Study Questions for Exam Three

Exam Three will cover material from Chapter 12 and section 13.1. This is the material covered in Homework Assignments 9 - 12. You will *not* be tested on any sections or topics that we have skipped, such as Symmetry in Data Sets from Section 12.2, etc.

Note that this is a study guide, not a sample exam - it is much longer than your exam will be. However, the ideas and the question types represented here (along with your written homework and online homework) will help prepare you for your exam.

Solutions to these questions can be found at:

http://www.math.wsu.edu/faculty/martin/Math105/exams/ex3SGsolutions.pdf
On the exam, you **must** show your work for all problems. Credit will not be given for correct answers that are not justified. Unless otherwise specified, use eight decimal places in your work, then round your final answer to two decimal places.

The following information and formulas (and no others) will be provided on your exam in exactly this format. Knowing the other important formulas not listed here, and knowing when and how to use them, is up to you.

You will also be given a copy of the table “Areas Under the Standard Normal Curve” on the back of the formula page of your exam. That table is on page 690 of your text, or you can find a copy here:

http://www.math.wsu.edu/faculty/martin/Math105/exams/normaltable.pdf

**Possibly useful formulas**

Standard Deviation: \( s = \sqrt{\frac{\sum (x - \bar{x})^2}{n-1}} = \sqrt{\frac{(x_1 - \bar{x})^2 + (x_2 - \bar{x})^2 + \ldots + (x_n - \bar{x})^2}{n-1}} \)

z-score: \( z = \frac{x - \bar{x}}{s} \)

Simple Interest: \( I = P r t \)

Simple Interest Future Value: \( A = P(1 + r t) \)

Compound Interest Future Value: \( A = P \left(1 + \frac{r}{n}\right)^m \)

Continuously Compounded Interest: \( A = Pe^{rt} \)
1. Use the data 15, 5, 3, 2, 33, 2 to answer the following questions.
   
   (a) Find the mean
   (b) Find the median.
   (c) Find the mode.
   (d) Find the range.
   (e) Find the standard deviation.
   (f) Find the three quartiles for the data.
   (g) Draw a box plot to represent the data.
   (h) Between what two values does the middle 50% of the data fall?
   (i) Between what two values does the upper 50% of the data fall?

2. You are given the following set of data:
   
   20, 30, 40, 25, 35, 22, 50
   
   Find the mean and the standard deviation of the data.

3. Solve the following problems using Polya's Method. Explain your solution as a step-by-step process, listing each of the four steps in the appropriate place and describing briefly how you applied each step to the problem.
   (a) Give an example of a set of data with a mean of 6, mode of 4 and median of 5.
   (b) A set of six quiz scores has a mean of 7. One of the six quiz scores was not recorded, but the other scores are: 8, 9, 7, 5, and 6. What was the sixth quiz score?

4. 
   (a) What can be said about a set of data whose standard deviation is zero? Give an example of a small set with this property and show the standard deviation. Your set must contain at least three data points.
   (b) What can be said about the standard deviation of a set whose data is all very close to the mean? Give an example of a small set with this property and show the standard deviation. Your set must contain at least three data points.

5. Without actually calculating the standard deviation, determine which set would have the highest standard deviation. Explain your reasoning.
   
   Set A: 1, 2, 50, 98, 99
   Set B: 48, 49, 50, 53, 55

6. Suppose a set of data, Set A, has a standard deviation of 2. Another set of data, Set B, has a standard deviation of 15.
   
   (a) What can be said about Set B as compared to Set A?
   (b) If you know that both sets are scores from the same exam, given in two different sections of the same course, what can be said about Set B as compared to Set A?
7. Explain how two data sets could have equal means and modes but still differ greatly. Give an example with two data sets to illustrate.

8. The two most frequently used measures of central tendency are the mean and the median. Discuss the following: Does either measure take every data value into account? Which measure is the most affected by extreme scores? What are the advantages of each?

9. We want to compare two different groups of students, students taking Math 105 in a traditional lecture format and students taking Math 105 in a distance learning format. We know that the mean score on the research paper is 85 for both groups. What additional information would be provided by knowing the standard deviation?

