Review for Exam 2

1. Ground level ozone is a health hazard because it may cause asthma and heart attacks, etc. The World Health Organization (WHO) recommends ozone levels of more than 51 ppb (parts per billion)[1]. In 2008, the US Environmental Protection Agency (EPA) recommended no more than 75 ppb; this is now under review until 2013.[2]

   In Dallas, Texas, the ozone level is reported daily.[3] Assume the values are normally distributed with mean 49 ppb and standard deviation 14 ppb.

   (a) What is the probability that the daily reading is above the WHO limit? The EPA limit? Before calculating, decide which probability will be larger.

   (b) How often is the weekly average above the WHO limit? Above the EPA limit? (Think of the seven weekly readings as random sample.)

[1] In fact, 100 μg/m3 8-hour mean http://whqlibdoc.who.int/hq/2006/WHO_SDE_PHE_OEH_06.02_eng.pdf, which converted to ppb gives about 51. http://ww2.unhabitat.org/wuf/2006/aqm/tool28.htm

[2] 2008 standard at http://www.epa.gov/glo/pdfs/fs20100106std.pdf;. Now suspended till 2013 http://www.economist.com/blogs/democracyinamerica/2011/09/sorry-air

[3] Texas Commission on the Environment http://www.tceq.state.tx.us/nav/data/ozone_data.html. Estimates of mean, SD from data.

(c) How often is the monthly average above the WHO limit? Above the EPA limit? (Take a 31-day month.)

(d) Estimate the Estimate the mean and standard deviation of a single year-long sample of daily readings.

(e) Consider the means of all year-long samples of daily readings. (Take a 365 day year.)

(i) What is the distribution of these means? Give the name of the distribution and its mean and standard deviation.

(ii) Using the "Rule of Thumb" for the normal distribution, find the range of values where the sample mean is likely to lie. (That is, 95% of the time).

2. The weights of figure skaters are normally distributed. For male skaters, the mean is 170 lbs with a standard deviation of 10 lbs. For female skaters, the mean is 110 lbs with a standard deviation of 5 lbs. Let X be the weight of a randomly selected male skater and Y be the weight of a randomly selected female skater.
   (a) What is $P(X < 150)$?
   (b) Approximately 90% of the male figure skaters weigh more than how many pounds?
   (c) The weight of a pair of figure skaters (a male and a female) can be thought of as a new random variable. Let the random variable $W = X + Y$. What is the mean of W?
   (d) Suppose we consider the weights of the male partner and the female partner to be independent. What is the standard deviation of the random variable W?
   (e) It does not seem likely that the weights of the male partner and the female partner would be independent. If the correlation r between X and Y equals 0.77, what is the standard deviation of the random variable W?

3. A politician is urging tighter restrictions on drivers' licenses issued to teens. He claims that "in one of every five auto accidents a teenager is behind the wheel."
   (a) If the politician is correct, what is the probability that you would find no teen drivers in a random sample of 5 accidents? One or more? All five?

   (b) You decide to do a little research and find 67 records of car accidents over the past few months. Only nine of the accidents had a teenager behind the wheel. Assume that we can consider these 67 accidents as a random sample of all accidents. If the politician is correct, what is the chance that you would observe 9 or fewer accidents with a teenager behind the wheel?
   (c) How would your answer change if you had observed a larger number of accidents with teen drivers out of the 67?
   (d) How would your answer change if you had observed 9 accidents with teen drivers out of a random sample of more than 67 accidents?

4. A New Zealand study on women's body image and ethnicity surveyed a group of women who were all slightly lighter than average. A question about what they thought about their own weight gave the following results.

	Body Image		
	Underweight	Right weight	Overweight
Asian	3	16	31
European	3	14	83

   Let A be the event that a randomly selected woman in the study is Asian, E that she is European, U that she thinks she is underweight, R that she thinks she is the right weight, and O that she thinks she is overweight. Using these letters, express the following probabilities and find the values:

   (a) The probability that a woman is Asian.
   (b) The probability that a woman thinks she is the right weight.
   (c) The probability of an Asian woman who thinks she is the right weight.
   (d) The probability that an Asian woman thinks she is overweight.
   (e) The probability that a European woman thinks she is overweight
   (f) The probability that a woman who thinks she is overweight is Asian.
   (g) Are ethnicity and body image independent?

