Multiple Choice Questions

1. A fast- food restaurant chain with 700 outlets in the United States describes the geographic location of its restaurants with the accompanying table of percentages. A restaurant is to be chosen at random from the 700 to test market a new style of chicken. Given that the restaurant is located in the eastern United States, what is the probability it is located in a city with a population of at least 10,000? (correct to 3 decimal places)

	Region				
Population of City		**North East**	**South East**	**South West**	**North West**
	< 10,000	1%	6%	3%	0%
	10,000 – 100,000	15%	2%	12%	5%
	> 100,000	20%	4%	7%	25%

   a. 0.456
   b. 0.41
   c. 0.854
   d. 0.146
   e. None of the above.

2. A certain confidence interval of population proportion p is $0.35 < p < 0.48$. Then the sample proportion and margin of error are (correct to 3 decimal places)
   a. 0.83 and 0.13
   b. 0.415 and 0.065
   c. 0.83 and 0.065
   d. 0.415 and 0.13
   e. None of the above

3. Given that events C and D are independent, P(C) = 0.3, and P(D) = 0.6, are C and D mutually exclusive?
   a. Yes
   b. No
   c. Cannot be determined

4. A quiz consists of 100 multiple choice questions, each with five possible answers, only one of which is correct. If the student guesses on each question, then the average number of questions answered incorrectly by the student is
   a. 50
   b. 60
   c. 20
   d. 80
   e. None of the above

5. A physical fitness association is including the mile run in its secondary- school fitness test. The time for this event for boys in secondary school is known to possess a normal distribution with a mean of 450 seconds and a standard deviation of 50 seconds. The fitness association wants to recognize the fastest 10% of the boys with certificates of recognition. What time would the boys need to beat in order to earn a certificate of recognition from the fitness association? (correct to 2 decimal places)
    a. 532.25 sec
    b. 367.75 sec
    c. 385.92 sec
    d. 514 sec
    e. None of the above
6. The amount of soda a dispensing machine pours into a 12 ounce can of soda follows a normal distribution with a standard deviation of 0.32 ounce. Every can that has more than 12.80 ounces of soda poured into it causes a spill and the can needs to go through a special cleaning process before it can be sold. What is the mean amount of soda the machine should dispense if the company wants to limit the percentage that need to be cleaned because of spillage to 3%? (correct to 4 decimal places)
    a. 12.1984 oz
    b. 12.1056 oz
    c. 13.4944 oz
    d. 13.4016 oz
    e. None of the above
7. Smith is a weld inspector at a shipyard. He knows from keeping track of good and substandard welds that for the afternoon shift 5% of all welds done will be substandard. If Smith checks 300 of the 7500 welds completed that shift, what is the probability that he will find at least 25 substandard welds? (correct to 3 decimal places)
    a. 0.996
    b. 0.504
    c. 0.496
    d. 0.004
    e. None of the above
8. Jim buys his school supplies in bulk. On one particular shopping trip he bought 5 red pens at $1.29 each, 3 blue pens at $1.49 each, 6 green pens at $1.79 each and 9 black pens at $0.99 each. What was the average cost of a pen? (correct to 2 decimal places)
    a. $1.33
    b. $1.39
    c. $1.29
    d. $0.99
    e. None of the above

9. A study was designed to investigate the effects of two variables - (1) a student's level of mathematical anxiety and (2) teaching method - on a student's achievement in a mathematics course. Students who had a low level of mathematical anxiety were taught using the traditional expository method. These students obtained a mean score of 490 with a standard deviation of 20 on a standardized test. Assuming a bell- shaped distribution, where would approximately 99.7% of the students score?
    a. Below 430 or above 550
    b. Between 450 and 530
    c. Between 430 and 550
    d. Below 450 or above 530
    e. None of the above
10. The United States can be divided into four geographical regions: Northeast, South, Midwest, and West. The Northeast region consists of 9 states; the South region consists of 16 states; the Midwest consists of 12 states; and the West consists of 13 states. If a survey is to be administered to the governors of 10 of the states and we want equal representation for the states in each of the four regions, how many states from the South should be selected? Round to the nearest whole state.
    a. 2
    b. 4
    c. 5
    d. 3
    e. None of the above
11. A certain number of undergraduate students were asked to view a 40-minute television program that included advertisements for a digital camera. Some students saw a 30-second commercial and others saw a 90-second version. Same commercial was shown either 1, 3, or 5 times during the program. This experiment was conducted to determine effectiveness of the advertisement. How many factors are there in this experiment?
    a. 3
    b. 2
    c. 6
    d. 0
    e. None of the above
12. The National Association of Realtors estimates that 23% of all homes purchased in 2004 were considered investment properties. If a sample of 800 homes sold in 2004 is obtained and it was noted that 248 homes were to be used as investment property. Would this be unusual?
    a. Yes
    b. No
    c. Cannot be determined

