# Performance Based Learning and Assessment Task

## *Data Analysis Activity*

**I. ASSESSSMENT TASK OVERVIEW & PURPOSE:**
The students will: select a topic for investigation in the form of a survey, design and administer the survey, and calculate the designated descriptive statistics. Then, the students engage in calculating scale and categorical questions.

**II. UNIT AUTHOR:**
Whitney Wall Bortz, Radford City Public Schools

**III. COURSE:**
Algebra Functions and Data Analysis

**IV. CONTENT STRAND:**
Data Analysis

**V. OBJECTIVES:**
The student will be able to: 1)Conduct a survey and gather data about a research topic, 2)Using descriptive statistics, calculate the given proportions for scale and categorical questions, 3)Graphically and in written form express data results and conclusions

**VI. REFERENCE/RESOURCE MATERIALS:**
Students will use: Calculator, Graph paper, Computer Access

**VII. PRIMARY ASSESSMENT STRATEGIES:**
The task includes an assessment component that performs two functions: (1) for the student it will be a checklist and provide a self-assessment and (2) for the teacher it will be used as a rubric. The assessment list for the first activity is intended to evaluate the content and structure of the surveys. The list for the second activity is intended to measure the descriptive statistics, graphs and calculations of the collected data.

**VIII. EVALUATION CRITERIA:**
Assessment List for Activity 1 &2, corresponding rubrics.

**IX. INSTRUCTIONAL TIME:**
Eight to nine 90-minute class sessions

# Data Analysis Task

**Strand**
Data Analysis

**Related SOL**
- AFDA.7 (The student will analyze the normal distribution)
- AFDA. 8 (The student will design and conduct an experiment/survey)

**NCTM Standards**:
- Apply and adapt a variety of appropriate strategies to solve problems
- Understand how sample statistics reflect the values of population parameters and use sampling distributions as the basis for informal inference;
- Compute basic statistics and understand the distinction between a statistic and a parameter.
- Communicate mathematical thinking coherently and clearly to peers, teachers, and others

**Materials/Resources**
Students will use: Graphing calculators, Computer Lab assess (integrated into timeline of schedule), Microsoft Word/ Excel, Survey Monkey or Qualtrics (optional, to enhance survey options)

**Assumption of Prior Knowledge**
- Students have a basic understanding of the modes of central tendency, collecting data and analyzing the results.
- The student should feel comfortable gathering data from a population, developing meaningful and open-ended questions and collecting results
- The students may have difficulty creating questions that are open-ended and also questions that have a categorical response. The teacher will guide the student through the question creation process and support as needed.
- The relevant contexts the student grapples with in this activity are: the analysis & impact of social issues, health, education and media influences on pre-teens and teens

## Introduction: Setting Up the Mathematical Task
In this activity, you will investigate the relationship between survey design and data collection paired with data analysis. In this project, you will design and administer a survey to at least 15 people. Your topic should be appropriate for classroom research and must be pre-approved by

your teacher. Be careful not to choose a topic that would make any of your participants uncomfortable or require them to disclose personal information against their will. It is very important that those you invite to take your survey know that participation will be both anonymous and also voluntary. You will not ask for names, and your data will not be linked to identities in any way. You will then analyze the results of the survey and write a report on what you have found. This unit project is divided into two activities. Below, you will find a detailed description of what is required.

## Student Exploration

**Student/Teacher Actions**

Activity 1: Survey Design and Data Collection

1. Choose one of the following three topics to investigate:
    a. How do students feel about the school cafeteria food?
    b. What are students' opinions about the education they are receiving at our school?
    c. What do students think about the extracurricular activities at school?
2. The survey should have a title and a brief description of the topic.

The following are design considerations that you must consider when creating your survey and planning its administration. Then, please answer the following on a separate sheet of paper:

3. What is the population?
4. How did you sample it?
5. How did you control for bias?
6. Design a survey.
    a. The survey should have 8 questions. You should not ask questions that provide only a YES/NO response. Provide your participants with open-ended questions, to ensure that you collect enough relevant and specific information.
    b. Two questions should be categorical (e.g. what is your gender? What is your grade?)
    c. Two questions should ask students to provide a numerical answer that would yield continuous data. (e.g., How much do you spend each week in the cafeteria?)
    d. Four questions should involve some type of rating scale. The scale should have five levels and therefore correspond to 1, 2, 3, 4, 5. (e.g. strongly disagree, disagree, neutral, agree, strongly agree).
    e. You should have a coding system for each question so that answers correspond with numbers.
7. Your surveys should be typed and copied.

