You are allowed to operate a calculator and refer to one page (front and back of standard 8.5 by 11 inch sheet) of notes while taking this examination. Your solutions should be clear, complete, and sufficiently detailed in order to demonstrate your understanding and communicate your reasoning and method of solving the problem. Each problem will be evaluated on a 5-point standard rubric.

Student's Name

Problem 1

Healthy females have a mean red blood cell count of 4.8 million cells per microliter of whole blood with a standard deviation of 0.3 million cells per microliter and a mean white blood cell count of 7250 cells per microliter of whole blood with a standard deviation of 1375 cells per microliter. A female patient is given a blood test. Her red blood cell count (RBC) was found to be 4.3 million cells per microliter while her white blood cell count (WBC) was found to be 6100 cells per microliter.

(a) Relatively speaking, does this patient have a lower red blood cell count or white blood cell count?

$$z_{\text{RBC}} = \frac{4.3 - 4.8}{0.3} \approx -1.67 \qquad z_{\text{WBC}} = \frac{6100 - 7250}{1375} \approx -0.84$$

Relatively speaking, this patient had a lower red blood cell count because her red blood cell count standard score of -1.67 was less than her white blood cell count standard score of -0.84.

(b) Classify as to the type of data and determine the level of measurement for the particular data item : blood cell type (red or white).

The blood cell type (red or white) is qualitative data that reaches the nominal level of measurement because red or white is categorical and only represents the name of the type of blood cell.

Problem 2

The principal at Tahoe Elementary School randomly selected three of the school's twelve classes of students to participate in an opinion poll. All of the children in each of the three randomly selected classes were asked the question "What is your favorite fruit to eat?". The following results were obtained.

Apple, Grapes, Apple, Apple, Banana, Apple, Apple, Grapes, Orange, Apple, Apple, Banana, Strawberries, Apple, Apple, Grapes, Apple, Orange, Apple, Apple, Apple, Apple, Grapes, Grapes, Apple, Orange, Apple, Apple, Banana, Apple, Apple, Apple, Strawberries, Apple, Orange, Grapes, Grapes, Apple, Grapes, Grapes, Grapes, Banana, Grapes, Banana, Apple, Banana, Grapes, Apple, Banana, Strawberries, Banana, Apple, Orange, Grapes, Orange, Grapes, Apple, Orange.

(a) Identify the method of sampling used to collect this data.

The method of cluster random sampling was used to collect this data since the students were grouped by classes and every child in the randomly selected classes was included in the sample.

(b) Construct a percentage distribution table with this data.

Favorite Fruit to Eat of Children Attending
Tahoe Elementary School

Favorite Fruit	Percentage	
Apple	44.8%	$= 26/58 \cdot 100\%$
Grapes	24.1%	$= 14/58 \cdot 100\%$
Banana	13.8%	$= 8/58 \cdot 100\%$
Orange	12.1%	$= 7/58 \cdot 100\%$
Strawberries	5.2%	$= 3/58 \cdot 100\%$

Problem 3

Use appropriate descriptive statistics methods to describe the important characteristics of the data collected in Problem 2.

Since children's favorite fruit to eat involves qualitative data, a distribution table, the mode, and the variation ratio would be appropriate descriptive statistics methods to describe the distribution, central tendency, and dispersion of this data.

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Mode

Most Frequently Mentioned

$$Mode = Apple$$

$$VR = 1 - \hat{p}_{\text{mode}} = 100\% - 44.8\% == 55.2\%$$

When children attending Tahoe Elementary School were asked the question "What is your favorite fruit to eat?", most of them mentioned an apple. Grapes were the favorite fruit to eat by 24.1% of the children. A banana was selected by 13.8%, and an orange was picked by 12.1%. Only 5.2% of the children polled said that strawberries were their favorite fruit to eat. The variation ratio for the favorite fruit to eat of children attending Tahoe Elementary School was 55.2%.

Problem 4

Twenty-five different automobiles were tested in dry conditions at a speed of 65 miles per hour for total stopping distance. The sample results, measured in feet, are given below.

345, 348, 342, 348, 342, 337, 342, 349, 346, 347, 358, 351, 343, 347, 349,
350, 345, 340, 352, 349, 353, 346, 338, 345, 339

