Final for Statistics 113
Elements of Probability and Statistics - Fall 1999
Material Covered: Chapters 1–28 of Workbook and text
For: 15th December

This is a 2 hour final, worth 22% and marked out of 22 points. The total possible points awarded for each question is given in square brackets at the beginning of each question. Anything that can fit on two sides of an $8\frac{1}{2}$ by 11 inch piece of paper may be used as a reference during this final. A calculator and appropriate statistical tables may also be used. No other aids are permitted.

Name (please print): _____ . **ID Number:** _____.
last first

---

1. In a particular town with 25,000 households, a simple random sample of 500 households revealed 398 households had dogs.

(a) [1] Match the two columns below.

statistical terms	dog example
(i) population	**(i)** all households
(ii) sample	**(ii)** percentage of all households with dogs
(iii) statistic	**(iii)** dog or not of 500 households
(iv) parameter	**(iv)** percentage of 500 households with dogs
	(v) 500 households
	(vi) dog or not of 25,000 households

statistical terms	(i)	(ii)	(iii)	(iv)
dog example				

(b) [1] The percentage of households in the town with dogs

is estimated to be _____,

and the SE of the percentage is _____.

2. Random selection problems.

(a) [1] Thirty–two draws are made at random with replacement from the box

1	1	1	2	2	3

.

Circle none, one or more. (Yes: it is possible to circle more than one choice!)

(i) A histogram of the numbers drawn is bell shaped.

(ii) A probability histogram for the sum is bell shaped.

(iii) A probability histogram of the numbers drawn is skewed right.

(iv) A probability histogram for the average is bell shaped.

(v) A histogram for the product is positively skewed.

(b) [1] Given the following simulation table,

digit	1,4,7	2,5,8	3,6,9
represents	Bulldog	Pomeranian	Corgi

use the sixth row of the random numbers table, beginning at the first column, moving left to right, and list the first three types of dogs chosen. Circle one.

(i) Bulldog, Pomeranian, Corgi

(ii) Pomeranian, Bulldog, Corgi

(iii) Bulldog, Pomeranian, Pomeranian

(iv) Bulldog, Bulldog, Corgi

(v) Corgi, Bulldog, Pomeranian

---

3. A supposed randomized controlled experiment on mammography (x–ray screening for breast cancer) is conducted. Benefits are measured by comparing death rates in the treatment and control groups. Instead of following instructions, however, doctors assign high risk females to the screening group.

(a) [1] Because of this, the screening is made to look (circle one) **more** / **less** effective than it really was.

(b) [1] **True** / **False** A possible confounder is age of female.

4. One ticket is drawn at random from each of the two boxes shown below (two tickets, in total, are drawn):

(A) $\boxed{3}\ \boxed{6}\ \boxed{9}$

(B) $\boxed{2}\ \boxed{4}\ \boxed{6}\ \boxed{8}\ \boxed{10}$

(a) [1] One possible outcome is $(3, 2)$.

The other fourteen outcomes are: _____.

(b) [1] The chance the number drawn from A is

larger than the number drawn from B is _____.

(c) [1] The chance the number drawn from A is

smaller than the number drawn from B is _____.

---

5. For dog owners in Indiana in 1999, the relationship between education (years of schooling completed) and earned income can be summarized as follows:

average education ≈ 12 years,	SD ≈ 3.5 years	
average income $\approx \$31,000$	SD $\approx \$7,000$	$r \approx 0.65$

The scatter plot is football–shaped.

(a) [1] If earned income is the dependent variable, the regression line is (circle closest one)

(i) earned income $= 1300 \times$ education $+ 15400$

(ii) education $= 0.000325 \times$ earned income $+ 1.925$

(iii) earned income $= 0.000325 \times$ education $- 1.925$

(iv) education $= 1300 \times$ earned income $+ 15400$

(v) earned income $= 1300 \times$ education $- 15400$

(b) [1] **True** / **False** The regression effect/fallacy tells us that lower income dog owners seem to earn more than their level of education would indicate.

