Midterm Exam 03

Psychology 310
Form 201311081

Instructions. Answer all items. There is no penalty for guessing. We have attempted to verify that each question has only one correct answer, and that answer is given. Errors are still possible, of course. Please put a note on your exam paper if you think there is an error or ambiguity.

Your Last Name_____ Your First Name _____

1. You have a group of 139 students, and you measure their ability to perform a certain cognitive task at the age of 9, then again at the age of 11. You wish to determine whether the proportion of students that can perform the task has changed. Use McNemar's Z-test to assess the null hypothesis that $p_1 = p_2$, where p_1 and p_2 are the population proportions of people who were able to perform the task on the two occasions. The data are summarized in a 2×2 table below:

		Time 1	
		Yes	No
Time 2	Yes	22	37
	No	60	20

The absolute value of the Z-statistic is

(a) 3.982
(b) 5.726
(c) 2.335
(d) 6.58
(e) 3.017
(f) 4
(g) 2.029

2. Suppose you perform 20 *independent* medical tests, each with a probability of a false positive equal to $\alpha = 0.05$. What is the probability that you commit *at least one* false positive?

(a) 0.6415
(b) 0.3585
(c) 0.7738
(d) 0.6613
(e) 0.7121

3. Let the universal set be $\Omega = \{1, 2, 3, 4, 5, 6\}$. Define $A = \{1, 2\}$, $B = \{3\}$. The set $W = \{4, 5, 6\}$ is equal to which of the following?

(a) $\overline{A \cup B}$
(b) $(\Omega - A) - B$
(c) $\Omega - (A \cup B)$
(d) Both (a) and (b) above are equal to W
(e) (a), (b), and (c) above all are equal to W

4. You are playing 7 card draw poker. What is the probability of drawing exactly 2 queens and exactly 2 aces (in any order) in a poker hand of 7 cards?

(a) 3.9295587e-08
(b) 1.9647794e-08
(c) 0.0035638193
(d) 0.00044461
(e) 5.0999999e-06

5. You have a pegboard with 8 holes in it. You have 4 red pegs and 4 blue pegs. How many distinctly different orderings of pegs in holes can you create?

   (a) 16

   (b) 70

   (c) 140

   (d) 210

   (e) 126

6. Given the following data for 6 subjects measured at two different times.

	Time 1	Time 2
1	20	20
2	33	13
3	17	17
4	21	18
5	22	20
6	26	21

   Perform the 2-sample correlated sample t-test for equal means. The t-statistic value is _____, the degrees of freedom are ___.

   (a) 1.827241; 5

   (b) 1.432681; 6

   (c) 0.709724; 5

   (d) 1.613743; 5

   (e) 4.680178; 5

   (f) 1.760432; 4

7. Imagine you are the Dean of Education at a large university, and you must select two professors out of a pool of ten candidates to represent the Education Faculty at a regional meeting. How many different teams of two candidates could you construct?

   (a) 90

   (b) 45

   (c) 55

   (d) 51

   (e) 44

8. You have 5 graduate students in your class. Each must make a presentation. How many distinctly different presentation orders are there?

   (a) 5
   (b) 15
   (c) 85
   (d) 20
   (e) 120

9. Suppose that a pro basketball player is *truly* a 51.1% foul shooter, that is, the true probability of success is $p = .511$ and that foul shots are just like random binomial trials. If this player shoots 32 foul shots in one game, what is the probability that the player will be successful on 28 or more attempts?

   (a) 1.40877e-05
   (b) 2.25752e-06
   (c) 0.0704002
   (d) 0.000669711
   (e) 1.63452e-05

10. Given the following probability distribution for the discrete random variable X

x	$\Pr(X = x)$
1	0.684
2	0.196
3	0.12

    Compute the expected value of X, i.e, $E(x)$

    (a) 1.508
    (b) 1.58
    (c) 1.292
    (d) 1.436
    (e) 1.149
    (f) 1.005

11. Given the same probability distribution as the preceding problem, what is the variance of X?

    (a) 0.5102
    (b) 0.4859
    (c) 0.92322
    (d) 0.58308
    (e) 0.38872
    (f) 0.34013
    (g) 0.45189

12. A and B are *independent* events. Suppose $\Pr(A) = 0.41$ and $\Pr B = 0.34$. Find $\Pr A \cup B$.

    (a) 0.75
    (b) 0.25
    (c) 0.373
    (d) 0.6106
    (e) 0.681

13. A binomial random variable with parameters $N = 69$ and $p = 0.130435$ has a mean of ___ and a variance of ___

    (a) 0.13; 0.002
    (b) 9; 7.326
    (c) 9.9; 9.47
    (d) 8.182; 6.468
    (e) 9; 15.652
    (f) None of the above is correct

14. *Simulation and/or Analytical.* You toss a fair coin until it comes up heads for the first time. The random variable X is the number of the toss on which the first head occurred. Find the total probability that X is an even integer, i.e., $2, 4, 6, \ldots$. Which of the following is closest to the correct answer?

    (a) 0.25
    (b) 0.781
    (c) 0.191
    (d) 0.666
    (e) 0.556
    (f) 0.819
    (g) 0.333

15. Suppose you run an opinion poll based on a random sample of size $n = 200$, asking potential voters whether they support a particular ballot initiative. If the true proportion of voters supporting the initiative is 0.5, and a binomial model is correct for the opinion poll, what is the probability that the sample proportion of voters will be within $\pm 5\%$ of the true population proportion? (*Hint.* Use the binomial distribution.)

    (a) 0.86263
    (b) 0.77637
    (c) 0.82104
    (d) 0.90577
    (e) 0.88851

16. Two different normally distributed populations A and B, both have standard deviations of 15 on attribute X. However, population A has a mean of 115, while population B has a mean of 100. If you randomly sample one individual from population A and one individual from population B, what is the probability that A will have a higher X score than B? (*Hint*: Think in terms of a simple linear combination that can answer your question, and draw on the fact that linear combinations of independent normal variables are normally distributed with a variance that can be computed easily from the information given.)

    (a) 0.64621
    (b) 0.76025
    (c) 0.79066
    (d) 0.38012
    (e) 0.50176
    (f) 0.56258

17. Suppose set A is a proper subset of set B. Define Ω as the universal set. Which of the following is *not* true?

    (a) $A \cup B = B$
    (b) $A - B = \emptyset$
    (c) $\overline{A} \cup \overline{B} = \overline{(A \cap B)}$
    (d) $A \cap B = B$
    (e) $\overline{(A - B)} = \Omega$

18. Suppose you give a final exam that consists of only 10 multiple choice items with 4 alternatives (a – d) each. Due to a glitch in the machine scoring algorithm, the correct key was replaced with a totally random key. Consequently, the probability of getting an item correct is 0.25 for each of the 10 items. If 50% is a passing grade, on average, what proportion of your students is expected to pass?

    (a) 0.10938
    (b) 0.09375
    (c) 0.07813
    (d) 0.22412
    (e) 0.0601
    (f) 0.25

19. You deal a bridge hand of 13 cards off the top of a poker deck. What is the probability that the cards are *all red*?

    (a) 8.189274e-06
    (b) 2.129211e-05
    (c) 1.80164e-05
    (d) 5.07735e-05
    (e) 3.603281e-05
    (f) 1.637855e-05

20. You have 7 green pegs, 4 red pegs, and 4 black pegs. How many different arrangements of pegs can you produce in a pegboard with 15 holes?

    (a) 6435
    (b) 1365
    (c) 450450
    (d) 900900
    (e) 5005