STAT 1220
Common Final Exam

FALL 2013
December 6, 2013

PLEASE PRINT THE FOLLOWING INFORMATION:

Name: ____________________    Instructor: ____________________

Student ID #: ____________________    Section/Time: ____________________

THIS EXAM HAS TWO PARTS.

PART I.
Part I consists of 30 multiple choice questions. Each correct answer is scored 2 points; each incorrect (or blank) answer is scored 0, so there is no penalty for guessing. You may do calculations on the test paper, but your answers must be marked on the OPSCAN sheet with a soft lead pencil (HB or No. 2 lead). Any question with more than one choice marked will be counted as incorrect. If more than one choice seems correct, choose the one that is most complete or most accurate. Make sure that your name and ID number are written and correctly bubbled on the OPSCAN sheet.

PART II.
Part II consists of 3 free response questions, with values as indicated. You must show all work in the space provided or elsewhere on the exam paper in a place that you clearly indicate. Work on loose sheets will not be graded.

FOR DEPARTMENT USE ONLY:

Part II.

<table>
<thead>
<tr>
<th>Question</th>
<th>1</th>
<th>2</th>
<th>3</th>
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<tbody>
<tr>
<td>Score</td>
<td></td>
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<table>
<thead>
<tr>
<th>Part I</th>
<th>Part II</th>
<th>TOTAL</th>
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PART - I

1. In order to determine the opinion of people about credit cards, a survey of 1000 US adults was taken and it was found that 83% think that credit cards tempt people to buy things they can’t afford. The population of interest is

   (a) All the 1000 US adults who participated in the survey.
   (b) All the US adults.
   (c) All US adults excluding the 1000 US adults who participated in the survey.
   (d) Any 830 out of 1000 US adults participating in the survey.
   (e) None of the above.

For questions 2, 3 and 4: The following data is a sample of maximum temperature readings (in Degrees Celsius) in May 2013 in Minneapolis:

7, 3, 0, -1, -4, 2, 5, -6, -2, -3, 1

2. The sample mean temperature is

   (a) -1.00   (b) 0.11   (c) 0.18   (d) -2.11   (e) 0.00

3. The sample median temperature is

   (a) 0.18   (b) 0.00   (c) -4.00   (d) -1.00   (e) -3.00

4. The sample standard deviation of temperature is

   (a) -1.56   (b) 0.00   (c) 4.22   (d) 3.92   (e) 2.12

5. Heights of men in US follow an approximately bell shaped distribution with a mean of 70 inches and standard deviation of 3 inches. The percentage of men whose height is between 67 inches and 76 inches is about

   (a) 95%   (b) 81.5%   (c) 68%   (d) 99.7%   (e) 50%
6. A multiple-choice quiz has five questions each with four answers. You have no idea what the answer is to any question and have to guess each answer. The probability of answering at least one question correctly is

(a) 0.24  (b) 0.25  (c) 0.5  (d) 0.76  (e) 0.06

For questions 7, 8, 9 and 10: There are two production lines in a factory which produces good and defective parts. An inspection of 160 parts was made. The following table shows the inspection results. A part is randomly selected from those 160 parts.

<table>
<thead>
<tr>
<th>Types</th>
<th>Good</th>
<th>Defective</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Line 1</td>
<td>65</td>
<td>5</td>
<td>70</td>
</tr>
<tr>
<td>Line 2</td>
<td>82</td>
<td>8</td>
<td>90</td>
</tr>
<tr>
<td>Total</td>
<td>147</td>
<td>13</td>
<td>160</td>
</tr>
</tbody>
</table>

7. The probability that the part is defective and produced by Line 2 is about

(a) 0.05  (b) 0.44  (c) 0.50  (d) 0.91  (e) 0.92

8. The probability that the part is made by Line 1 given that the part is defective is about

(a) 0.05  (b) 0.38  (c) 0.49  (d) 0.50  (e) 0.91

9. The probability that the part is defective or produced by Line 1 is about

(a) 0.38  (b) 0.44  (c) 0.49  (d) 0.91  (e) 0.92

10. The events $F$ : Female and $B$ : Business Major are known to be independent events. The true statement about the events $F$ and $B$ is

(a) $P(F \cup B) = P(F) + P(B)$
(b) $P(F \cup B) \neq P(F) + P(B)$
(c) $P(F \cap B) = P(F)P(B)$
(d) $P(F \cap B) \neq P(F)P(B)$
(e) $P(F \mid B) = P(B)$
For questions 11, 12 and 13: The probability distribution of a discrete random variable $x$ is as shown in the following table

<table>
<thead>
<tr>
<th>$x$</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>$P(x)$</td>
<td>0.03</td>
<td>0.14</td>
<td>0.31</td>
<td>0.33</td>
<td>0.15</td>
<td>0.04</td>
</tr>
</tbody>
</table>

