

Psychology 310  
Practice Exam 2

Student Name: \_\_\_\_\_

**Instructions: Answer all questions** by circling the correct answer on the test paper. There is **no penalty for guessing**. If you believe that an item is incorrect, or has more than one correct answer, indicate your reasoning on the test paper with a brief note. This exam is open book, open note, and calculators may be used. Computers may not be used. **Official Time Limit: 120 minutes. Students may bring their papers to my office any time up to and including 1:30pm. You are free to work on the exam in the classroom or in your personal office. During this time, you are not allowed to discuss any aspect of the exam with any individual other than the course instructor or the course TA.**

- 1 Incorrectly accepting a false statistical null hypothesis is to commit
  - (a) a Type II Error
  - (b) a Beta Error
  - (c) a Type I Error
  - (d) a Gamma Error
  
- 2 Suppose you have a binomial process based on 9 trials, with probability of success equal to  $\frac{1}{3}$ . What is the probability of obtaining exactly 4 successes in this situation?
  - (a)  $\frac{448}{2187} = 0.20485$
  - (b)  $\frac{7744}{6561} = 1.1803$
  - (c)  $\frac{4160}{19683} = 0.21135$
  - (d) None of the above.
  
- 3 In Reject-Support testing, a Type II Error represents
  - (a) An incorrect positive in favor of the experimenter's theory
  - (b) An incorrect negative against the experimenter's theory
  - (c) A correct positive in favor of the experimenter's theory
  - (d) A correct negative against the experimenter's theory

4 Given the following probability distribution for the random variable  $X$

$x$	$P_X(x)$
1	.1
2	0.18
3	.2
4	.2
5	0.32

The variance of  $X$  is \_\_\_\_\_

- (a) 1.9484
  - (b) 2.0484
  - (c) 2.0332
  - (d) 1.8484
- 5 Suppose that the sex of a child is completely random, i.e., boys and girls occur in independent sequences with probability .50 each. What percentage of families with 5 children will have all 5 the same sex?
- (a) 6.25%
  - (b) 12.5%
  - (c) 5.0%
  - (d) 7.5%
- 6 You have a pegboard with a line of 9 holes. How many distinctly different sequences can you construct that have 5 black pegs and 4 white pegs?
- (a) 116
  - (b) 136
  - (c) 15120
  - (d) 126
- 7 Suppose that there is no such thing as being “on a hot streak” in basketball, i.e., when a player shoots, a binomial process is a good model for whether the player makes or misses a shot. Suppose that a player is “a 50% shooter,” that is, the player has a probability of success of .5. What is the probability that, if he takes 16 shots, he will make exactly 8?
- (a) 0.13747
  - (b) 0.19638
  - (c) 0.17674
  - (d) 0.1571

- 8 Suppose you play a game where you know your probability of winning is .8. You play the game with even odds, i.e., if you win, you make \$50, if you lose, you lose \$50. Suppose you play the game 10 times. Which of the following is closest to the probability you will win money, i.e., win *more than 5* of the games?
- (a) 0.96721
  - (b) 0.87913
  - (c) 0.79121
  - (d) 0.61539
- 9 You deal 5 cards without replacement from a shuffled poker deck. What is the probability that there will be exactly one ace, and that it will be drawn on card number 2?
- (a)  $5.9895 \times 10^{-2}$
  - (b) 0.94011
  - (c)  $6.2499 \times 10^{-2}$
  - (d)  $5.7399 \times 10^{-2}$
- 10 If a family has 3 children, what is the probability that they have exactly 2 girls?
- (a) 0.375
  - (b) 0.625
  - (c) 0.66667
  - (d) 0.33333
- 11 Samantha has 7 vases that she wishes to arrange on a shelf in her kitchen. How many different ways can she order the vases?
- (a) 5
  - (b) 5040
  - (c) 240
  - (d) 362880
- 12 Statistic  $A$  has a sampling variance of 58 and statistic  $B$  has a sampling variance of 86. The relative efficiency of  $A$  relative to  $B$  is
- (a) 2.1986
  - (b) 1.4828
  - (c) 0.67442
  - (d) None of the above answers are correct

- 13** The sampling distribution of the sample mean based on  $N$  independent observations
- (a) has a variance of  $\sigma^2/N$  for any population distribution
  - (b) is always exactly normal, for any sample size, when the population distribution is normal
  - (c) converges asymptotically to a normal distribution in shape under the conditions of the Central Limit Theorem
  - (d) All of the above answers are correct

