## Psychology 317 Final Exam

## March 17, 2009

### Instructions

1. Use a pencil, not a pen

2. Put your name on each page where indicated, and in addition, put your section on this page.

3. Exams will be due at 10:20!

4. If you find yourself having difficulty with some problem, go on to the rest of the problems, and return to the troublemaker if you have time at the end of the exam.

5. Leave your answers as reduced fractions or decimals to three decimal places or as many decimal places as you need for a meaningful answer.

6. **CIRCLE** **ALL** **ANSWERS:** **You** **will** **lose** **credit** **if** **an** **answer** **is** **not** **circled!!**

7. Check to make sure that you have all questions (see grading below)

**8.** **SHOW** **ALL** **YOUR** **WORK:** **An** **answer** **that** **appears** **from** **nowhere** **will** **receive** **no** **credit!!**

9. Don't Panic!

10. Good luck!

INFORMATION AND DEFINITIONS

A standard deck has 4 suits (Clubs, Diamonds, Hearts, Spades) with 13 cards per suit (Ace, 2-10, Jack, Queen, King).

### Grading

Problem Points Grader

1a-c 6 Tim

2a-c 14 Tim

3a-b 15 Zach

4a-d 20 Yu

5a-c 15 Andy

6a-c 30 Zach

TOTAL /100

1. For each function listed below please state whether the function *is* a probability distribution, is *not* a probability distribution, or whether there **isn't enough information** to classify it as a probability distribution or not. Provide justifications for your answers. (2 points apiece)

a) 

b) 

c) 

2. Here is a set of n = 8 scores drawn from a population.

 34, 44, 21, 34, 21, 103, 28, 21

a) What are the mean, median, mode, variance, and standard deviation of these scores? (5 points)

b) What are your estimates of the mean, variance, and standard deviation of the population from which these scores were drawn? What are your estimates of the variance and standard deviation of the sampling distribution from which the sample mean was drawn. (5 points)

c) What is the member of this set which, if removed, would maximally decrease the variance of the scores? Provide a brief justification for your answer. NOTE: You need not do any additional calculations. (4 points).

3. Fiona’s Fish ‘n Stuff sells only catfish (C), bass (B), salmon (S), and trout (T).

* Overall, 80% of Fiona’s fish are fresh (F) while the rest are frozen (Z).
* Overall, 4% of Fiona’s fish are catfish, 75% are salmon, and 6% are trout.
* Overall, 13.2% of Fiona’ fish are fresh bass.
* Half of all catfish are fresh.
* Considering **salmon and trout only**, fish type and fresh/frozen are independent.

a) Fill in the contingency table below. (12 points)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | C | B | S | T |  |
| F |  |  |  |  |  |
| Z |  |  |  |  |  |
|  |  |  |  |  |  |

b) Based on your contingency table, suppose that a random fish is selected from Fiona’s. Compute the following probabilities. (1 points apiece)

p(C|Z) =

p(Z|T) =

p(B|C)=4. The game of "Bongo" works as follows. On each trial you, the player, draw two cards from a 26-card deck that consists only of the diamonds and spades (i.e., no hearts or clubs). The cards are drawn *without replacement*. Each card is worth:

6 if the card’s suit is a diamond

8 if the card’s suit is a spade.

The number of points you get on the trial equals the value of the first card’s suit plus half the value of the second card’s suit (e.g., if you get a diamond then a spade you get 6+8/2 = 10). However, if the two cards are from the same suit then each is worth the full value of the card’s suit (getting two cards in the same suit is called "getting a Bongo").

a) Compute the probability distribution for the number of points per trial. Compute the expected value, variance, and standard deviation of this distribution. (HINT: Make a table of all possible combinations of first card/second card along with the probability and number of points associated with each such outcome). (9 points)

b) Is there a single mode of the distribution? If so, what is it? If not, why not? (1 points)

Question 4 continues on the next page 🖙Question 4 continues…

Use your probability distribution from Part (a) to compute the following:

c) Suppose that a person played 350 Bongo trials. Compute the expected frequency distribution of points. (4 points)

d) Suppose that you play 1000 Bongo trials. What are the mean and standard deviation of the number of Bongos you expect to get (remember a Bongo means both cards are of the same suit)? If B is the number of Bongos you get, what is the probability,

 p (481 < B ≤ 490)

(6 points)5. A "Kongamouse" is a large Australian rodent whose weights are normally distributed with a population mean,  = 10.000 kilograms, and a *variance*, 2, of 0.500.

a) Write the probability density function of Kongamouse weights (5 points)

b) Consider an interval that contains 70% of this distribution. If the lower bound of this interval is 9.500 kilograms, what is the upper bound? (6 points)

(HINT: Draw the distribution and the desired interval)

c) Suppose you measure Kongamouse weights in grams instead of kilograms(there are 1,000 grams in a kilogram). Rewrite your probability density function from Part (a) of Kongamouse weights, and recompute your answer to Part (b). (4 points)6. A Botanist is studying a desert cactus-like plant called a "Anakin". There are two kinds of Anakins: yellow Anakins and red Anakins. We are concerned with Anakin *heights*, measured in cm.

**It is known that the population mean height of yellow Anakin is Y = 20 cm.**

The population mean height of red Anakins is unknown. It is, however, known that all Anakin heights—both red and yellow Anakins—have a population standard deviation,  = 5 cm.

a) Suppose that you plan to collect a single random sample of n = 65 red Anakins. You plan to test the null hypothesis that red and yellow Anakins have the same mean height against the alternative hypothesis that, on the average, red Anakins are *shorter* than yellow Anakins. You plan to use the standard  level of 0.05. What will you use as a summary score and what would this summary score have to be such that you would reject the null hypothesis? (15 points)

b) Suppose that red Anakins are in fact an average of 1 cm. shorter than yellow Anakins. What is , and what is the power of the test in Part (a)? (5 points)

c) Suppose that the red Anakin sample mean turned out to be 18.2 cm. What is your best estimate of R the population mean height of red Anakins? Compute a **99%** confidence interval around this sample mean. (10 points)