13. Which type of bias occurs because we do not obtain complete information about a population?
    a. Nonresponse bias
    b. Sampling bias
    c. Response bias
    d. No bias
    e. None of the above
14. A local juice manufacturer distributes juice in bottles labeled 12 ounces. A government agency claims that the company is cheating its customers. The agency selects 20 of these bottles, measures their contents, and obtains a sample mean of 11.7 ounces with a standard deviation of 0.7 ounce. If the population data is normally distributed, the P-value of the hypothesis test to test the agency's claim is (correct to 3 decimal places)
    a. 0.035
    b. 0.35
    c. 0.07
    d. 0.7
    e. None of the above
15. The owner of a farmer's market was interested in determining how many oranges a person buys when they buy oranges. He asked the cashiers over a weekend to count how many oranges a person bought when they bought oranges and record this number for analysis at a later time. The data is given below in the table.

x	1	2	3	4	5	6	7	8	9	10
P(x)	0.05	0.19	0.20	0.25	0.12	0.10	0	0.08	0	0.01

    The random variable x represents the number of oranges purchased and P(x) represents the probability that a customer will buy x oranges. The variance of the number of oranges purchased by a customer is (correct to 2 decimal places)
    a. 3.97
    b. 1.95
    c. 3.57
    d. 0.56
    e. None of the above
16. A private opinion poll is conducted for a politician to determine what proportion of the population favors adding more national parks. How large a sample is needed in order to be 99% confident that the sample proportion will not differ from the true proportion by more than 3%?
    a. 22
    b. 1844
    c. 1509
    d. 3684
    e. None of the above

17. A machine has four components, A, B, C, and D, set up in such a manner that all four parts must work for the machine to work properly. Assume the probability of one part working does not depend on the functionality of any of the other parts. Also assume that the probabilities of the individual parts working are P(A) = P(B) = 0.93, P(C) = 0.99, and P(D) = 0.95. The probability that at least one of the four parts will work is (correct to 3 decimal places)
    a. 1.0
    b. 0.187
    c. 0.0
    d. 0.813
    e. None of the above
18. In the past, the mean running time for a certain type of radio battery has been 9.6 hours. The manufacturer has introduced a change in the production method and wants to perform a hypothesis test to determine whether the mean running time has changed as a result. The null (H_0) and alternative (H_1) hypotheses are
    a. H_0: $\mu \geq 9.6$ hours; H_1: $\mu = 9.6$ hours
    b. H_0: $\mu > 9.6$ hours; H_1: $\mu > 9.6$ hours
    c. H_0: $\mu \neq 9.6$ hours; H_1: $\mu = 9.6$ hours
    d. H_0: $\mu = 9.6$ hours; H_1: $\mu > 9.6$ hours
    e. None of the above
19. A coin is tossed 1000 times and 540 heads appear. The P-value of the hypothesis testing to test the claim that this is not a biased coin is (correct to 3 decimal places)
    a. .001
    b. .011
    c. .11
    d. .206
    e. None of the above
20. One hundred people were asked, "Do you favor stronger laws on gun control?" Of the 33 that answered "yes" to the question, 14 were male. Of the 67 that answered "no" to the question, six were male. The probability that a randomly chosen respondent is a male given that the respondent does not favor the gun law is
    a. 14/33
    b. 19/33
    c. 1/5
    d. 6/67
    e. None of the above
21. In a χ^2 test of independence, with *m* rows and *n* columns in the contingency table, the number of degrees of freedom associated with the test statistic is
    a. *mn*-1
    b. *mn*+1