11. $P(2 \leq x \leq 4)$ is about

(a) 0.31 (b) 0.78 (c) 0.45 (d) 0.50 (e) 0.64

12. The mean of the random variable $x$ is about

(a) 3.55 (b) 0.59 (c) 3.00 (d) 4.12 (e) 3.96

13. The standard deviation of the random variable $x$ is about

(a) 1.24 (b) 1.12 (c) 13.85 (d) 3.72 (e) 1.96

14. Thirty-two percent of college students say they use credit cards because of the rewards program. A credit card company randomly selected 20 college students and asked them to name the reason they use credit cards. The mean and standard deviation of the number of college students in any such sample who say they use credits cards because of the rewards program are respectively

(a) 3.2, 1.043 (b) 6.4, 2.086 (c) 6.4, 4.172 (d) 9.31, 2.32 (e) 10.22, 3.12

15. Let $z$ denote the standard normal random variable. Then $P(z < -2.11 \text{ or } z > 2.11)$ is

(a) 0.0174 (b) 0.0348 (c) 0.9826 (d) 0.5 (e) 0.9652
For questions 16 and 17: The life span of brand A-batteries is normally distributed with a mean of 2000 hours and a standard deviation of 30 hours.

16. The probability that the life span of a brand A-battery is more than 2065 hours is about

(a) 0.9850  (b) 0.95  (c) 0.4925  (d) 0.5075  (e) 0.015

17. The minimum life span required for a brand A-battery to be in the top 10% of life span is about

(a) 2030  (b) 2003.22  (c) 2038.46  (d) 2049.35  (e) 2000

18. A stock broker is examining her track record. Over the last 12 quarters, the mean net gain in stock price for all her clients’ portfolios was $3 with a standard deviation of $6. The probability that a randomly selected sample of 35 clients will have a sample mean net gain less than 0 is about

(a) 0.015  (b) 0.5  (c) 0.0015  (d) 0.9985  (e) 0.12

19. An Internet service provider sampled 540 customers and found that 75 of them experienced an interruption in high speed service during the month of September. A 95% confidence interval for the proportion of all customers who experienced an interruption during the month of September is about

(a) (0.1097, 0.1681)  (b) (0.1209, 0.1591)  (c) (0.1053, 0.1747)  (d) (0.1016, 0.1784)  (e) (0.1108, 0.1692)

20. A hybrid course is one that contains both online and classroom instruction. In a study performed at a certain college, a software package was used as a main source of instruction in a hybrid college algebra course. The software recorded the number of hours it took for each student to meet the objectives of the course. In a random sample of 45 students, the mean number of hours was 80.5. If the population standard deviation was 51.2, a 90% confidence interval for the mean number of hours it takes a student to meet the course objectives is about

(a) (72.87, 88.13)  (b) (65.55, 95.45)  (c) (60.85, 100.15)  (d) (70.72, 90.28)  (e) (67.95, 93.05)
21. A random sample of 25 Hollywood movies made since the year 2000 had a mean length of 111.7 minutes with a standard deviation of 13.8 minutes. Assuming that the length of Hollywood movies is approximately normally distributed, a 95% confidence interval for the mean length of all Hollywood movies is

(a) (106.00, 117.40)  (b) (107, 116.4)  (c) (104.59, 118.81)  (d) (108.17, 115.23)
(e) (105.3, 118.1)

22. You wish to estimate the proportion of computers that need repairs by the time the product is three years old. A prior study found that 19% of computers needed repairs by the time the product was three years old. The minimum number of computers that must be included in the sample if you want to be 99% confident that the sample proportion is within 3.5% of the population proportion is

(a) 483  (b) 677  (c) 206  (d) 834  (e) 340

For questions 23, 24, and 25: A research center claims that more than 65% of US adults have used a cellular phone to access the internet. In a random sample of 125 adults, 69% say that they have used a cellular phone to access the internet.

23. The null and alternative hypotheses to test that more than 65% of US adults have used a cellular phone to access the internet at 5% level of significance are.

(a) $H_0 : p = 0.69$ versus $H_a : p < 0.69$
(b) $H_0 : p = 0.65$ versus $H_a : p \geq 0.65$
(c) $H_0 : p = 0.65$ versus $H_a : p > 0.65$
(d) $H_0 : p = 0.65$ versus $H_a : p \neq 0.65$
(e) $H_0 : p \geq 65$ versus $H_a : p \leq 65$

24. The value of the test statistic $z$ is about

(a) 0.06  (b) -0.94  (c) 0.65  (d) 0.94  (e) 0.69

25. The $p$-value of the test is about

(a) 0.8264  (b) 0.69  (c) 0.65  (d) 0.05  (e) 0.1736
26. A Type II error in a test of hypothesis occurs if

(a) we do not reject $H_0$ when in fact $H_0$ is true
(b) we do not reject $H_a$ when in fact $H_a$ is true
(c) we reject $H_0$ when in fact $H_a$ is true
(d) we reject $H_0$ when in fact $H_0$ is true
(e) we do not reject $H_0$ when in fact $H_0$ is false

27. A random sample of 15 residents of Mecklenburg county has a mean annual income of $55,500 and a standard deviation of $8000. A random sample of 12 residents of Cabarrus county has a mean annual income of $54,900 and a standard deviation of $7800. The population variances are known to be equal. At 5% level of significance, to test the claim that the mean annual incomes in the two counties are different, the null and alternative hypotheses are

