|  |
| --- |
|  |

**Part I Multiple Choice (10 items,‘20 points)**

**Please circle your answer clearly and unambiguously.**

1. In statistics, the universe or “totality of items or things” under consideration is known as:

a. a sample. b. a population. c. a parameter. d. a statistic

2. In statistics, the portion of the universe that has been selected for analysis is called:

a. a sample. b. a population. c. a parameter. d. a statistic

3. A Type H error is committed when

a. we reject a Null Hypothesis when it is true. b. we i reject a Null Hypothesis when it is true. c. we reject a Null Hypothesis when it is false. d. we don’t reject a Null Hypothesis when it is false.

4. The process of using sample statistics to draw conclusions about true population

parameter is called a. the scientiﬁc method. b. statistical inference. c. sampling technique. d. descriptive statistics..

5. To assign probabilities to an experiment, which of the following statements must be true? 1) The probability for each experimental outcome must be between “(-) 1” and

lG(+) 1”. 2) The sum of the probabilities for all experimental outcomes must sum to “l”. 3) The probability for each experimental outcome must be between “O” and “l” 4) The sum of the probabilities for all experimental outcomes must sum to a. 1 & 2 only b. 1 & 4 only c. 2 & 3 only d. 3 & 4 only.

6. Which of the following statements about the normal distribution is NOT true?

a. The mean, median and mode are the same. b. Exactly 68.26% of the observations will fall between plus-one and minus-one standard

deviations from the mean. c. It is a discrete probability distribution. d. All of the above statements are true concerning the normal distribution.

|  |
| --- |
|  |

7. The “power” of a test is its ability to

a. make a Type I error. b. NOT make a Type I error. c. make a Type II error. d. NOT make a Type II error.

8. In its standardized form, the normal distribution

a. has a mean of zero and a standard deviation of one. b. has a mean of one and a standard deviation of zero. c. has about 95% of its area fall between plus-one and minus-one standard deviations

from the mean. d. both a and c are correct.

9. The central limit theorem is important in statistics because

a. for a large n, it says the population is normal. b. for any population, it says that the sampling distribution of the sample mean is

approximately normal, regardless of the sample size. c. for a large n, it says that the sampling distribution of the sample mean is approximately

normal, regardless of the shape of the population. d.a&b

10. The standard deviation of the sampling distribution of is also known as the

a. point estimate of the population mean b. standard error of the mean

c. z-score d.a&b

|  |
| --- |
|  |

*/*

**Part H**

**Problems (180 points total)**

**Please show a\_ll work. The more I can tell of what you did, the more chance for partial credit you may get even if your ﬁnal answer is incorrect. NOTE!!!! Answers with no work shown will Qt be accepted even if they are correct!**

l) A building contractor is seeking to build the Superman Museum in Smallville. In order

for a major project such as this to proceed, the proposal must go through a three step process - 1) evaluation by the planning commission resulting in a positive or negative recommendation to the City Council, 2) presentation of the proposal to the voters by the City Council, and 3) ﬁnal approval by the voters. Previous experience has indicated that the planning commission recommends approval of proposals such as this to the City Council 15% of the time. If the planning commission does recommend approval, the

Smallville City Council has historically voted to present the proposal to the voters 95%

of the time. If the planning commission does Q recommend approval, the Smallville City Council has historically voted to present the proposal to the voters only 5% of the time. When proposals such as are presented to the voters, they have subsequently received voter approval 70% of the time.

a) Draw a tree diagram for this experiment and indicate all the experimental

outcomes, indicating the probability for each outcome. (8 Points)

b) What is the probability that the proposal will ﬁnally be approved? (2 Points)

|  |
| --- |
|  |

2)

In a national study of substance abuse treatment centers, 450 centers were included. Of these: 75 were located in California and had 100 employees or more, 32 were located in California and had less than 100 employees, 122 were located in outside California and had 100 employees or more, and 221 were located in outside California and had less than 100 employees.

a) Construct the joint probability table for these data. (5 Points)

b) What is the marginal probability that a center is located in Califomia? (1 Point)

c) If a treatment center has more than 100 employees, what is the probability it is

located in California? (2 Points)

d) If a treatment center is located outside California, what is the probability it has

less than 100 employees? (2 Points)