10. Do you think it is possible to find two data sets such that the first data set has a smaller range but a larger standard deviation than the second set? If so, give an example of two such data sets. If it is not possible, explain why not.

11. Suppose that a data set has a mean of 100 and a standard deviation of 5. If a positive number k is added to every item of the data set, how will this affect the mean and the standard deviation?

12. The scores below were obtained on the final examination in an introductory mathematics class of twenty students.

   98 80 98 71 79 94 71 45 89 71
   62 61 95 77 83 49 65 58 56 89

   (a) Make a stem-and-leaf display of the data.
   (b) Find the median of the data.
   (c) Find the mode of the data.
   (d) Find the three quartiles for the data.
   (e) Draw a box plot to represent the data.
   (f) Construct a grouped frequency distribution table for the data, using the ranges 40-49, 50-59, … , 90-99.
   (g) Make a histogram of the data using the ranges 40-49, 50-59, … , 90-99 on the horizontal scale.
   (h) Draw the line graph of the data.
(i) Using the following grade scale, create a pie chart (circle graph) representing the grades obtained on the exam.

<table>
<thead>
<tr>
<th>Grade</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 59</td>
<td>F</td>
</tr>
<tr>
<td>60 - 69</td>
<td>D</td>
</tr>
<tr>
<td>70 - 79</td>
<td>C</td>
</tr>
<tr>
<td>80 - 89</td>
<td>B</td>
</tr>
<tr>
<td>90 - 100</td>
<td>A</td>
</tr>
</tbody>
</table>

13. (a) Give the three quartiles for the data 59, 23, 20, 58, 16, 33, 51, 24, 53, 54, 58.
   (b) Draw a box plot to represent the data in part (a).

14. A survey was taken on Maple Avenue. In each of 20 homes, people were asked how many cars were registered to their households. The results were recorded as follows:

<table>
<thead>
<tr>
<th>Number of Cars</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>20</td>
</tr>
</tbody>
</table>

   (a) Find the mean.
   (b) Find the median.
   (c) Find the mode.

15. The stem and leaf plot below shows the number of students that attended lecture in the last 20 class meetings.

```
1 | 7 8 9 9
2 | 2 4 6 6 6 7 7 8
3 | 0 0 3 3 4 4 4 5
```

   Use the data from the stem and leaf plot to find the

   (a) mean.
   (b) median.
   (c) mode.
16. Construct a stem and leaf display for data given below.

Here are the final scores for the last 16 games played by the local basketball team:

```
45 54 53 65
67 75 57 59
87 86 79 74
67 75 87 65
```

17. Use the information below to complete a circle graph (pie chart).

Intended major of high school students:

<table>
<thead>
<tr>
<th>Major</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Science</td>
<td>32%</td>
</tr>
<tr>
<td>Social Science</td>
<td>8%</td>
</tr>
<tr>
<td>Humanities</td>
<td>20%</td>
</tr>
<tr>
<td>Business</td>
<td>16%</td>
</tr>
<tr>
<td>Other</td>
<td>24%</td>
</tr>
</tbody>
</table>

18. Suppose that you want to construct a graph to represent the following data.

<table>
<thead>
<tr>
<th>Blood Type</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>O</td>
<td>90</td>
</tr>
<tr>
<td>A</td>
<td>84</td>
</tr>
<tr>
<td>B</td>
<td>18</td>
</tr>
<tr>
<td>AB</td>
<td>8</td>
</tr>
</tbody>
</table>

If you are mostly interested in the number of people in each category as a percentage of the total number of people, would a bar chart or a pie chart be more useful? Explain your thinking.

19. Shortly before a mayoral election, a market research firm took a poll to find out which candidate people were planning to vote for. The results are shown below.

<table>
<thead>
<tr>
<th>Candidate</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Li Fong</td>
<td>2120</td>
</tr>
<tr>
<td>Bob Green</td>
<td>2329</td>
</tr>
<tr>
<td>Sue Moore</td>
<td>1042</td>
</tr>
<tr>
<td>Jose Alvarez</td>
<td>399</td>
</tr>
</tbody>
</table>

You wish to construct a graph to represent the data. It should be easy to see from your graph which candidate is in the lead. Which graph would be more useful, a bar graph or a pie chart? Explain your thinking.
20. A relative frequency distribution is given below for the size of families in one U.S. City.