---

6. Try the following questions.

(a) [1] A list of numbers are given. Match the two columns below.

column I	column II
(i) SD of list is 0; this means	**(i)** there are no numbers on the list
(ii) r.m.s. of list is 0; this means	**(ii)** the numbers on the list must be zero
	(iii) all numbers on the list are the same
	(iv) the average of the list is 0
	(v) the product of the list is 0
	(vi) the sum of the list is 0

column I	(a)	(b)
column II		

[Hint: For example, the list, {0, 2, 5, 9}, has an average of 4.]

(b) [1] A personality test is administered to a large group of Scotch Terriers. Five scores are given below, in original units and in standard units.

original units	79	64	52	(b)
standard units	1.8	0.8	(a)	-1.4

Complete the following table.

(a)	(b)

7. In a random sample of 1000 dog–owners, 500 of them were found to have an income of at least \$25,000.

(a) [1] A few possible box models which could describe this problem are given below, where "1" represents "at least \$25,000" and "0" represents "at most \$25,000".

(A) model A

500 tickets 1	500 tickets 0

(B) model B

300 tickets 1	700 tickets 0

(C) model C

100 tickets 1	900 tickets 0

The box model which would seem to be the most appropriate model is (circle one) **A** / **B** / **C**. We (circle one) **are** / **are not** certain that this box model is the actual (true, population) box model.

(b) [1] A 95% CI of the percentage of dog–owners with at least \$25,000

is _____.

(c) [1] If, instead of 1000 dog owners, a random sample of size 10 had been chosen instead, the SE of the percentage would have (circle closest one)

(i) increased by a factor of 100

(ii) increased by a factor of 10.

(iii) remained the same.

(iv) decreased by a factor of 10.

(v) decreased by a factor of 100.

8. Doggy Chow Incorporated claims dog owners spend \$105 on dog food a month. A dog owners club claims the average is lower than \$105. Suppose, in a random sample of 31 dog owners, the sample average spent on dog food is \$102 and the sample SD is \$1.50.

(a) [1] The SE of the average amount spent on dog food

is equal to _____.

(b) [1] Using the normal tables, the chance that the average cost of dog food for 31 dog owners is less than \$105, assuming an average of \$105, is

$P =$ _____.

---

9. [1] Doggy Chow Incorporated claims dog owners spend \$105 on dog food a month. A dog owners club claims the average is lower than \$105. Suppose, in a random sample of 9 dog owners, the sample average spent on dog food is \$102 and the sample SD is \$3.50. The SE of the average is equal to (circle closest one)

(i) 1.167 **(ii)** 1.237 **(iii)** 1.513 **(iv)** 1.621 **(v)** 1.734

---

10. Consider the following data which is the result of an investigation of the relationship between the level of anxiety a person experiences and whether or not the person is a dog owner.

	dog owner	not a dog owner	subtotals
normal anxiety levels	100	101	201
reduced anxiety levels	103	53	153
subtotals	203	154	354

(a) [1] Under the hypothesis that anxiety and dog ownership is independent, complete the following table.

	dog owner	not a dog owner	subtotals
normal anxiety levels			201
reduced anxiety levels			153
subtotals	203	154	354

(b) [1] The observed χ^2 test statistic

is _____.

(c) [1] The data (circle one) **supports / does not support** the claim of independence between anxiety and dog ownership.

1. (a) vi,iii,iv,ii; (b) 0.796, 0.018
2. (a) ii,iv; (b) v
3. (a) less; (b) True
4. (a) (3,2), ..., (9,10); (b) $\frac{7}{15}$; (c) $\frac{7}{15}$
5. (a) i; (b) True
6. (a) ii,iii; (b) 0,25
7. (a) A, are not; (b) 0.5 ± 0.0316; (c) (ii)
8. (a) 0.629; (b) 0
9. i
10. (a) 115,87,88,67; (b) 9.69; (c) does not support