A city has a professional basketball team playing at home and a professional hockey team playing away on the same night. From past experience, the probability of the basketball team wimaing a home game has been 0.601 and the probability of the hockey team winning an away game 0.492. Historically, when both teams play on the same night, the chance that the lead story in the next morning’s sport section would be about the basketball team has been 65% and about the hockey team 35%. If the morning edition of the paper carries the lead story titled “We Winl”. What is the probability the story is about the basketball team? (5 Points)

|  |
| --- |
|  |

*/*

4) An electronics store has determined that on average 20% of customers entering the store

will make a purchase. Given this:

**a)**

b)

d)

What is the probability that 2 of the next 6 customers entering the store will make a purchase? (3 Points)

What is the probability that 1 of the next 6 customers entering the store will make a purchase? (3 Points)

What is the probability that 0 of the next 6 customers entering the store will make a purchase? (3 Points)

What is the probability that more than 2 of the next 6 customers entering the store will make a purchase? (4 Points)

What is the expected value of this distribution? (2 Points)

What is the standard deviation of this distribution? (2 Points)

|  |
| --- |
|  |

5) Consider the following two mutual funds presented in this chart with the probability of

each of these returns on $1000 invested.

y Probability Fund X

Recession 0.2 (-) $150

Stable economy 0.5 0

Growth Economy 0.3 100

a) Compute the expected return for Fund X. (3 Points)

b) Compute the expected return for Fund Y. (3 Points)

c) Compute the standard deviation for Fund X. (3 Points)

d) Compute the standard deviation for Fund Y. (3 Points)

e) Compute the covariance for Fund X and Fund Y. (4 Points)

Fund Y

$70

150

(-) 110

|  |
| --- |
|  |

f) Compute the portfolio expected retum and portfolio risk for the following

proportion invested in Fund X: (10 Points)

0.40

A special industrial battery must have a shelf life of at least 500 hours. A hypothesis test is conducted with a signiﬁcance level of alpha 0.05. If the batteries from a batch have an actual life of 480 hours, the production manager wants only a 5% probability that they would accept such a defective batch. If the population standard deviation of these batteries is known to be 35 hours, what sample size would be needed for a test that would meet the manager’s speciﬁcations‘? (10 Points)

|  |
| --- |
|  |

Managers at a ﬁrm are studying the delivery times of two suppliers. They are trying to determine if they should stay with their current supplier (A) or start using a new supplier (B) that claims to be able to provide them with a shorter delivery time than they are currently getting from supplier A. The ﬁrm decides to test this claim. For a period of time they sent some orders to supplier A and some to supplier B. If they ﬁnd a signiﬁcantly shorter delivery time for supplier B, they will switch. They give you the data to analyze and ask for your recommendation based on your ﬁndings. Below are your data:

a. What are the null and alternative hypotheses for your analysis? (5 Points)

b. At alpha=0.05, what is the critical value for the test statistic and what are the

rejection rules? (5 Points)

**c. What is the test statistic? (5 Points)**

d. What is the p-value? (5 Points)

e. What is your conclusion and recommendation to the ﬁrm? (5 Points)

|  |
| --- |
|  |

***/***

8) A marketing research ﬁrm basis its charges to clients on the assumption that the average

phone call lasts 15 minutes. A sample of 35 calls was done to test the assumption that the null hypothesis of the mean being less than or equal to 15 minutes was true. The sample had a standard deviation of 4 minutes.

a. What is the Type H error in this situation? What might be the impact of that

error on the company? (6 Points)

b. At alpha=0.0l, what is the probability of making a Type II error if the mean is

actually 16 minutes? (5 Points)

What is the power of the test with this population mean? (3 Points)

c. At alpha=0.0l, what is the probability of making a Type II error if the mean is

actually 19 minutes‘? (5 Points)

What is the power of the test with this population mean? (3 Points)

10

|  |
| --- |
|  |

Managers at a laboratory are studying the productivity of two automated chemical analysis systems. They are trying to determine if they should stay with their current system (A) or start using a new system (B) that claims to be able to provide them with more samples analyzed in a given time period than they are currently getting from system A. The lab decides to test this claim. They have the new system installed temporarily and operate both systems for a period of time. If they ﬁnd a signiﬁcantly greater productivity from system B, they will switch. They give you the data to analyze and ask for your recommendation based on your fmdings. Below are your data:

System A System B

I11 = I12 =

x1 = 100 samples per hour x2 = 103 samples per hour s1= 7 samples per hour s2 = 9 samples per hour

a. What are the null and alternative hypotheses for your analysis? (5 Points)

b. At alpha=0.01, what are the rejection rules? (5 Points)

c. What is the test statistic? (5 Points)

d. What is the p-value‘? (5 Points)

What is your conclusion and recommendation to the lab? (5 Points)

11