PLEASE PRINT THE FOLLOWING INFORMATION:

Name: ___________________________  Instructor: ___________________________

Student ID #: ___________________  Section/Time: ___________________________

THIS EXAM HAS TWO PARTS.

PART I.
Consists of 30 multiple choice questions (2 points each). Read all questions carefully. You may do calculations on the test paper. Mark the number of the opscan sheet corresponding to the test question number with a Number 2 pencil or a mechanical pencil with HB lead. Mark only one answer; otherwise the answer will be counted as incorrect. In case there is more than one answer, mark the best answer. Please make sure that your name and ID appear on the opscan sheet in the spaces provided.

PART II.
This part consists of 3 problems (a total of 40 points). You must show all work for each question in the space provided to receive full credit for that question. If you write your explanations in another part of the test, please indicate accordingly.

FOR DEPARTMENTAL USE ONLY:
Part II

<table>
<thead>
<tr>
<th>Questions</th>
<th>1</th>
<th>2</th>
<th>3</th>
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</thead>
<tbody>
<tr>
<td>Score</td>
<td></td>
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<table>
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<tr>
<th>Part I</th>
<th>Part II</th>
<th>TOTAL</th>
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<tbody>
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</table>
Use the following information to answer problems 1, 2, and 3.
In a certain city the number of power outages in each of the last 10 months are

\[ 3, 7, 5, 1, 2, 0, 5, 4, 1, 2 \]

1. The mean of this sample is:
   a) 3
   b) 3.5
   c) 4
   d) 4.5
   e) 5

2. The standard deviation of this sample is:
   a) 1.52
   b) 2.21
   c) 3.26
   d) 4.16
   e) 5.09

3. The median of this sample is:
   a) 2
   b) 2.5
   c) 3
   d) 3.5
   e) 4

Use the following information to answer questions 4 and 5.
The price of all college textbooks follows a bell-shaped distribution with mean $110 and standard deviation $25.

4. Approximately what percent of college textbooks cost between $85 and $135?
   a) 55%
   b) 68%
   c) 75%
   d) 95%
   e) 99.7%
5. Approximately 95% of college textbooks cost between
   a) $85 and $115
   b) $90 and $110
   c) $60 and $160
   d) $45 and $198
   e) $50 and $125

Use the following information to answer questions 6-8.

The table below shows the results of a survey in which researchers examined the relationship between a certain biological trait and the presence of a certain gene.

<table>
<thead>
<tr>
<th>Trait Present</th>
<th>Gene Present</th>
<th>Gene not Present</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>52</td>
<td>31</td>
<td>83</td>
</tr>
<tr>
<td>Trait Not Present</td>
<td>27</td>
<td>64</td>
<td>91</td>
</tr>
<tr>
<td>Total</td>
<td>79</td>
<td>95</td>
<td>174</td>
</tr>
</tbody>
</table>

A person is chosen at random from those surveyed.

6. The probability that this person has the trait is approximately:
   a) .30
   b) .63
   c) .37
   d) .48
   e) .16

7. The probability that this person has both this trait and the gene is approximately:
   a) .30
   b) .63
   c) .45
   d) .16
   e) .37

8. Given that the gene is present, the probability that this person has the trait is approximately:
   a) .63
   b) .45
   c) .66
   d) .48
   e) .30
Use the following information to answer questions 9, 10, and 11.
A certain gambling game allows the player to win either $1, $2, or $3 or to lose $1 (that is to win $-1). If $x$ denotes the amount of dollars that the player wins then the probability distribution of $x$ is

<table>
<thead>
<tr>
<th>$x$</th>
<th>$-1$</th>
<th>$1$</th>
<th>$2$</th>
<th>$3$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$P(x)$</td>
<td>.35</td>
<td>.07</td>
<td>.01</td>
<td></td>
</tr>
</tbody>
</table>

9. The missing entry in the table is
   a) .67  
   b) .35  
   c) 0    
   d) .43  
   e) .57

10. How much money does the player expect to win?
   a) -.05  
   b) -.35  
   c) 2    
   d) 1    
   e) .52

11. What is the probability that the player wins $2 or $3?
   a) .17  
   b) .01  
   c) .35  
   d) .08  
   e) .07

12. A certain airplane has only two engines. The probability that the first fails is .01 and the probability that the second fails is .02. If the event that one of them fails is independent of the event that the other fails, what is the probability that at least one fails.
   a) .010  
   b) .020  
   c) .002  
   d) .0298  
   e) .040
13. If \( z \) denotes a standard normal random variable, then \( P(-.25 < z < 1.21) \) is about
   a).8869
   b).4856
   c).4013
   d).8713
   e).2882

14. If \( x \) denotes a normal random variable with mean 3 and standard deviation 5, then
   \( P(-1 < x < 7) \) is about
   a).5762
   b).7881
   c).2119
   d).3413
   e).1587

Use the following information to answer questions 15 and 16.
The amount of time per week (in hours) that students at a certain school spend doing homework is approximately normally distributed with mean 15 and standard deviation 2. A sample of 50 students from this school is taken.