<table>
<thead>
<tr>
<th>Size</th>
<th>Relative frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>0.416</td>
</tr>
<tr>
<td>3</td>
<td>0.238</td>
</tr>
<tr>
<td>4</td>
<td>0.198</td>
</tr>
<tr>
<td>5</td>
<td>0.092</td>
</tr>
<tr>
<td>6</td>
<td>0.039</td>
</tr>
<tr>
<td>7+</td>
<td>0.017</td>
</tr>
</tbody>
</table>

A family is selected at random. Find the probability that the size of the family is less than 5. Round your answer to three decimal places.

21. According to the Bureau of Labor Statistics, the distribution of ages among the civilian labor force is approximately normally distributed with a mean of 38 and a standard deviation of 12.

(a) Fill in the labels on the normal curve with the appropriate values for the mean and three standard deviations above and below the mean.

(b) Between what ages do the middle 68% of all workers fall?
(c) What percentage of workers are between 14 and 62 years old?
(d) Between what ages do the middle 99.7% of all workers fall?

22. Find the requested probabilities for the standard normal distribution.

(a) What percent of the total population is found between the mean and the $z$-score $z = 0.7$?
(b) What percent of the total population is found between the $z$-scores $z = -1.91$ and $z = 0$?
(c) Find $P(0.7 \leq z \leq 1.91)$, the probability that a randomly selected value in the standard normal distribution is between 0.7 and 1.91 standard deviations above the mean.
(d) Find $P(0.7 \leq z)$, the probability that a randomly selected value in the standard normal distribution is more than 0.7 standard deviations above the mean.
23.

(a) At Loop College, the mean grade point average (GPA) of the current student body is 2.76 with a standard deviation of 0.64. Jay is a student at Loop College with a z-score of 1.8. Find Jay’s GPA. Round to the nearest hundredth.

(b) At Cedar Grove College, the mean GPA of the current student body is 3.24 with a standard deviation of 0.21. Rick is a student at Cedar Grove College with a GPA of 3.77. Find Rick’s z-score. Round to the nearest tenth.

(c) Which student from parts (a) and (b) above has the better relative GPA?

24. A set of scores from a math exam is normally distributed with mean $\bar{x} = 70$ and standard deviation $s = 5$. The scores are from a class of 80 students.

(a) Fill in the labels on the normal curve with the appropriate values for the mean and three standard deviations above and below the mean.

(b) Find $P(70 \leq x)$, or in other words, find the probability that a randomly selected student in the class obtained a score of 70 points or higher.

(c) How many students scored 70 points or higher?

(d) What is the z-score that corresponds to $x = 70$? (In other words, convert 70 to its z-score.)

(e) What is the z-score that corresponds to $x = 75$?

(f) What is the z-score that corresponds to $x = 62$?

(g) Find the percentage of students that scored between 70 and 75.

(h) Find the percentage of students that scored between 62 and 75.

(i) How many students scored between 62 and 75?

25. Find the future value after 10 years if a $1000 investment earns 12% annual interest compounded monthly.
26. You have $100 that you invest at 7% simple interest.
   (a) How much interest will you earn in five years?
   (b) What is the value of your investment after five years?

27. You have $100 that you would like to double. How long will this take at 4% simple interest?

28. Max borrowed $1000 from his parents, agreeing to pay them back when he graduated from college in five years. If Max paid his parents $1300 at the end of the five years, what annual simple interest rate did he pay?

29. A particular bond pays 6.5% simple interest. How much should you invest in the bonds if you want them to be worth $3000 in ten years?

30. You invest in an account that pays 6% interest, compounded quarterly. You would like your investment to grow to $10,000 in 16 years. How much would you have to invest in order for this to happen?

31. You invest $8500 in a savings account paying 7% interest compounded quarterly.
   (a) What is the future value of the account after 5 years?
   (b) How much interest is earned in that time?

32. Carla has $5000 to invest. Which investment yields the greater return over 3 years: 10% compounded monthly or 9.85% compounded daily?

33. If the inflation rate persists at 8% over time, find the approximate cost of the items below in 20 years.
   (a) postage stamp: 42 cents
   (b) 3-bedroom home: $150,000