8. Administer the survey to at least 15 people.
9. Once surveys are completed, you will enter data into a table in Microsoft Word or Microsoft Excel. You will do this together as a class in the computer lab

Activity 2: Data Analysis
1. For the two categorical questions, calculate the proportion of participants who gave each answer. Write the proportions as a fraction, percent and decimal.
2. For two of the quantitative questions, calculate the following descriptive statistics:
   a. Mean
   b. Median
   c. Mode
   d. Variance
   e. Standard Deviation
3. Pick one of the scale questions and calculate separate means for two categories. For example, a mean for females and a mean for males. Write a short explanation of what the comparison in number three tells you about the two groups.
4. For two of the categorical questions, create a graph (e.g. bar graph, pie chart etc.) to visually display the data.
5. Analyze 2 questions in more detail:
   a. Calculate the range and interquartile range in addition to the descriptive statistics in number 7. Are there any outliers?
   b.  Is this data normally distributed? What is the shape of the data? Justify your answer.

Activity 1 is estimated to take 4-5 class days and Activity 2 is estimated to take 3-4 class days.
- Teachers will invite the students to draw upon their prior knowledge by brainstorming the formulas for: mean median, mode, variance and standard deviation individually. Then as a class, the students will compare their answers and confirm the correct formula before addressing the activity.
- The students are a group of collective knowledge; the teacher will encourage the students to draw on that knowledge first before seeking out other resources.
- Teachers will review the formulas as well as how the formulas are related and build off of one another.
- Student will make mathematical thinking public by using the appropriate mathematic vocabulary in conversations and in making connections between calculated statistics.

**Whole Class Sharing/Discussion**
Students will gather together in the close of these activities and share key findings or surprising facts.  Teachers will make a list of the findings so that the students can visually see the results

of the class. Then the teachers will address any results that appeared more often than others and reasons for this conclusion.

**Monitoring Student Responses**

- Students should take into careful consideration the questions they want to ask on the surveys. After each of the statistics is found, the students should see if they can come to any conclusions on their own and then bring those contributions to a class discussion.
- Common misconceptions or misunderstanding may arise in the difference between categorical and quantitative questions. Teachers should clarify the differences between questions and provide examples of each type of question for the students.
- Students are to communicate their thinking by asking questions and listening to other's comments and contributions.
- Students are to communicate with each other respectfully and supportively.
- Teachers are to highlight the frequently asked questions and provide strategies for avoiding and resolving difficulty.
- Teachers are to extend the material for students that are ready to move forward and emphasize real world applications.

# Assessment List and Benchmarks

Assessment List for Activity 1: Survey Design and Data Collection

| Num | Element | Point Value | Earned Assessment | |
|---|---|---|---|---|
| | | | Self | Teacher |
| 1 | The survey has a title and a description. | 2 | | |
| 2 | Population of interest is stated. | 2 | | |
| 3 | Sample is described and is appropriate to the population of interest. | 2 | | |
| 4 | It is stated how the student controlled for bias. | 2 | | |
| 5 | Survey has eight questions that are not yes or no questions. | 2 | | |
| 6 | The survey has two clearly-worded and organized categorical questions. | 2 | | |
| 7 | The survey has two clearly-worded and organized open-ended questions for which participants provide a numeric answer that yields continuous data. | 2 | | |
| 8 | The survey has four clearly-worded and organized questions with rating scales. | 2 | | |
| 9 | The survey is typed, copied, and neatly structured. | 2 | | |
| 10 | The student has obtained at least 15 responses. | 2 | | |
| 11 | A coding scheme is provided on a separate sheet of paper | 2 | | |
| 12 | Data has been correctly entered into a table | 2 | | |
| 13 | Data entry is organized and clear to understand | 2 | | |
| 14 | All materials are neat | 2 | | |
| 15 | The assignment materials are well-organized. | 2 | | |
| | Total | 30 | | |

