Math 220 : Elementary Statistics — Kane Nashimoto
Exam 2 - Ch. 3, 5, 6
Spring 2009 — Name : _____

Directions: This exam contains seven problems worth a total of 100 points. For each computational problem, you must first write the formula to be used and present all your subsequent work in order to receive full or partial credit. Circle your final answers.

1. At a college, the cumulative grade point averages (CGPAs) of all students can be best characterized as having a normal distribution with mean $\mu = 2.86$ and standard deviation $\sigma = 0.39$.

   (a) Suppose that you randomly select one student who is attending this college. What is the probability that his or her CGPA will be higher than 3.50? (8 pts.)

   (b) Only 15% of the students have CGPAs lower than x. Find the value of x. (8 pts.)

2. Featured below are numbers of men and women who possess the gene that can lead to a certain type of neurological disorder.

	Gene	
Gender	Present	Absent
Men	8	791
Women	23	1563

   (a) Compute the conditional percentages of the individuals who possess the gene for men and women separately. (8 pts.)

   (b) Based on the conditional percentages obtained in (a), describe the association between gender and presence of the gene. (6 pts.)

3. Of all the households in a city, 57% have at least one child, 34% have total household incomes of $70,000 or more, and 14% have at least one child and total incomes of $70,000 or more. Suppose that you randomly select one household from this city.

   (a) What is the probability that the selected household has a total income of $70,000 or more, given that it has at least one child? (6 pts.)

   (b) What is the probability that the selected household has at least one child, has a total income of $70,000 or more, or both? (6 pts.)

   (c) Are the events "selected household has at least one child" and "selected household has a total income of $70,000 or more" independent? Justify your answer. (8 pts.)

4. Suppose that you throw a ball into a basket from 10 feet away 15 times. For each throw, the probability that the ball will go into the basket is .70. Let X be the number of times the ball goes into the basket.

   (a) Compute the expected number of times the ball will go into the basket. (6 pts.)

   (b) Compute the probability that the ball will go into the basket 10 times or more. (6 pts.)

   (c) Compute the probability that the ball will go into the basket more than 6 times but less than 12 times. (6 pts.)

5. On a stretch of a highway, 14% of the cars travel more than 10 mph over the speed limit. If you observe five cars at random on this highway, what is the probability that at least one of them will be traveling more than 10 mph over the speed limit? Hint: Use complement. (6 pts.)

6. Shown below are scores on Exam #1 and Exam #2 for a sample of $n = 7$ students in a history class. Note that the scores have been standardized, that is, they are z-scores.

	Student						
Exam	1	2	3	4	5	6	7
#1 (x)	+0.76	−1.05	+1.02	−0.27	−0.79	+1.28	−0.96
#2 (y)	+0.85	−0.14	+0.27	−1.05	−1.21	+1.59	−0.31

   (a) Use your calculator to compute the Pearson correlation coefficient between X and Y and the regression equation for predicting Y from X. (8 pts.)

   (b) Notice, in (a) above, that the regression slope is equal to the correlation coefficient (i. e., $b = r$) and that the y-intercept is (approximately) zero. Briefly explain why this is the case using the formulae $b = r(s_y/s_x)$ and $a = \bar{y} - b\bar{x}$. (6 pts.)

7. For a sample of 20 college students, number of semesters completed was modeled as a function of age (in years) using a simple linear regression. Number of semesters completed ranged from 2 to 8 and age ranged from 19 and 22. The results of the analysis are presented on the following page.

   (a) Predict the number of semesters completed for a student who is 21 years old. (6 pts.)

   (b) Interpret the value of the coefficient of determination in the context of the problem. (6 pts.)

Figure 1. SPSS output for Problem 7.

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	Age[a]	.	Enter

a. All requested variables entered.

b. Dependent Variable: Semesters

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.516[a]	.266	.225	1.425

a. Predictors: (Constant), Age

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	13.255	1	13.255	6.528	.020[a]
	Residual	36.545	18	2.030		
	Total	49.800	19			

a. Predictors: (Constant), Age

b. Dependent Variable: Semesters

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-19.182	9.900		-1.938	.069
	Age	1.227	.480	.516	2.555	.020

a. Dependent Variable: Semesters