22S:30/105, Statistical Methods and Computing
Spring 2013, Instructor: Cowles
Midterm 1

Show your work on any problems that involve calculations.

Name: Solutions

Course no. (30, 105, or 197) _____

1. What is the data type of each of the following variables (circle one for each):

   (a) systolic blood pressure in women ages 65-74

   2
   i. Binary
   ii. Nominal
   iii. Ordinal
   iv. Discrete quantitative
   v. Continuous quantitative

   (b) the number of auto thefts in Wyoming in each year from 1901-2000

   i. Binary
   2 ii. Nominal
   iii. Ordinal
   iv. Discrete quantitative
   v. Continuous quantitative

   (c) the ratings of high school choirs in a statewide competition (superior, excellent, good, fair, poor)

   i. Binary
   ii. Nominal
   2 iii. Ordinal
   iv. Discrete quantitative
   v. Continuous quantitative

2. For each of the following variables, which shape would you expect its distribution to have? (circle one answer for each)

   (a) lengths of oak leaves

   2 i. roughly symmetric
   ii. right skewed
   iii. left skewed

   (b) the amount of money spent on clothing in 2012 by each woman in Iowa City

   i. roughly symmetric
   2 ii. right skewed
   iii. left skewed

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3. The respiratory rate in healthy dogs follows a normal density with mean 22 breaths per minute and standard deviation 6 breaths per minute.

The body temperature in healthy dogs follows a normal density with mean 101.5 degrees Fahrenheit and standard deviation 0.5 degrees F.

If my dog Donny has a respiratory rate of 12 breaths per minute and a body temperature of 100 degrees F, is he more unusual with regard to respiratory rate or temperature? Justify your answer with appropriate numeric calculations.

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$$z_{resp} = \frac{12-22}{6} = -1.67$$

$$z_{temp} = \frac{100-101.5}{0.5} = -3.0$$

He is more unusual in temperature.

4. A dataset on predictors of low birthweights in infants is included in the textbook Hosmer and Lemeshow (2000) *Applied Logistic Regression: Second Edition*. These data are copyrighted by John Wiley & Sons Inc. The observations in the dataset are mother-ifant pairs. Three of the variables are:

J

`bwt`	--	`birthweight of the infant in grams`
`age`	--	`age of the mother in years at time of giving birth`
`smoke`	--	`1 if the mother was a smoker; 0 otherwise`

Refer to the attached SAS output in answering the following questions about this dataset.

(a) Based on the scatterplot of **bwt** versus **age**, what is your best guess of the correlation between these two variables? (circle one)

2

i. -0.67
ii. -0.33
iii. 0.00
iv. 0.33
v. 0.67

$\frac{1}{2}$ for 0.33

(b) If **bwt** were measured in pounds instead of grams, would the sample correlation coefficient r between **bwt** and **age** change? Explain briefly.

2 No. The correlation coefficient has no units.

(c) On the scatterplot, circle any points that would be influential if we fit a linear regression model to these data.

2

(d) If **bwt** were measured in pounds instead of grams, would the value of the regression slope b change? Explain briefly.

2 Yes. The slope is the number of units change in the response variable that we would expect given a 1-unit change in the explanatory variable, so it depends on the units of both

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(e) What is the lowest birthweight in the group in which mothers were smokers (smoke = 1)? Give a numeric answer and explain how you got it.

2 pts $6.1 \times 10^2 = 610$ grams

(f) The distribution of birthweights in the group in which mothers were nonsmokers (smoke = 0) is (circle one):

i. roughly symmetric

ii. skewed right

2 iii. skewed left ← 1/2

iv. multimodal

v. no information is given in the SAS output to answer this

(g) Would the mean and standard deviation be good numeric summaries to report for the birthweight variable bwt in each of the groups defined by smoke = 0 and smoke = 1? (Yes or no; briefly explain your answer.)

2 Yes both are roughly symmetric, so mean and standard deviation are appropriate.

(h) In this dataset, are birthweights generally higher for nonsmoking mothers or smoking mothers? Justify your answer referring to SAS output.

2 higher for nonsmokers. The boxplots show that Q1, median, and Q3 are all higher in nonsmokers.

(i) Does the difference in birthweights between smoking and nonsmoking mothers mean that there is a correlation between mother's smoking status and infant's birthweight? (Yes or no; briefly explain your answer.)

2 No. It indicates association but not correlation. Smoking status is binary. Correlation requires that both variables are quantitative.