(a) $H_0 : \mu_1 - \mu_2 > 0$ versus $H_a : \mu_1 - \mu_2 \leq 0$
(b) $H_0 : \mu_1 - \mu_2 = 0$ versus $H_a : \mu_1 - \mu_2 \geq 0$
(c) $H_0 : \mu_1 - \mu_2 = 0$ versus $H_a : \mu_1 - \mu_2 > 0$
(d) $H_0 : \mu_1 - \mu_2 \geq 0$ versus $H_a : \mu_1 - \mu_2 < 0$
(e) $H_0 : \mu_1 - \mu_2 = 0$ versus $H_a : \mu_1 - \mu_2 \neq 0$

28. To test whether a certain fuel additive improves gas mileage, investigators measured the gas mileage (in miles per gallon) of five cars and found the following data.

<table>
<thead>
<tr>
<th>Car</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gas mileage without fuel additive</td>
<td>45</td>
<td>47</td>
<td>44</td>
<td>49</td>
<td>51</td>
</tr>
<tr>
<td>Gas mileage with fuel additive</td>
<td>46</td>
<td>49</td>
<td>44</td>
<td>50</td>
<td>53</td>
</tr>
</tbody>
</table>

The population of paired difference of gas mileage has normal distribution with unknown standard deviation. At 10% level of significance, to test the claim that the fuel additive improves gas mileage the formula of the test statistics is

(a) $Z = \frac{\bar{d} - \mu_0}{\sigma_d / \sqrt{n}}$  
(b) $T = \frac{\bar{d} - \mu_0}{s_d / \sqrt{n}}$  
(c) $T = \frac{(\bar{x}_1 - \bar{x}_2) - D_0}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$  
(d) $T = \frac{d - D_0}{s_d / \sqrt{n}}$  
(e) $T = \frac{X - \mu_0}{s / \sqrt{n}}$
29. The simple linear regression equation for relating to \( x = \text{age} \) and \( y = \# \text{ of text messages} \) for a sample of 15 persons is given by \( \hat{y} = 37.08 - 1.6x \). Given that \( s_x = 2.098 \) and \( SS_{xx} = 55 \), a 90% confidence interval for the slope \( \beta_1 \) of the regression line is closest to

(a) (0.06, 0.46)
(b) (−2.5, −1.3)
(c) (−3.7, 0.5)
(d) (1.1, 2.1)
(e) (−2.1, −1.1)

30. The equation of a regression line is \( \hat{y} = 10.28 + 4.92x \). If \( x \) increases by one unit, then

(a) \( y \) decreases by about 4.92 units
(b) \( y \) increases by about 4.92 units
(c) \( y \) decreases by about 10.28 units
(d) \( y \) increases by about 10.28 units
(e) the response of \( y \) cannot be predicted.

End of Multiple Choice Section
PART - II

1. It is hoped that a newly developed pain reliever will more quickly produce perceptible reduction in pain to patients after minor surgeries than a standard pain reliever. The standard pain reliever is known to bring relief in an average of 3.5 minutes with standard deviation 2.1 minutes. To test whether the new pain reliever works more quickly than the standard one, 50 patients with minor surgeries were given the new pain reliever and their times to relief were recorded. The experiment yielded sample mean $\bar{x} = 3.1$ minutes and sample standard deviation $s = 1.5$ minutes. Is there sufficient evidence in the sample to indicate, at the 5% level of significance, that the newly developed pain reliever does deliver perceptible relief more quickly?

   a) (3 pts) State the null and the alternative hypotheses.

   $H_0 :$

   $H_a :$

   b) (4 pts) Write down the formula of the test statistics and find its value.

   c) (3 pts) Determine the rejection region and make a decision.

   d) (2 pts) State your conclusion in the context of the problem.
2. A travel association says that the mean daily lodging cost for a family traveling in North Carolina is the same as in South Carolina. The mean daily lodging cost for 14 families in North Carolina is $135 and the standard deviation is $26. The mean daily lodging cost for 12 families in South Carolina is $137 and standard deviation is $20. The two populations are independent, normally distributed and with equal standard deviations. At 5% level of significance, is there enough evidence to reject the travel association’s claim?

a) (3 pts) State the null and the alternative hypotheses.

\[ H_0 : \]

\[ H_a : \]

c) (4 pts) Write down the formula of the test statistics and find its value.

d) (3 pts) Determine the rejection region and make a decision.

e) (2 pts) Make a conclusion in the context of the problem.
3. Data collected from a sample of 8 students relating study time \((x\text{ in hours per week})\) and leisure time \((y\text{ in hours per week})\) yielded

\[
\bar{x} = 59.37, \quad \bar{y} = 4.25, \quad SS_{xx} = 1843.87, \quad SS_{xy} = -49.75, \quad SS_{yy} = 7.5.
\]

a) (4 pts) Calculate the sample correlation coefficient.

b) (4 pts) Find the equation of the regression line relating \(y\) to \(x\).

c) (2 pts) Predict the number of leisure hours per week for a student who studies 90 hours per week.

d) (6 pts) Test at at 10% significance level, the claim that the slope of the regression line between study time and leisure time is negative. Interpret the result in the context of the problem.