5. The Department of Animal Regulations released information on pet ownership for the population consisting of all households in a particular county. Let the random variable X be the number of licensed dogs per household. The distribution for the random variable X is given below:

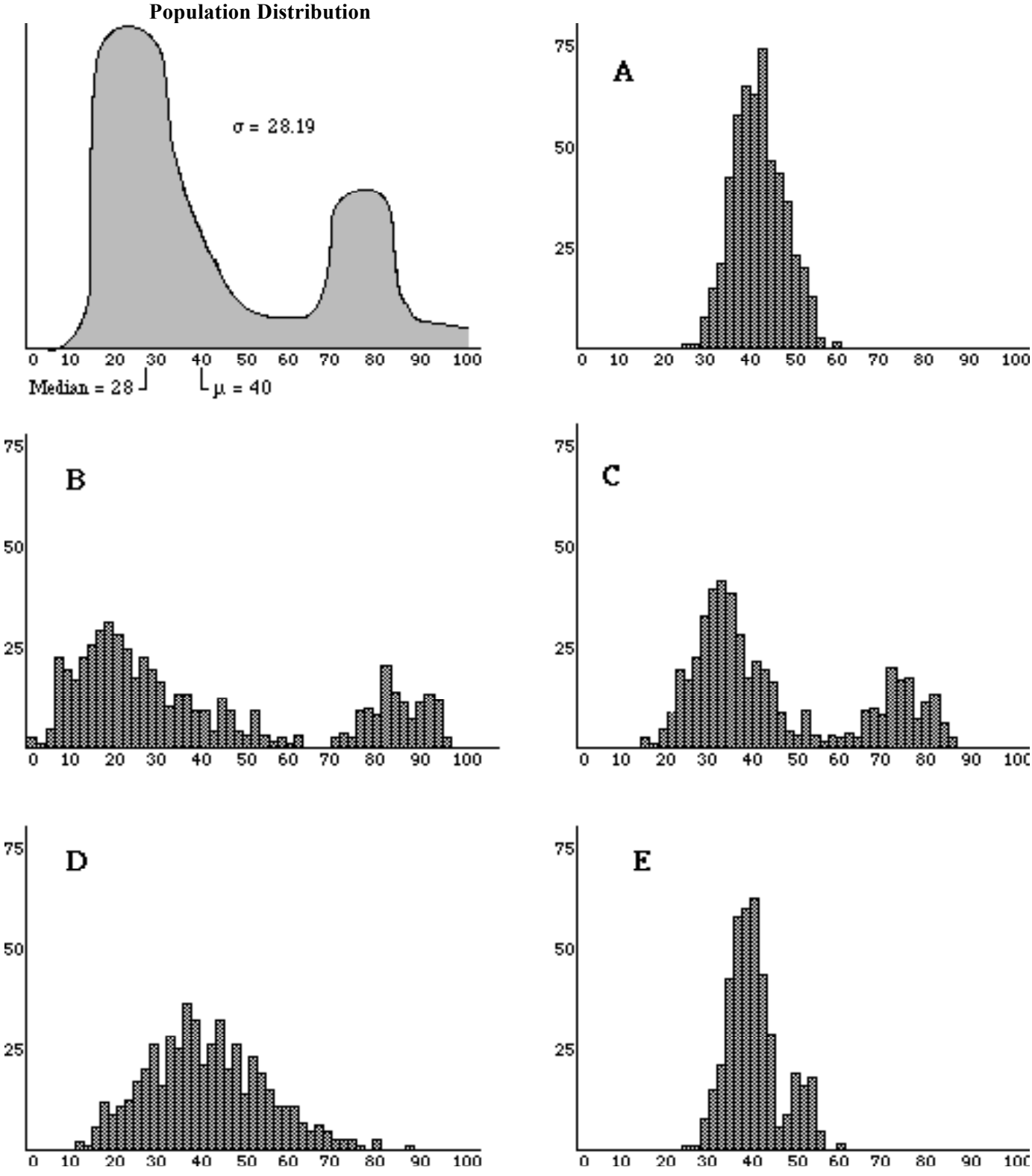
Value of X	0	1	2	3	4	5
Probability	0.52	0.22	0.13		0.03	0.01

   a. The probability for $X = 3$ is missing. What is it?
   b. What is the probability that a randomly selected household from this community owns at least one licensed dog?
   c. Find the cdf.

   d. What is the average number of licensed dogs per household in this county?

6. You take samples from a population containing 62% students. Find the means and standard errors for the proportion of students in samples of $n = 100$ and of $n = 400$. What do you observe?
   Mean is 62% for each sample.

7. The distribution for a population of test scores is displayed at the ***top left***. The other five graphs, A to E, represent possible distributions of sample means for random samples drawn from the population.



Which graph approximates the distribution of sample means for 500 samples of size **4**? (circle one)

A B C D E

The standard deviation of the sampling distribution you chose is (check one):

Smaller_____the same_____Larger_____

than the standard deviation of the population?

Which graph represents a distribution of sample means for 500 samples of size **25**? (circle one)

A B C D E

What do you expect for the shape of the sampling distribution you chose in?

- o Shaped more like a normal distribution.
- o Shaped more like the population.

The standard deviation of the sampling distribution for n = 4 is

Smaller_____the same_____ Larger_____

than the standard deviation of the sampling distribution you chose for n = 25?