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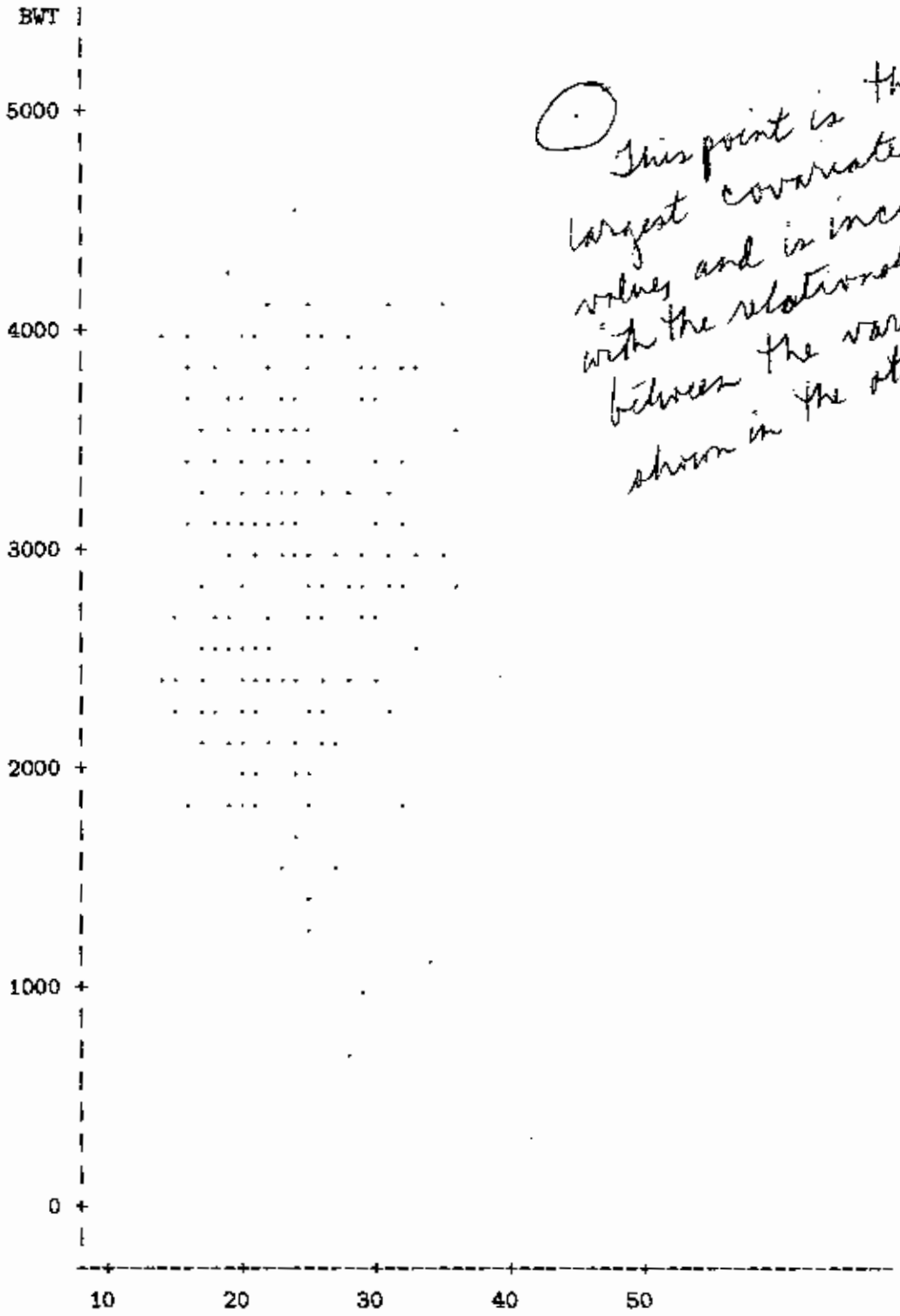
Plot of BWT*AGE. Symbol used is '.'.



This point is the largest covariate values and is inconsistent with the relationship between the variables shown in the other points.

SMOKE=0

Stem	Leaf	#	Boxplot
48	9	1	
46			
44	9	1	
42			
40	00551577	8	
38	0366814478	10	
36	011355037779	12	
34	0266789479	10	
32	002233377227	12	
30	6668990088	10	
28	144468822288	12	
26	24423558	8	
24	04450025	8	
22	4480258	7	
20	66809	5	
18	9037	4	
16	03	2	
14	799	3	
12	3	1	
10	2	1	

Multiply Stem.Leaf by 10**+2

SMOKE=1

Stem	Leaf	#	Boxplot
42	4	1	
40			
38	684	3	
36	344556	6	
34	347	3	
32	0602237	7	
30	03488935	8	
28	21265889	8	
26	066778	6	
24	11127770069	11	
22	12005788	8	
20	88239	5	
18	28334	5	
16	9	1	
14			
12			
10	4	1	
8			
6	1	1	0

Multiply Stem.Leaf by 10**+2

The UNIVARIATE Procedure
Variable: BWT

Schematic Plots