with classmates
- **Online resources** - Khan Academy, StatQuest, YouTube tutorials

Practice Problems

Try these activities to build your skills:

1. **Upload practice data** and calculate descriptive statistics
2. **Create different types of plots** to visualize data
3. **Run simulations** to see how statistical concepts work
4. **Perform hypothesis tests** with different significance levels
5. **Compare results** from different statistical methods

Getting Support

When You Need Help

For technical issues: - Check this manual first - Try refreshing the page - Check your internet connection - Contact your instructor

For statistics questions: - Review your course materials - Attend office hours - Use course discussion forums - Work with study groups

For accessibility support: - Contact your instructor - Reach out to campus disability services - Report issues for the development team to fix

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Conclusion

Congratulations! You now know how to use all the main features of CueStat. Remember:

- **Practice makes perfect** - The more you use it, the easier it gets
- **Explore freely** - You can't break anything
- **Ask questions** - Your instructor is there to help
- **Have fun** - Statistics can be interesting when you see it in action!

Good luck with your statistical analyses!

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For updates and additional resources, check with your instructor or visit the CueStat repository.