| | | | | |
|---|---|---|---|---|
| **RUBRIC FOR ACTIVITY 1** | | | | |
| **#** | **Element** | **0** | **1** | **2** |
| 1 | Title and description | No title or description provided | Title and description are incomplete | Title and description provided |
| 2 | Population of interest stated | Population not stated | Population stated but incorrect | Population stated and accurate |
| 3 | Description of sample | No description of sample | Description of sample not accurate | Sample is described accurately |
| 4 | Description of how bias was controlled | No description provided | Insufficient description. | Bias control accurately described and good reasoning provided |
| 5 | Survey questions (8 total) | No performance tasks | NA | Includes eight total questions. |
| 6 | Two categorical questions. | No categorical question | Only 1 categorical question | Includes 2 clear, categorical questions |
| 7 | Two open-ended, numeric response questions. | No open-ended, numeric response questions | Only 1 open-ended numeric response question. | Includes 2 clear, open-ended numeric response questions. |
| 8 | Four rating scale questions | No rating scale questions | Less than 4 rating scale questions | Includes 4 clear questions with rating scales. |
| 9 | Survey typed and neat | Survey not typed or not neat | Survey lacks neatness | Survey is typed, copied and neatly structured. |
| 10 | Fifteen survey responses | Five or less responses | Between 6 and 14 responses | Student obtained 15 responses. |
| 11 | Coding Scheme | No coding scheme provided | Coding scheme is inaccurate or incomplete | Coding scheme provided and accurate to data. |
| 12 | Data entry into table | Student has not entered data into a table | Some data entered into table | Data correctly entered into the table. |
| 13 | Data entry is organized and accurate | Data inaccurate and disorganized | Data either inaccurate or disorganized | Data accurate and organized |
| 14 | Neatness of materials | Materials are not neat | Materials are lacking in neatness | Materials are neat and easy to read. |
| 15 | The components of the project are organized. | No organization | Some organization | Materials are well-organized when handed in. |

Assessment List for Activity 2: Data Analysis

| Num | Element | Point Value | Earned Assessment Self | Teacher |
|---|---|---|---|---|
| 1 | Includes proportions of responses for at least one categorical question | 3 | | |
| 2 | Includes proportions of responses for two questions | 3 | | |
| 3 | Includes descriptive statistics for one question. | 3 | | |
| 4 | Includes descriptive statistics for a second question. | 3 | | |
| 5 | Includes descriptive statistics for a third question. | 3 | | |
| 6 | Calculates separate means for two groups for one of the quantitative questions. | 3 | | |
| 7 | Provides a description of what the comparison of the two group means tells us about the data. | 3 | | |
| 8 | Calculates the range and interquartile range and constructs a boxplot for at least one question. | 3 | | |
| 9 | Calculates the range and interquartile range and constructs a boxplot for a second question. | 3 | | |
| 10 | For at least one of the questions, the student uses the data to state whether the data is normally distributed. | 3 | | |
| 11 | For a second question, the student uses data to state whether the data is normally distributed. | 3 | | |
| 12 | There is a graph provided for at least one of the survey questions. | 3 | | |
| 13 | There is a graph provided for a second survey question. | 3 | | |
| 14 | The student shows work on calculations and these are neat. | 3 | | |
| 15 | The project as a whole is neatly written or typed and well-organized. | 3 | | |
| | TOTAL POINTS | 45 | | |

