Math 124.16 Final Exam
Answer Sheet
The first answer is the right answer.

1. Consider the pie chart:

A. Which table of percentages matches the pie chart?
   a. 12% 25% 25% 38%
   b. 14% 14% 29% 43%
   c. 11% 22% 33% 33%
   d. 10% 20% 30% 40%

B. Which bar chart matches the pie chart?
2. Consider the following data:
24 28 31 32 36 38 41 42 44 48 49 52 53 55 59

A. The median is:
   a. 42
   b. 41.5
   c. 43
   d. 44

B. The mean is:
   a. 42.13
   b. 42
   c. 42.34
   d. 41.78

C. The standard deviation is:
   a. 10.56
   b. 10.32
   c. 9.86
   d. 10.20

D. Which is the correct stemplot?
   a. 2 | 48
      3 | 1268
      4 | 12489
      5 | 2359
   b. 2 | 25568
      3 | 2479
      4 | 158
      5 | 256
   c. 2 | 45569
      3 | 3788
      4 | 06
      5 | 0222
   d. 2 | 1234
      3 | 22
      4 | 236
      5 | 004559

E. The correct boxplot is:
   a. 
1. If these data represent a sample drawn from a population, then a 95\% confidence interval for the population mean would be:
   
   a. (36.7, 47.6)
   b. (31.6, 52.7)
   c. (32, 52)
   d. (28, 55)

3. Here are the results of one of the studies that link high blood pressure to death from cardiovascular disease. The researchers classified a group of white males aged 35 to 64 as Low blood pressure or High, then followed the subjects for five years. The following two-way table gives the results of the study:

<table>
<thead>
<tr>
<th>Cardiovascular death</th>
<th>Blood Pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>low</td>
</tr>
<tr>
<td>yes</td>
<td>21</td>
</tr>
<tr>
<td>no</td>
<td>2655</td>
</tr>
<tr>
<td>total</td>
<td>2676</td>
</tr>
</tbody>
</table>

A. Which chart correctly shows the conditional percentages?

<table>
<thead>
<tr>
<th>Cardiovascular death</th>
<th>Blood Pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>low</td>
</tr>
<tr>
<td>yes</td>
<td>0.8%</td>
</tr>
<tr>
<td>no</td>
<td>99.2%</td>
</tr>
</tbody>
</table>

b. |

<table>
<thead>
<tr>
<th>Cardiovascular death</th>
<th>Blood Pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>low</td>
</tr>
<tr>
<td>yes</td>
<td>28%</td>
</tr>
<tr>
<td>no</td>
<td>45%</td>
</tr>
</tbody>
</table>
B. Suppose you wanted to do a hypothesis test for this study. What would be the null and alternative hypotheses?

a. H0: Blood pressure does not affect the probability of death from cardiovascular disease
   Ha: Blood pressure does affect the probability of death from cardiovascular disease

b. H0: Blood pressure does affect the probability of death from cardiovascular disease
   Ha: Blood pressure does not affect the probability of death from cardiovascular disease

c. H0: $\mu_1 = \mu_2$
   Ha: $\mu_1 < \mu_2$

d. H0: Blood pressure does not affect the probability of death from cardiovascular disease
   Ha: Higher blood pressure increases the probability of death from cardiovascular disease

C. What would be the appropriate statistical test to use?

a. chi-square
b. ANOVA
c. t-test for independent samples
d. t-test for matched pairs
e. regression

4. In order to study whether IQ level is related to birth order, data were collected from a sample of 510 students on their birth order (Oldest/In Between/Youngest) and their score on an IQ test.

A. The data collected in this study would be best displayed using:

a. side-by-side boxplots
b. a pie chart
c. a histogram
d. a scatterplot
e. a two-way table

B. Suppose you wanted to do a hypothesis test for this study. What would be the null and alternative hypotheses?

a. H0: Birth order does not affect IQ
   Ha: Birth order does affect IQ
b. H0: Birth order does affect IQ
   H1: Birth order does not affect IQ

c. H0: μ1 = μ2
   H1: μ1 ≠ μ2

d. H0: Birth order does not affect IQ
   H1: Birth order increases IQ

C. What would be the appropriate statistical test to use?
   a. ANOVA
   b. t-test for independent samples
   c. t-test for matched pairs
   d. regression
   e. chi square

5. A local ice cream shop kept track of the number of cans of cold soda it sold each day, and the temperature that day, for 40 days during the summer. The data are displayed in the scatterplot below:

   ![Scatterplot](image)

A. The correlation coefficient for these data is:
   a. 0.91
   b. 0.32
   c. -0.57
   d. 0

B. Let x be the temperature and y the number of cans of soda sold. What is the correct regression equation?
   a. y = 99 + 0.91x
   b. y = -99 + 0.91x
   c. y = 99 - 0.91x
   d. y = -99 - 0.91x

C. If you wanted to do a hypothesis test on these data, the null and alternate hypotheses would be:
a. \( H_0: \) There is no linear relationship between temperature and sodas sold  
   \( H_a: \) There is a linear relationship between temperature and sodas sold  

b. \( H_0: \) There is a linear relationship between temperature and sodas sold  
   \( H_a: \) There is no linear relationship between temperature and sodas sold  

c. \( H_0: \) There is no linear relationship between temperature and sodas sold  
   \( H_a: \) More sodas are sold when the temperature increases  

d. \( H_0: \) There is no relationship between temperature and sodas sold  
   \( H_a: \) There is a relationship between temperature and sodas sold  

11. What would be the appropriate statistical test to use?  
   a. regression  
   b. ANOVA  
   c. t test for independent samples  
   d. t test for matched pairs  
   e. chi square  

6. What is necessary for the application of the chi-square test?  
   a. The expected counts in each cell of the data table must be greater than 5.  
   b. The actual counts in each cell of the data table must be greater than 5.  
   c. The data must be normally distributed.  
   d. The total number of data must be greater than 30.  