(a) Calculate the standard deviation for this data and interpret the result.

```
1-Var Stats
 x̄=346.04
 Σx=8651
 Σx²=2994189
 Sx=4.987317248
 σx=4.886552977
↓n=25
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$$s_x \approx 5.0$$

On average, the total stopping distance for these automobiles traveling at a speed of 65 mph in dry conditions varied about the mean total stopping distance by about 5.0 feet.

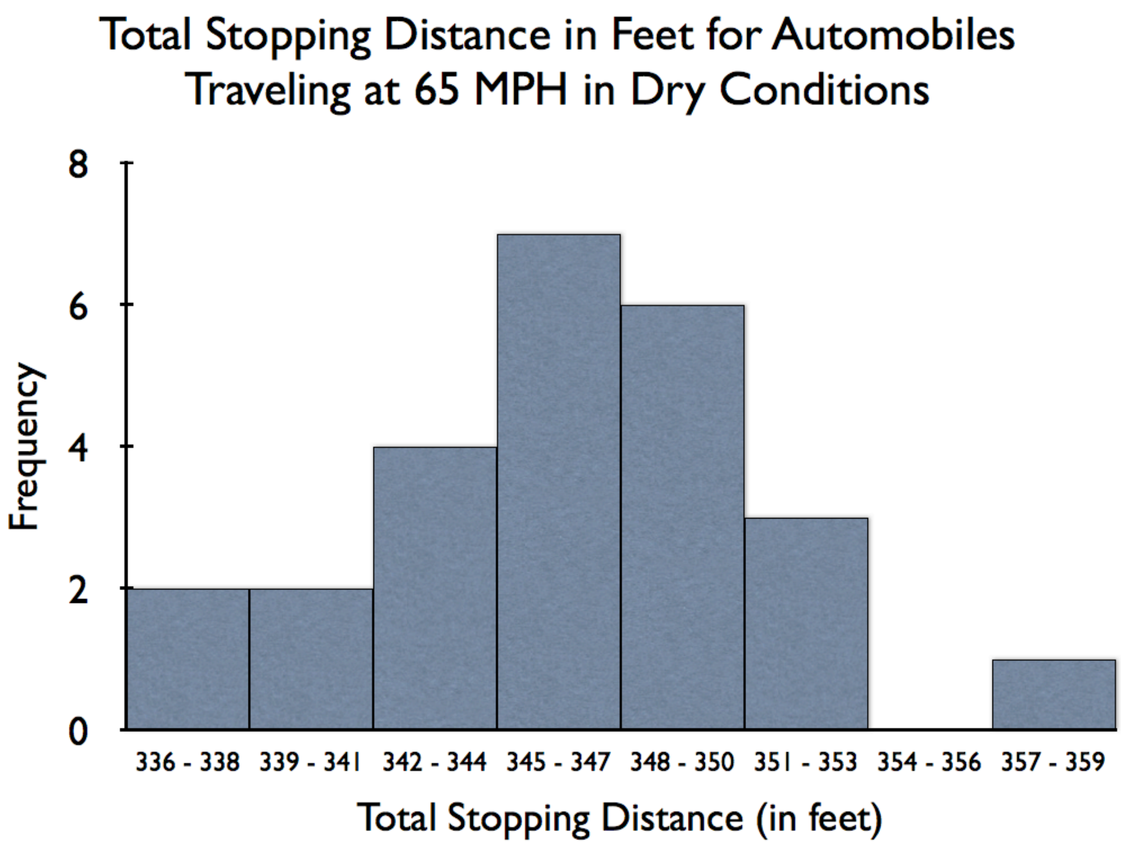
(b) According to these results, would it be unusual for an automobile traveling at 65 miles per hour in dry conditions to take a total of 358 feet to come to a complete stop?

$$t = \frac{358 - 346.04}{4.987} \approx 2.40$$

Yes. According to these results, it would be unusual for an automobile traveling at 65 mph in dry conditions to take a total of 358 feet to come to a complete stop since the corresponding standard score of 2.40 is +2 or higher.

Problem 5

(a) Construct a frequency histogram with an initial grouping of 336 to 338 feet for the data collected in Problem 4.



(b) Use appropriate descriptive statistics methods to describe the important characteristics of the data collected in Problem 4.

$$346.0 - 3 \cdot 5.0 = 331.0 \qquad 346.0 + 3 \cdot 5.0 = 361.0$$

Since the total stopping distance involves quantitative data with no outliers, a histogram, the mean, and the standard deviation would be appropriate descriptive statistics methods to describe the distribution, central tendency, and dispersion of this data.

$$\overline{x} \approx 346.0 \qquad s_x \approx 5.0$$

The total stopping distance for automobiles traveling at 65 mph in dry conditions exhibits a bell-shaped distribution with a mean of 346.0 feet and a standard deviation of 5.0 feet.

Problem 6

Thirty-six Loggerhead Sea Turtle (*Caretta caretta*) nests were uncovered, and the number of eggs in each nest (the clutch size) was counted. A stem-and-leaf plot for this sample is given below.

9	2	3							
9	5	7	**8**	9	9				
10	0	1	1	3	3	4	4		
10	6	6	6	6	8	8	9	9	9
11	1	1	**2**	2	2	3			
11	5	5	7	8					
12	1	2							
12	6								

(a) Find the percentile for the nest with a clutch size of 98 eggs.

Since L = 4 of the n = 36 nests had a clutch size less than P_K = 98 eggs,

$$k = \frac{L}{n} \cdot 100\% = \frac{4}{36} \cdot 100\% = 11.111\% \approx 11\%$$

So, P_{11} = 98. That is, the nest with a clutch size of 98 eggs falls at the 11th percentile.

(b) Find the 70th percentile for this data.

Since $L = \frac{k}{100\%} \cdot n = \frac{70\%}{100\%} \cdot 36 = 25.2$ is not a whole number, the value of P_{70} is approximated by selecting $x_{(26)}$ the data value in the next higher whole number location in the sorted list of data. So, the 70th percentile for the clutch size of Loggerhead Sea Turtle nests in this sample is 112 eggs.

(c) Find the median for this data and interpret the result.

The median is the 50th percentile. Since $L = \frac{k}{100\%} \cdot n = \frac{50\%}{100\%} \cdot 36 = 18$ is a whole number, the value of P_{50} = Med is given by the midpoint of the $x_{(18)}$ and $x_{(18+1)} = x_{(19)}$ data values in the sorted list of data.

$$Med = P_{50} = \frac{x_{(18)} + x_{(19)}}{2} = \frac{106 + 108}{2} = 107$$

Thus, half of the Loggerhead Sea Turtle nests in this sample had a clutch size less than 107 eggs.