| | | | | | |
|---|---|---|---|---|---|
| **RUBRIC FOR ACTIVITY 2** | | | | | |
| **#** | **Element** | **0** | **1** | **2** | **3** |
| **1** | Proportions of responses for the first categorical question | Does not provide proportional values for a categorical question. | Provides an incomplete response to this task or has significant errors | Provides the proportional values but is not fully complete or includes minor error. | Provides the proportion of responses for each category as a ratio, percent and decimal. |
| **2** | Proportions of responses for a second categorical question | Does not provide proportional values for a second categorical question. | Provides an incomplete response to this task or has significant errors | Provides the proportional values but is not fully complete or includes minor error. | Provides the proportion of responses for each category as a ratio, percent and decimal. |
| **3** | Descriptive statistics for the first question. | Descriptive statistics are not present or very minimal. | Provides descriptive statistics but these are incomplete or contain significant errors. | Provides the required descriptive statistics with few errors. | Provides correctly calculated mean, median, mode, variance and standard deviation |
| **4** | Descriptive statistics for a second question | Descriptive statistics are not present or very minimal. | Provides descriptive statistics but these are incomplete or contain significant errors. | Provides the required descriptive statistics with few errors. | Provides correctly calculated mean, median, mode, variance and standard deviation |
| **5** | Descriptive statistics for a third question | Descriptive statistics are not present or very minimal. | Provides descriptive statistics but these are incomplete or contain significant errors. | Provides the required descriptive statistics with few errors. | Provides correctly calculated mean, median, mode, variance and standard deviation |
| **6** | Calculations for the mean for two separate groups on one question. | Calculations are not present. | Calculations have significant error. | Calculations have few errors. | Calculations for both means are done completely and accurately. |
| **7** | Explanation of the results for the two calculated means | An explanation is missing from the project | Components of the response are missing or contain significant error. | Provides an explanation but this contains few errors. | Provides a thorough and accurate reflection about what the two different means may tell us. |
| **8** | Range and interquartile range and boxplot for a first question | Range and interquartile range not provided | Range and interquartile range calculations include significant error. | Range and interquartile range are calculated with minor errors. | Range and interquartile range are present and accurately calculated. |
| **9** | Range and | Range and | Range and | Range and | Range and |

| | | interquartile range not provided | interquartile range calculations include significant error. | interquartile range are calculated with minor errors. | interquartile range are present and accurately calculated. |
|---|---|---|---|---|---|
| | interquartile range and boxplot for a second question | interquartile range not provided | interquartile range calculations include significant error. | interquartile range are calculated with minor errors. | interquartile range are present and accurately calculated. |
| 10 | Uses descriptive statistics to analyze whether the data from one question are normally distributed | Attempt at this question not provided | Reasoning for whether the data is normally distributed is not data-based or contains major error | Reasoning for whether the data is normally distributed contains minor error | Student provides accurate, and data-based reasoning for whether data is normally distributed. |
| 11 | Uses descriptive statistics to analyze whether the data from the second question are normally distributed. | Attempt at this question not provided | Reasoning for whether the data is normally distributed is not data-based or contains major error | Reasoning for whether the data is normally distributed contains minor error | Student provides accurate, and data-based reasoning for whether data is normally distributed. |
| 12 | Bar graph for a first survey question | Graph not provided | The graph contains significant error. | The graph provided contains minor error | A graph is provided and is appropriate and accurate |
| 13 | Bar graph for a second survey question | Graph not provided | The graph contains significant error. | The graph provided contains minor error | A graph is provided and is appropriate and accurate |
| 14 | Student shows work on calculations and these are neat | Lacks work shown or work lacks neatness. | Incomplete or unclear calculations | Calculations included but neatness needs some improvement | Calculations included and written or typed neatly |
| 15 | Each component and the project as a whole is well-organized. | No evidence of organization. | Organization needs improvement. | Organization is acceptable. | Well-organized |

**Benchmarks**

## Are you Happy with your Education at GHS?

I am conducting this survey as part of a project for (Algebra 1). I am interested in learning more about how the students in our school feel about the quality of education they are receiving here at GHS. The population I am interested in learning about is all of the students in our high school, but I will only be giving the survey to a small sample of 15 – 20 students in our high school.

The survey is anonymous, and I will not be writing down your names or anything about your identity. Please answer the following eight questions. It should only take you about five minutes.

1. **What is your gender? (circle one)**

MALE                    FEMALE

2. **What is your grade level? (circle one)**

9th grade                10th grade                11th grade                12th grade

3. **How many classes do you have in total this semester?** _____

4. **How much time do you usually spend doing homework each week?** _____

5. **I learn at least one new thing every day. (circle one)**

strongly disagree        disagree        neutral        agree        strongly agree

6. **My teachers care about my learning. (circle one)**

strongly disagree        disagree        neutral        agree        strongly agree

7. **I find the material that we are studying in most of my classes to be interesting. (circle one)**

strongly disagree        disagree        neutral        agree        strongly agree