- 14** Other factors remaining constant, which of the following factors would increase power?
- (a) Decrease sample size
  - (b) Increase  $\alpha$
  - (c) Increase  $\beta$
  - (d) Increase the error variance in the data

- 15** Suppose you somehow knew that the population standard deviation  $\sigma$  is 10, and that the population distribution is normal. You wish to test the null hypothesis that  $\mu = 0$ , using the 1-Sample Z-test of the form

$$Z = \frac{\bar{X} \cdot}{\sigma/\sqrt{N}}$$

What is the statistical power if  $\alpha = .05$ ,  $N = 34$ , and  $\mu = 4.0$

- (a) 0.58069
  - (b) 0.44521
  - (c) 0.69425
  - (d) 0.77425
  - (e) 0.51617
  - (f) 0.54521
  - (g) 0.64521
  - (h) 0.70973
- 16** Suppose you observe a sample of size 40 independent observations from a normal distribution, and obtain a sample mean of  $\bar{X} \cdot = 80.2$ . If the population standard deviation is  $\sigma = 21.0$ , then a 95% confidence interval for the population mean  $\mu$  has endpoints:
- (a) 74.738, 85.662
  - (b) 73.041, 87.359
  - (c) 39.041, 121.36
  - (d) 73.692, 86.708
  - (e) 76.880, 83.52

- 17 If  $E(X) = 4.0$ ,  $E(Y) = 2.0$ , and  $E(XY) = 12.0$ , then the covariance of the random variables  $X$  and  $Y$  is necessarily equal to
- (a) 0
  - (b) 4.0
  - (c) 6
  - (d) -4.0
  - (e) -2.0
- 18 If  $A = \{1, 2, 3, 4, 5\}$  and  $B = \{2, 5, 6\}$ , then  $A \cap B = ?$
- (a)  $\{2, 5\}$
  - (b)  $\{1, 3, 4\}$
  - (c)  $\{1, 2, 3, 4, 5, 6\}$
  - (d) None of the above
- 19 For any two events  $A$  and  $B$ , we can say that the probability of  $A \cup B$  is always \_\_\_\_\_
- (a) equal to  $\Pr(A) + \Pr(B) - \Pr(A \cap B)$
  - (b) less than  $\Pr(A \cap B)$
  - (c) less than  $\Pr(A - B)$
  - (d) equal to  $\Pr(A) + \Pr(B)$
- 20 There are 2,500,000 adult people in the large metropolitan area where you live. There is a serial killer on the loose who can be assumed to be a local adult resident, and otherwise all that is known about the serial killer is that (a) the killer has blonde hair, (b) the killer drives a red car, and (c) the killer likes to listen to Tiny Tim records. It is also known that, in the general population, the probability a person has blonde hair is .20, the probability that a person drives a red car is .05, and the probability that a person likes Tiny Tim records is .001. Assuming these behaviors are independent, the probability that a person has all 3 of these behaviors is .00001. Suppose you have just started dating someone, and they have blonde hair. They arrange to pick you up for your first date, and they drive up in a red sports car. The evening goes well, and you decide to go for a romantic drive by the lake. At that point, your date puts on a CD of "Tiptoe Through the Tulips," by Tiny Tim. Knowing probability as well as you do, you
- (a) run screaming to the woods, from where you call the police on your cell phone, since the probability is .99999 that your date is the killer
  - (b) conk your date on the head with your cell phone, realizing that it is very unlikely that anyone who is not the killer would have this combination of traits
  - (c) Ignore the evidence, since the odds are still about a million to one that your date is not the killer
  - (d) Stay relaxed but vigilant, knowing that the odds are still about 24 to 1 that your date is not the killer

- 21 New spark plugs have just been installed in a small airplane with a 4-cylinder engine. For each spark plug, the probability that it is defective and will fail during the first 20 minutes of flight is 0.0001. Assume that spark plugs fail independently of each other. What is the probability that *at least one* of the spark plugs will fail during the first 20 minutes of flight?
- (a) 0.0004
  - (b) 0.9996
  - (c)  $3.9994 \times 10^{-4}$
  - (d) 0.9999
- 22 In a recent election, 55.0% of the voters were Republican and 45.0% were not. Of the Republicans, 80.0% voted for Candidate X, and of the non-Republicans, 10.0% voted for Candidate X. Consider a randomly selected voter. What is the probability that the voter is Republican *and* voted for candidate X?
- (a) 0.45
  - (b) 0.44
  - (c) 0.8
  - (d) 0.7
- 23 Convergence to a normal sampling distribution occurs
- (a) faster when sampling from a highly skewed distribution than when sampling from a uniform distribution
  - (b) faster (i.e., at a smaller  $N$ ) when sampling from a uniform distribution than when sampling from a highly skewed distribution
  - (c) faster when sampling from a uniform distribution than when sampling from a normal distribution
  - (d) none of the above is correct
- 24 In the casino game of roulette, a gambler can bet on which of 38 numbers will be selected by the spin of a wheel. On a \$2 bet, the gambler gains \$70 for picking the correct number, but loses the \$2 otherwise. Let  $X$  be the amount won or lost on a roll. What is  $E(X)$ ?
- (a) -4.0
  - (b) -0.10526
  - (c) 34.0
  - (d) -0.02
  - (e) 3.7895