7. To apply the ANOVA test:  
   a. the ratio between the largest sample standard deviation and the smallest must be less than 2  
   b. the sample standard deviations must be identical  
   c. the sample means must all be different  
   d. the sample means must be normally distributed  
   e. the sample sizes cannot be larger than 30  

8. A and B go to Reno, where A likes to play blackjack while B prefers the slot machines. The probability that A will lose money is 0.8; the probability that B will lose money is 0.7. What is the probability that they will both win money?  
   a. 0.06
b. 0.56

c. 0.05

d. 1.5

9. Some people take medicine when they get a cold, others just tough it out. Suppose (made-up numbers) 40% of people take cold medicine, 30% of those who take cold medicine recover in five days or less and 35% of those who don’t take medicine recover in five days or less. Overall what percentage of people recover in five days or less?

   a. 33%
   b. 30%
   c. 35%
   d. 32%
   e. There is not enough information to solve the problem.

10. An automatic coffee machine dispenses cups of coffee whose volume per cup varies normally. Ideally the average amount of coffee dispensed per cup is 10 oz. A quality-control researcher randomly selects 8 cups of coffee from the machine and finds that in this sample the mean volume is 9.92 oz and the standard deviation is 0.23 oz.

A. The inspector believes that the machine is not dispensing the right amount of coffee and sets up a hypothesis test to check his belief. What are his null the alternative hypotheses, and what test should he use?

   a. H0: the average amount dispensed per cup is 10 oz
      Ha: the average amount dispensed per cup is not 10 oz
      Use a t-test on one sample.

   b. H0: the average amount dispensed per cup is 10 oz
      Ha: the average amount dispensed per cup is less than 10 oz
      Use a z-test on one sample.

   c. H0: the average amount dispensed per cup is not 10 oz
      Ha: the average amount dispensed per cup is 10 oz
      Use a z-test on one sample.

   d. H0: the average amount dispensed per cup is less than 10 oz
      Ha: the average amount dispensed per cup is 10 oz
      Use a t-test on one sample.

B. If the p-value of your test is 0.038 and your significance level is 5%, what is your conclusion?

   a. The machine is not dispensing the right amount of coffee per cup.

   b. The machine is dispensing too little coffee per cup.

   c. The machine is dispensing too much coffee per cup.
d. No conclusion can be drawn.
e. The machine is dispensing the right amount of coffee per cup.

11. Suppose the heights of men average 67.8" with a standard deviation of 3". What is the probability that a group of 25 men have an average height of more than 69"?
   a. 0.022
   b. 0.978
   c. 0.031
   d. 0.345

Essay Questions

1. Discuss the advantages and disadvantages of observational studies vs. experimental studies.

   The principal advantage of observational studies, compared to experimental studies, is that observational studies measure subjects in a natural setting rather than an artificial setting. Experimenters must be cautious when designing experimental studies to avoid environments that generate undesirable behaviors like the desire to please the experimenter. A secondary advantage of observational studies is that they permit the investigation of behaviors that may be too dangerous or undesirable to ask someone to engage in. Experimental studies, on the other hand, have the advantage that all variables can be controlled. You can ask a random half of the subjects to do one thing (for example, take a medicine) and the other half to do something else (for example, take a placebo), so you get a fair measure of the different effects of the two actions without the concern that the type of people who might spontaneously choose one action are qualitatively different from those who would choose the other. In some studies, called blind studies, experimental subjects do not even know to which group they belong, while in observational studies subjects always know which group they have chosen to join. Blind experimental studies allow experimenters to disentangle the psychological effects of different behaviors (like taking a drug or not) from the objective effects.

2. An ABC/Washington Post poll around May 10 found that 54% of voters plan to vote for Barack Obama and 46% for John McCain. The poll interviewed 1122 voters. Conduct a hypothesis test to determine if the data show, at the 5% significance level, that Obama will win the election. State your null and alternative hypotheses and explain carefully all the steps you take and your conclusion.

   The null hypothesis is H0: 50% of voters will choose Obama. The alternative hypothesis is Ha: more than 50% of voters will choose Obama. The significance level is 5%.
The sample size is $n = 1122$ and the sample proportion is $0.54$.

The $z$-score for the sample is

$$z = \frac{0.54 - 0.50}{\sqrt{0.53 \times 0.50 / 1122}} - 2.68$$

The $p$-value is $P(Z > 2.68) = 0.004$, which is considerably smaller than the required significance level of 0.05. Thus the sample leads us to reject the null hypothesis and accept the alternative hypothesis that Obama will win a majority of the votes.