8. **By the time I graduate from GHS, I think I will be well-prepared for college.**

strongly disagree  disagree  neutral  agree  strongly agree


**THANK YOU FOR TAKING MY SURVEY!!!**


<u>Coding scheme for survey</u>

1. Male = 1; Female = 2
2. $9^{th}$ grade = 1; $10^{th}$ grade = 2; $11^{th}$ grade = 3; $12^{th}$ grade = 4
3. Code will be the numeric answer
4. Code will be the numeric answer
5. Strongly disagree=1; disagree = 2; neutral = 3; agree = 4; strongly agree = 5
6. Strongly disagree=1; disagree = 2; neutral = 3; agree = 4; strongly agree = 5
7. Strongly disagree=1; disagree = 2; neutral = 3; agree = 4; strongly agree = 5
8. Strongly disagree=1; disagree = 2; neutral = 3; agree = 4; strongly agree = 5

Sample Activity 1

1. What is the population?
   *All students at GHS.*

2. How did you sample this population?

   *I used the list of teachers and drew names out of a hat in order to randomly select one teacher from each grade level. I then went to each of those teachers and asked if they would ask 5 students to take the survey. I drew numbers from a hat and asked teachers to give the survey to students who fell in those places on the roster.*

3. How did you control for bias?

   *This technique was not perfect, since only one teacher from each grade level was represented. However, as described above, I used random selection of both teachers and the students who took the survey. It also helped that all four grades were represented.*

Activity 2: Data Analysis

6.  For the two categorical questions, calculate the proportion of participants who gave each answer. Write the proportions as a fraction, percent and decimal.

Gender

1.  Male: 6/10 = 3/5 = 60% = 0.60
2.  Female: 10/16 = 5/8 = 62.5% = 0.625

Grade

1.  $9^{th}$: 9/16 = 56.25% = 0.5625
2.  $10^{th}$: 4/16 = ¼ = 25% = 0.25
3.  $11^{th}$: 2/16 = 1/8 = 12.5% = 0.125
4.  $12^{th}$: 1/16 = 6.25% = 0.0625


1.  For three of the other questions, calculate the following descriptive statistics:
    a.  Mean
    b.  Median
    c.  Mode
    d.  Variance
    e.  Standard Deviation

"My teachers care about my learning.":

Raw Scores:   5, 5, 4, 4, 4, 4, 3, 3, 1, 1, 5, 2, 3, 2, 4, 4

Mean:   $\frac{5+5+4+4+4+4+3+3+1+1+5+2+3+2+4+4}{16} = \frac{54}{16} = 3.375$

Mode:   1, 1, 2, 2, 3, 3, 3, 4, 4, 4, 4, 4, 4, 5, 5, 5
4 (occurs 6 times)

Median:   $\frac{n+1}{2} = \frac{17}{2} = 8.5$th item / average of $8^{th}$ and $9^{th}$ items: 4

Variance:   $\frac{2(1-3.375)^2+2(2-3.375)^2+3(3-3.375)^2+6(4-3.375)^2+3(5-3.375)^2}{16}$

$= \frac{2(-2.375)^2+2(-1.375)^2+3(-.375)^2+6(.625)^2+3(1.625)^2}{16}$

$$= \frac{2(5.640625)+2(1.890625)+3(.140625)+6(.390625)+3(2.640625)}{16}$$

$$= \frac{11.28125+3.78125+.421875+2.34375+7.921875}{16}$$

$$= \frac{25.75}{16} = 1.609375$$

STD: $\quad\quad\quad \sqrt{1.609375} = 1.268611446$

"I find the material we are studying in most of my classes interesting.":

Raw Scores: 1, 2, 1, 5, 3, 2, 4, 1, 5, 3, 4, 3, 3, 2, 2, 4

Mean: $\quad\quad \frac{1+2+1+5+3+2+4+1+5+3+4+3+2+2+4}{16} = \frac{42}{16} = 2.625$

Mode: $\quad\quad$ 1, 1, 1, 2, 2, 2, 2, 3, 3, 3, 3, 4, 4, 4, 5, 5
$\quad\quad\quad\quad$ Two modes: 2 & 3 (both occur 4 times)

Median: $\quad\quad \frac{n+1}{2} = \frac{17}{2} = 8.5$th item / average of $8^{th}$ and $9^{th}$ items: 3

Variance: $\quad \frac{3(1-2.625)^2+4(2-2.625)^2+4(3-2.625)^2+3(4-2.625)^2+2(5-2.625)^2}{16}$

$$= \frac{3(-1.625)^2+4(-.625)^2+4(.375)^2+3(1.375)^2+2(2.375)^2}{16}$$

$$= \frac{3(2.640625)+4(.390625)+4(.140625)+3(1.890625)+2(5.640625)}{16}$$

$$= \frac{7.921875+1.5625+.5625+5.671875+11.28125}{16}$$

$$= \frac{27}{16} = 1.6875$$

STD: $\quad\quad\quad \sqrt{1.6875} = 1.299038106$

"I think I will be prepared for college.":

