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Math 282 spring   2011 Exam 2   Name_____
15 problems, 10 points each As always SHOW WORK.

Use the following information for problems 1) and 2). Suppose it is desired to predict the weight of the human brain from a measurement of head size. The correlation $r = 0.8719$.

	variable	mean	standard deviation
Y	brain weight	1263.2	164.5
X	head size	15.174	0.8862

1) Find the slope of the least squares line.

$$b = r \frac{s_y}{s_x} = .9719 \frac{164.5}{0.8862} = \boxed{161.846}$$

-8 for $.9719 \frac{.8862}{164.5} = .00469$

2) Find the intercept of the least squares line.

$$a = \bar{Y} - b\bar{X} = 1263.2 - 161.846(15.174) = \boxed{-1192.651}$$

.give prop for $15.174 - .00469(1263.2) = 9.2445$

3) According to a 1992 survey in the magazine *Esquire*, out of 1000 students surveyed, 10% had committed a lewd act (such as had sex in public) in their school's library. What kind of sample was used to collect this data?

voluntary response sample

convenience −6

1

e   4) A beverage bottler must make sure that 12–ounce bottles actually contain 12 ounces of beverage. Suppose that the amount of beverage X that a bottling machine places in a bottle follows a highly skewed distribution with mean $\mu = 12.1$ ounces and standard deviation $\sigma = 0.2$ ounces. A simple random sample of 10 bottles from the bottling machine is tested. Find the probability that $\overline{X}$ is more than 12 ounces, if possible.

$$not\ possible$$

5) A beverage bottler must make sure that 12–ounce bottles actually contain 12 ounces of beverage. Suppose that the amount of beverage X that a bottling machine places in a bottle follows a normal distribution with mean $\mu = 12.1$ ounces and standard deviation $\sigma = 0.2$ ounces. A simple random sample of 10 bottles from the bottling machine is tested. Find the probability that $\overline{X}$ is more than 12 ounces, if possible.

$$\mu_{\overline{X}} = \mu = 12.1 \qquad \sigma_{\overline{X}} = \frac{\sigma}{\sqrt{n}} = \frac{0.2}{\sqrt{10}} = 0.0632$$

$$\frac{(12 - 12.1)}{.0632} = -1.58$$

$$-1.5 \Big| .0571$$

$$P(\overline{X} > -1.58) = 1 - .0571 = \boxed{.9429}$$

e   6) The probabilities for filing a petition for divorce in 1986 are shown below. What is the probability that the petition for divorce was filed jointly?

filed by	Wife	Husband	Jointly
probability	0.615	0.326	?

$$1 - .615 - .326 = \boxed{0.059}$$

predictor	coef	stdev	T	Pvalue
constant	-0.59	14.48	-0.04	0.968
assets	5.840	1.363	4.28	0.00045

7) It is desired to predict the total income of a bank from its total assets (in billions of dollars). The output above uses data from the 20 largest banks in 1973. Predict the income if assets = 7.5.

$$\hat{y} = a + bX = -0.59 + 5.84(7.5) = \boxed{43.21}$$

8) Using table B, line 105, draw a simple random sample (SRS) of size 3 from the following 9 people.
1 Carroll, 2 Collin, 3 Crawford, 4 Halverson, 5 Lawes, 6 McKeel 7 Stach, 8 Wayman, 9 Wenslow

$105: 9\ 5\ 59\ 2$

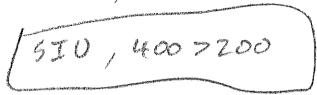$$\boxed{\text{Wenslow, Lawes, Collin} \\ \text{or Collin, Lawes, Wenslow}}$$

9) Suppose that X is the salary for a randomly selected actuary graduate. Assume that the mean $\mu = 50000$ and SD $\sigma = 10000$ (in dollars). Assume that the sample mean $\overline{X}$ is computed from a sample of size $n = 64$ and that the CLT holds. Find $P(\overline{X} \le 52250)$.

$$\mu_{\overline{X}} = \mu = 50000 \qquad \sigma_{\overline{X}} = \frac{\sigma}{\sqrt{n}} = \frac{10000}{\sqrt{64}} = 1250$$

$$Z = \frac{52250 - 50000}{1250} = 1.80$$

$$P(\overline{X} \le 52250) = \boxed{.9641}$$

$1 - .9641 = .0359$

3

10) Suppose a simple random sample of 200 University of Illinois students and a simple random sample of 400 SIU students SIU has about 2/3 of the number of students that the University of Illinois has. Which sample is more accurate (for determining the percentage of female students) or are the accuracies about the same? Explain.

SIU , 400 > 200

e   11) In a recent year, let A be the event vehicle sold was domestic (made in North America), B be the event that the vehicle was a light truck and C = "A and B" be the event that the vehicle was a domestic light truck. Then P(A) = 0.77, P(B) = 0.52, and P(A and B) = 0.44. Find P(A or B), the probability that the vehicle was domestic or a light truck.

$$= P(A) + P(B) - P(A \text{ and } B)$$
$$= .77 + .52 - .44 = \boxed{0.85}$$

12) Suppose P(A) = 0.10, P(B) = 0.45 and that A and B are disjoint. Find P(A and B).

0

13) Suppose that Al needs $200 to buy his girl friend a gift but Al only has $100 dollars. He decides to go to a casino and to try to win $100 by playing red and black on the roulette wheel. He plans to bet on red every time he plays and the probability that he wins is 18/38. If he wins, then he will get twice the money bet. In order to win $100, should Al bet all $100 on a single bet or place many $1 bets? Explain.

Bet all $100 on a single bet

b/ the law of large numbers   or ~2

14) A diagnostic test for AIDS has probability 0.005 of producing a false positive (incorrectly stating that a person who does not have the AIDS virus is in fact infected). Suppose that 100 people are tested for the AIDS virus and that the tests are independent. What is the probability that at least one false positive will occur?

$$P(none) = \frac{.995}{1st} \cdots \frac{.995}{100th} = (.995)^{100}$$

$$P(at\ least\ one) = 1 - P(none) = \boxed{1 - (.995)^{100} \approx .39}$$

$(.005)^{100} = P(all\ were\ false\ positives)$, $1 - (.005)^{100} = P(not\ all\ were\ false\ positives)$

15) Suppose P(A) = 0.4 and P(B) = 0.5 and P(A and B) = 0.2. Are A and B are independent? Explain.

Yes $P(A\ and\ B) = .2 = .4 \cdot .5 = P(A) \cdot P(B)$