15. The mean and standard deviation of \( \bar{x} \) are
   a) \( \mu_{\bar{x}} = 15, \sigma_{\bar{x}} = 2 \)
   b) \( \mu_{\bar{x}} = 15, \sigma_{\bar{x}} = .491 \)
   c) \( \mu_{\bar{x}} = 15, \sigma_{\bar{x}} = .283 \)
   d) \( \mu_{\bar{x}} = 17, \sigma_{\bar{x}} = 2 \)
   e) \( \mu_{\bar{x}} = 17, \sigma_{\bar{x}} = .315 \)

16. What is the best approximation to the probability that the sample mean is between 14.5 and 15.5?
   a).96
   b).46
   c).08
   d).98
   e).92
17. A certain company makes electronic parts, of which 4% are defective. Let \( x \) be the number of defective parts in a shipment of 200 parts. What are the mean and standard deviation of \( x \)?
   a) (60, 7.68)
   b) (60, 2.77)
   c) (8, 7.68)
   d) (8, 2.77)
   e) (60, 48)

18. A poll found that only 10% of a random sample of 500 adults approved of attempts to clone a human. The 95% confidence interval for the true proportion of adults who approve of human cloning is closest to
   a) (.074, .126)
   b) (.26, .026)
   c) (.125, .261)
   d) (.015, .261)
   e) (.011, .016)

19. A nutrition laboratory tests 25 hot dogs and finds that their mean sodium content is 310mg with a standard deviation of 36mg. Assuming that the population of the fat content is normally distributed, a 95% confidence interval for the true mean sodium content of such hot dogs is
   a) (293, 322)
   b) (300, 320)
   c) (297, 315)
   d) (295, 325)
   e) (301, 319)

20. Assume that grades on the SAT are approximately normally distributed with mean 1060 and standard deviation 172. If Fiona takes the SAT, what should her score be on the test so that only 5% of all test takers score higher than she does?
   a) 1353
   b) 1311
   c) 1371
   d) 1322
   e) 1343
21. We want to test the hypothesis \( H_0 : p = .124 \) vs. \( H_1 : p < .124 \). A sample of size 1,300 produces a test statistic \( z = -1.73 \). The p-value is
   a).9582
   b).0208
   c).0418
   d).0832
   e) Not enough information

Use the following information to answer questions 22 and 23.
A researcher wants to test the hypothesis that \( H_0 : \mu = 0 \) vs \( H_1 : \mu \neq 0 \). She takes a sample size \( n = 25 \) and finds that \( s = 10 \) and \( \bar{x} = 8 \).

22. The test statistic for this test is closest to
   a)3.83
   b)1.72
   c)3.41
   d)2.96
   e) 4.00

23. If \( \alpha = .05 \), then the rejection region is
   a) \((-\infty, -2.064) \cup (2.064, \infty)\)
   b)\((-\infty, -4.128) \cup (4.128, \infty)\)
   c) \((-4.128, -2.064) \cup (2.064, 4.128)\)
   d) \((-2.064, 2.064)\)
   e) \((-4.128, 4.128)\)

24. We perform a hypothesis test and get a p-value of .073. Which of the following is true?
   a) We reject the null hypothesis at the \( \alpha = .1 \) level
   b) We retain the null hypothesis at the level \( \alpha = .05 \)
   c) We fail to reject the null hypothesis at the level \( \alpha = .025 \)
   d) All of the above
   e) None of the above
Use the following information to answer questions 25 and 26.

A certain company is marketing two types of hot dogs. The first is called "regular" and the second is called "low fat." A researcher wants to test if the fat content of the "low fat" hot dogs is significantly lower than the fat content of the "regular" hot dogs. She gets a random sample of 35 "regular" hot dogs and finds that they have a mean fat content of 36mg with a standard deviation of 12mg. She then gets a random sample of 30 "low fat" hot dogs and finds that they have a mean content of 27mg with a standard deviation of 9mg. Assume that the samples are independent of each other, and that the populations have the same standard deviation.