Raw Scores: 2, 2, 4, 4, 4, 3, 4, 3, 5, 4, 5, 2, 3, 2, 1, 4

Mean: $\quad\quad \frac{2+2+4+4+4+3+4+3+5+4+5+2+3+2+1+4}{16} = \frac{52}{16} = 3.25$

Mode: $\quad\quad$ 1, 2, 2, 2, 2, 3, 3, 3, 4, 4, 4, 4, 4, 4, 5, 5
$\quad\quad\quad\quad$ 4 (occurs 6 times)

Median: $\quad\quad \frac{n+1}{2} = \frac{17}{2} = 8.5$th item / average of $8^{th}$ and $9^{th}$ items: 3.5

Variance: $$\frac{1(1-3.25)^2+4(2-3.25)^2+3(3-3.25)^2+6(4-3.25)^2+2(5-3.25)^2}{16}$$

$$= \frac{1(-2.25)^2+4(-1.25)^2+3(-.25)^2+6(.75)^2+2(1.75)^2}{16}$$

$$= \frac{1(5.0625)+4(1.5625)+3(.0625)+6(.5625)+2(3.0625)}{16}$$

$$= \frac{5.0625+6.25+.1875+3.375+6.125}{16}$$

$$= \frac{21}{16} = 1.3125$$

STD: $$\sqrt{1.3125} = 1.145643924$$

2. Pick one of the scale questions and calculate separate means for two categories. For example, a mean for females and a mean for males. Write a short explanation of what the comparison in tells you about the two groups.

"…prepared for college." (Males):

$$\frac{2+2+3+4+5+3}{6} = \frac{19}{6} = 3.1\bar{6}$$

"…prepared for college." (Females):

$$\frac{4+4+4+4+3+5+2+2+1+4}{10} = \frac{33}{10} = 3.3$$

The means for males and for females are very similar. We can conclude that on average, females are slightly more confident that they will be prepared for college, but the sample sizes are different, so this makes it difficult to make these comparisons and then say that this represents the larger population.

3. Analyze 2 questions in more detail:
    a. Calculate the range and interquartile range. Use these calculations as well as what you have already done to create a box plot.

"My teacher cares about my learning"

Data: 1, 1, 2, 2, 3, 3, 3, 4, 4, 4, 4, 4, 4, 5, 5, 5

Range = 4

Interquartile range:

Minimum = 1   Q1 = 2.5          Q2 = 4        Q3 = 4        Maximum = 5 (see above)

Boxplot: (see attached)

"I think I will be prepared for college"

Data: 1, 2, 2, 2, 2, 3, 3, 3, 4, 4, 4, 4, 4, 4, 5, 5

Range = 4

Interquartile range:

Minimum = 1        Q1 = 2        Q2 = 3.5      Q3 = 4        Maximum = 5

Boxplot: (see attached)

       b. Is this data normally distributed?  How can you tell? What conclusions might you make from the data?

*"My teacher cares about my learning"*

The mean, median and mode are 3.375, 4 and 4. These values are similar, but the mean is quite a bit lower than the median and mode, considering that the range is only 1 to 5.

Also standard deviation is 1.61, so if normally distributed, we would expect 1.765 to 4.985 to contain roughly 68% of the data, but it contains more than 68% of the data, so this data probably has a very steep peak in the middle of data clustered around the mean.

*"I think I will be prepared for college"*

This question had a mean, median and mode of 3.25, 3.5 and 4 and a standard deviation of 1.15. Therefore, we would expect approximately 68% of the values to fall between 2.1 and 4.3 9/16 of the data fall between these two values which is actually only 56.25% of the data. However, 2.1 is so close to 2 that we could almost consider the data points at 2 to also fall in this interval.

The box plot appears fairly normal, but the values of the mean, median and mode appear to be close, but as stated in the previous example, this data has a very small range, so we may expect them to be even closer in a perfectly normal distribution

4. For two of the categorical questions, create a graph (e.g. bar graph, pie chart) to visually display the data (see attached sketches).