Name: ____________________________

Math 128 Exam III
Tuesday, April 22, 2010

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<th>Problem Number</th>
<th>Possible Points</th>
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Directions—Please Read Carefully! You have 75 minutes to take this exam. Make sure to use correct mathematical notation. To receive full credit on a problem, you will need to justify your answers carefully unless indicated otherwise—unsubstantiated answers will receive little or no credit. Please be sure to write neatly—illegible answers will receive little or no credit. If more space is needed, use the back of the previous page to continue your work. Be sure to make a note of this on the problem page so that the grader knows where to find your answers.

Calculators are allowed. Good Luck!!!
1. (3 points) Classify each of the following as simple random sampling, stratified random sampling, or convenience sampling. Circle your response.

(a) A researcher interviews a proportional number of mathematics students form the following age groups: 18–21, 22–30, and 31 and up.

\[ \text{Simple random sampling} \quad \text{Stratified random sampling} \quad \text{Convenience sampling} \]

(b) A research interviews 20 students chosen at random form a list of all mathematics students.

\[ \text{Simple random sampling} \quad \text{Stratified random sampling} \quad \text{Convenience sampling} \]

(c) A researcher interviews 20 mathematics students in a colleagues physics class.

\[ \text{Simple random sampling} \quad \text{Stratified random sampling} \quad \text{Convenience sampling} \]

\textbf{Solution:}

(a) Stratified random sampling

(b) Simple random sampling

(c) Convenience sampling

2. (3 points) For each of the following data sets, determine whether the best choice to represent the data graphically is a line graph, a bar graph, or a circle graph. Circle your response.

(a) The percent of people who sleep an average of 5 or fewer, 6, 7, 8, or 9 or more hours per night.

\[ \text{Line graph} \quad \text{Bar graph} \quad \text{Circle graph} \]


\[ \text{Line graph} \quad \text{Bar graph} \quad \text{Circle graph} \]

(c) The total sales of raffle tickets by each of the grades 3, 4, and 5.

\[ \text{Line graph} \quad \text{Bar graph} \quad \text{Circle graph} \]

\textbf{Solution:}

(a) Circle graph

(b) Line graph

(c) Bar graph
3. (8 points) The *Survey or Study Habits and Attitudes* (SSHA) is a psychological test that evaluates college students’ motivation, study habits, and attitudes towards school. A private college gives the SSHA to 18 of its incoming first-year women students. There scores are

\[154 \ 109 \ 137 \ 115 \ 152 \ 140 \ 154 \ 178 \ 101 \\
103 \ 126 \ 126 \ 137 \ 165 \ 165 \ 129 \ 200 \ 148\]

Answer each of the following questions based on this data.

(a) (3 points) Construct a stem-and-leaf plot of the data. Use the first two digits of each number as the stem part of your plot.

(b) (1 point) Are there any outliers?

(c) (2 points) What is the mean of the data?

(d) (2 points) What is the median of the data?

**Solution:**

(a)

<table>
<thead>
<tr>
<th>Stem</th>
<th>Leaf</th>
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<tbody>
<tr>
<td>10</td>
<td>1 3 9</td>
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<tr>
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<td>5</td>
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<td>20</td>
<td>0</td>
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(b) 200 is an outlier.

(c) The mean of the data is approximately 141.05.

(d) The median of the data is 138.5.
Scores on the Wechsler Adult Intelligence Scale (a standard IQ test) for the 20 to 34 age group are approximately normally distributed with mean $\mu = 110$ and standard deviation $\sigma = 25$. Use the 68-95-99.7 rule to answer the questions below.

(a) (3 points) About what percent of people in this age group have scores above 110?

(b) (3 points) About what percent have scores above 160?

(c) (3 points) In what range do the middle 95% of all scores lie?

Solution:
(a) 50%
(b) 2.5%
(c) 60–160
5. (6 points) Find the area and perimeter of the polygon on the geoboard below.

Solution: The perimeter is

\[ P = 1 + 1 + 1 + 2 + \sqrt{5} + \sqrt{5} + \sqrt{5} + \sqrt{2} + \sqrt{2} = 5 + 3\sqrt{5} + 2\sqrt{2} \approx 14.537. \]

The area is

\[ A = 9. \]
6. (6 points) A grapefruit has an outside diameter of 5 inches. When cut open it is discovered that the peel is 1/2 inches thick. What percentage of the grapefruit’s volume is the peel?

*Hint:* The volume of a sphere is given by $V = \frac{4}{3}\pi r^3$.

**Solution:** The radius of the grapefruit is 2.5 inches. The volume the grapefruit is

$$V_{\text{grapefruit}} = \frac{4}{3}\pi (2.5)^3 \approx 20.833\pi$$

and the volume of the peel is given by

$$V_{\text{peel}} = \frac{4}{3}\pi (2.5)^3 - \frac{4}{3}\cdot 2^3\pi = \frac{4}{3}\pi (2.5^3 - 2^3) \approx 10.167\pi.$$ 

Thus, the percentage of the peel’s volume of the total volume is

$$\frac{\frac{4}{3}\pi (2.5^3 - 2^3)}{\frac{4}{3}\pi (2.5)^3} = \frac{2.5^3 - 2^3}{2.5^3} \approx 0.488$$

or 48.8%.
7. (6 points) The rhombus in the figure below has a width of 4 cm and each side is 5 cm. What is the area of the rhombus?

Solution: We can divide the rhombus into four right triangles as below.

Using the Pythagorean Theorem,

\[ h = \sqrt{5^2 + 2^2} = \sqrt{21} \approx 4.58, \]

and the area of the rhombus is

\[ A = 4 \left( \frac{1}{2} 2h \right) = 4h = 4\sqrt{21} \approx 18.33 \text{ cm}^2. \]
8. (5 points) Fill in the blank with the metric unit of measurement that makes the statement reasonable.

(a) The capacity of the fuel tank on a 2010 Subaru Forester is 65 ________.

(b) The average total floor area of a house in Japan is 94.85 ________.

(c) The Verdon River in the south of France has a length of 166 ________.

(d) UCI regulations says that the weight of the bicycle used in professional bicycle races such as the Tour de France cannot be less than 6.8 ________.

(e) The volume of a cup of brewed coffee in the U.S. is typically 180 ________.

Solution:
(a) The capacity of the fuel tank on a 2010 Subaru Forester is 65 liters.
(b) The average total floor area of a house in Japan is 94.85 square meters.
(c) The Verdon River in the south of France has a length of 166 kilometers.
(d) UCI regulations says that the weight of the bicycle used in professional bicycle races such as the Tour de France cannot be less than 6.8 kilograms.
(e) The volume of a cup of brewed coffee in the U.S. is typically 180 milliliters (or 180 cubic centimeters).

9. (4 points) Match each class in column A to the best description in column B.

<table>
<thead>
<tr>
<th>A: Class</th>
<th>B: Typical Test Scores</th>
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<tbody>
<tr>
<td>(a) Class with a wide ability range</td>
<td>(i) High mean</td>
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<tr>
<td>(b) Honors class</td>
<td>(ii) Low standard deviation</td>
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<tr>
<td>(c) Students with very similar abilities</td>
<td>(iii) High standard deviation</td>
</tr>
<tr>
<td>(d) Remedial class</td>
<td>(iv) Low median</td>
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Solution: (a)—(iii), (b)—(i), (c)—(ii), (d)—(iv)
This page is for scratch work.