25. If \( \mu_R \) is the true mean of the fat content of "regular" hot dogs and \( \mu_L \) is the true mean of the fat content of the "low fat" hot dogs, which hypothesis are we interested in testing:
   a) \( H_0 : \mu_R - \mu_L = 0 \text{ vs } H_a : \mu_R - \mu_L \neq 0 \)
   b) \( H_0 : \mu_R - \mu_L = 0 \text{ vs } H_a : \mu_R - \mu_L > 0 \)
   c) \( H_0 : \mu_R - \mu_L = 0 \text{ vs } H_a : \mu_R - \mu_L < 0 \)
   d) All of the above.
   e) None of the above.

26. The test statistic is
   a)1.27
   b)3.45
   c)11.22
   d)3.37
   e)06

27. To see how a car's weight \( x \) affects its fuel consumption \( y \) (measured in miles-per-gallon), a linear regression is used. The correlation coefficient is found to be .72. What proportion of the variability in the miles-per-gallon is explained by the weight of the car?
   a).52
   b).72
   c).85
   d).36
   e).83

28. In a data set, if two variables \( x \) and \( y \) have a strong negative correlation, then a scatter-plot of their values would fit around
   a) a straight line going down to the right
   b) a straight line going up to the right
   c) a horizontal line
   d) a circle
   e) a parabola
29. A researcher took a sample of 45 electronics companies. The linear regression relating the amount of money spent on advertising (in millions of dollars) \( x \) and the gross revenue of the company (in millions of dollars) \( y \) was \( \hat{y} = 4.1 + 9.73x \). Select the most accurate statement:
   a) The gross revenue of a company is negatively correlated with the amount that it spends on advertising
   b) A $9.73 million increase in advertising increases the gross revenue on average by $1 million
   c) A $1 million increase in advertising increases the gross revenue on average by $9.73 million
   d) A $4.1 million increase in advertising increases the gross revenue on average by $1 million
   e) A $1 million increase in advertising increases the gross revenue on average by $4.1 million

30. We want a confidence interval for the mean life of a certain type of light bulb. If it is believed that the standard deviation of the life time of such light bulbs is 3 days. How large a sample should be selected so that the estimate with a 90% confidence level is within .5 days of the population mean?
   a) 10.82
   b) 96
   c) 97
   d) 98
   e) 97.42
Part II

1. Direct Mailing Company sells computers and computer parts by mail. The company claims that at least 90% of all orders are mailed within 72 hours after they are received. The quality control department at the company often takes samples to make sure that this is claim is valid. A recently taken sample of 150 orders shows that 129 of them were mailed within 72 hours. Test the hypothesis that the company's claim is true.

   a. State the null and alternative hypotheses.

   b. Construct the rejection region for a level $\alpha = .025$ test.

   c. Compute the value of the test statistic.

   d. State your conclusion about whether or not the company's claim is true.
2. A company institutes an exercise break for its workers to see if it improves job satisfaction. A random sample of 10 workers is asked their job satisfaction before and after the program is put into effect. Their job satisfaction index is given on the table below.

<table>
<thead>
<tr>
<th>Worker Number</th>
<th>Before</th>
<th>After</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>34</td>
<td>33</td>
</tr>
<tr>
<td>2</td>
<td>28</td>
<td>36</td>
</tr>
<tr>
<td>3</td>
<td>29</td>
<td>50</td>
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<tr>
<td>4</td>
<td>45</td>
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<td>5</td>
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<td>17</td>
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<td>9</td>
<td>15</td>
<td>12</td>
</tr>
<tr>
<td>10</td>
<td>27</td>
<td>36</td>
</tr>
</tbody>
</table>

Test the hypothesis that satisfaction has NOT improved. You can assume that the differences in the pairs are normally distributed.

a. State the null and alternative hypotheses.

b. Calculate the test statistic.

c. Identify the rejection region, using $\alpha = .05$.

d. Draw your conclusion and state it in the context of the problem.
3. Classified ads in the newspaper offer $n = 15$ used Toyota Corollas for sale. Their ages $x$ and their advertised prices (in thousands of dollars) $y$ can be summarized by the following statistics

$$
\sum x = 84 \quad \sum y = 108.9 \quad \sum xy = 431.6 \quad \sum x^2 = 670 \quad \sum y^2 = 969.6
$$

a. Assuming the existence of a linear relationship between a car’s age and its price, find the equation of a regression line relating $y$ to $x$.

b. Find $s_e$, the standard deviation of errors.

c. Predict the price of a 7 year old Toyota Corolla.

d. Construct a 90% prediction interval for the price of a 7 year old Corolla.