c. $mn-m-n+1$
d. $mn-m-n-1$
e. None of the above

22. The length of time it takes college students to find a parking spot in the library parking lot follows a normal distribution with a mean of 4.5 minutes and a standard deviation of 1 minute. The cut- off time which 75.8% of the college students exceed when trying to find a parking spot in the library parking lot is (correct to 1 decimal place)
    a. 5.3 min
    b. 4.8 min
    c. 5.2 min
    d. 3.8 min
    e. None of the above
23. In an hypothesis testing, Type II error is made if
    a. we reject the null hypothesis when the alternative hypothesis is true
    b. we do not reject the null hypothesis when the null hypothesis is true
    c. we reject the null hypothesis when the null hypothesis is true
    d. we do not reject the null hypothesis when the alternative hypothesis is true
    e. None of the above
24. In interpreting a boxplot of a data set we note that the median is to the left of the center of the box and the right line is longer than the left line. We can conclude that
    a. the data is symmetric
    b. skewness or symmetry cannot be determined by a box plot
    c. the data is skewed right
    d. the data is skewed left
    e. None of the above
25. The probability that a football game will go into overtime is 20%. What is the probability that two of three football games will go to into overtime? (correct to 3 decimal places)
    a. 0.04
    b. 0.2
    c. 0.384
    d. 0.096
    e. None of the above

Tie Breakers

1. Is there a relationship between marital status and happiness? In the 2006 General Social Survey, 2985 randomly sampled individuals were asked their level of happiness and marital status. The results are shown in the below Table. Does the sample evidence suggest that one's happiness depends on one's marital status? Conduct an hypothesis test to answer this question. Use 0.05 level of significance. Write down all necessary steps of the test such as hypotheses, test statistic, P-value, decision, and the conclusion.

		Marital Status			
		Married	**Widowed**	**Divorced/Separated**	**Never Married**
Happiness	**Very Happy**	600	63	112	144
	Pretty Happy	720	142	355	459
	Not too Happy	93	51	119	127

2. The American black bear (*Ursus americanus*) is one of eight bear species in the world. It is the smallest North American bear and the most common bear species on the planet. In 1969, Dr. Michael R. Pelton of the University of Tennessee initiated a long-term study of the population in Great Smoky Mountains National Park. One aspect of the study was to develop a model that could be used to predict a bear's weight (since it is not practical to weight bears in the field). One variable thought to be related to weight is the length of the bear. The following data represent the lengths of 12 American black bears.

Total Length (cm)	Weight (kg)
139	110
138	60
139	90
120.5	60
149	85
141	100
141	95
150	85
166	155
151.5	140
129.5	105
150	110

Treat total length as the explanatory variable and weight as the response variable to answer the following.

a. Compute the linear correlation coefficient between total length and weight.
b. Find the least-squares regression line.
c. Suppose a 149.0-cm bear is captured in the field. Use the least-square regression line to predict the weight of the bear.
d. What is the residual of the bear from part (c)?

3. Let $S = \{2, 3, 6, 18, 38, 81, 442, 469, 574, 608\}$. What is the probability of selecting 4 elements of S so that their sum is
    a. less than 400?
    b. odd?
    c. even and less than 400?

Multiple Choice Questions

1.c	6.a	11.b	16.b	21.c
2.b	7.d	12.a	17.a	22.d
3.b	8.a	13.b	18.e	23.d
4.d	9.c	14.a	19.b	24.c
5.c	10.d	15.c	20.d	25.d

Tie Breakers

1. **Hypotheses:**
   Null Hypothesis H_0: Happiness and marital status are independent (not related)
   Alternative Hypothesis H_1: Happiness and marital status are dependent (related)
   Test statistic = 224.116
   P-value = 1.26×10^{-45}
   Decision: Reject H_0
   Conclusion: There is sufficient evidence, at the 0.05 level of significance, to conclude that happiness and marital status are dependent. We conclude that happiness and marital status are related to each other.

2. a. 0.7039
   b. 1.6942 *x* -142.4709
   c. 109.9649 kg
   d. -25.0 kg

3. a. $\frac{{}_6C_4}{{}_{10}C_4} = \frac{15}{210}$, where ${}_nC_r = \frac{n!}{r!(n-r)!}$.
   b. $\frac{({}_3C_3 \cdot {}_7C_1) + ({}_3C_1 \cdot {}_7C_3)}{{}_{10}C_4} = \frac{112}{210}$
   c. $\frac{({}_2C_2 \cdot {}_4C_2) + ({}_2C_0 \cdot {}_4C_4)}{{}_{10}C_4} = \frac{7}{210}$