25 If the random variable  $X$  has an expected value of 100 and a variance of 49, then the random variable

$$Y = \frac{X-2}{7}$$

has a mean of \_\_\_\_\_ and a variance of \_\_\_\_\_

- (a) 14; 7
- (b) 98; 7
- (c) 98; 1
- (d) 14; 1

26 Suppose you wish to test the null hypothesis

$$H_0 : \mu = 100$$

against the alternative

$$H_1 : \mu \neq 100$$

What kind of test is this?

- (a) A 1-tailed test of a point hypothesis
- (b) A 2-tailed test of a regional hypothesis
- (c) A 2-tailed test of a point hypothesis
- (d) A 1-tailed test of a regional hypothesis

27 How many distinctly different subsets, *including the null set*, can be composed from 12 objects?

- (a) 479001600
- (b) 4096
- (c) 2048
- (d) 4095

28 Suppose an exam has 12 multiple choice items, and each has 4 alternatives. Suppose that a student who knows absolutely nothing about the course material guesses on all 12 items. On average, how many items would you expect the student to get right?

- (a) 4.0
- (b) 3.0
- (c) 9.0
- (d) 6.0

29 Given the following probability distribution for the random variable  $X$

$x$	$P_X(x)$
1	$a$
2	.1
3	.2
4	.15
5	0.4

The expected value of  $X$  is \_\_\_\_\_

- (a) 3.65
  - (b) 3.905
  - (c) 3.55
  - (d) 3.75
- 30 Suppose that the sex of a child is completely random, i.e., boys and girls occur in independent sequences with probability .50 each. What percentage of families with 5 children will have all 5 the same sex?
- (a) 5.0%
  - (b) 7.5%
  - (c) 12.5%
  - (d) 6.25%
- 31 You have a pegboard with a line of 13 holes. How many distinctly different sequences can you construct that have 3 black pegs and 10 white pegs?
- (a) 1716
  - (b) 286
  - (c) 276
  - (d) 296
- 32 Suppose that  $\sigma$  is known to be 15, and you gather data and construct a 95% confidence interval for  $\mu$ , using the standard technique. If this confidence interval ranges from 25 to 37.8, what would be the outcome of a hypothesis test, performed at the  $\alpha = .05$  significance level, of the statistical null hypothesis that  $\mu = 30$ ?
- (a) The hypothesis would be rejected if  $n$  is greater than 33, otherwise it would not be rejected
  - (b) Not enough information is provided to answer the question
  - (c) The null hypothesis would be rejected
  - (d) The null hypothesis would not be rejected

33 At 3am in the morning after the annual graduate student party (at which you consumed 5 beers, a jar of salsa, 8 ounces of potato chips, and 4 chocolate twinkies), you awaken with a splitting headache and stumble to the medicine cabinet in your dingy apartment. You grab four painkillers and gulp them down with a glass of water. You are about to head back to bed when you notice that your roommate has left a bottle of "rat-be-gone" tablets just to the left of the painkillers. (Your apartment has been overrun by rats recently, and your roommate decided to take action.) It suddenly hits you – you might have accidentally swallowed two rat-be-gone tablets!! Just then, you develop stomach cramps. You call the student hospital, but they put you on 30 minute hold. You don't own a car, and your roommate has not returned, so you realize there is no chance of obtaining help. At that point, you remember your outstanding Psych. 310 training, and your probabilistic thinking skills kick in. It is known that:

Since you reach with your right hand, the prior probability that you grabbed the painkiller bottle is .90.

The probability that you will have stomach cramps, given that you swallowed rat-be-gone, is .99. The probability that you will have stomach cramps given that you did not swallow rat-be-gone, is .50.

The probability that you will survive the night if you did indeed swallow rat-be-gone is .40. The probability that you will survive the night if you did not swallow rat-be-gone is .99999.

What is the probability that you will survive the night?

- (a) 0.87412
- (b) 0.34343
- (c) 0.43188
- (d) 0.48785