AP Statistics Problem Set #3

**1)** My iPod has about 10,000 songs. The distribution of the play times for these songs is heavily skewed to the right with a mean of 225 seconds and a standard deviation of 60 seconds. Suppose you choose an SRS of 10 songs from this population and calculate the mean play time $\bar{x}$ of these songs. What are the mean and standard deviation of the sampling distribution of $\bar{x}$? Explain.

**2)** Suppose that the blood cholesterol level of all men aged 20 to 34 (I'm in that group) follows a normal distribution with mean $\mu$ = 188 milligrams per deciliter (mg/dl) and standard deviation $\sigma$ = 41 mg/dl.
(a) Choose an SRS of 100 men from this population. What is the sampling distribution of $\bar{x}$?
(b) Find the probability that $\bar{x}$ estimates $\mu$ within $\pm$3 mg/dl. (This is the probability that $\bar{x}$ takes a value between 185 and 191 mg/dl). Show your work.
(c) Choose an SRS of 1000 men from this population. Now what is the probability that $\bar{x}$ falls within $\pm$3 mg/dl of $\mu$? Show your work. In what sense is the larger sample "better"?

**3)** Asked what the central limit theorem says, a student replies, "As you take larger and larger samples from a population, the histogram of the sample values look more and more normal." Is the student correct? Explain your answer.

**4)** Refer to question (1) above:
(a) Explain why you cannot safely calculate the probability that the mean play time $\bar{x}$ is more than 4 minutes (240 seconds) for an SRS of 10 songs.
(b) Suppose we take an SRS of 36 songs instead. Explain how the central limit theorem allows us to find the probability that the mean play time is more than 240 seconds. Then calculate this probability. Show your work.

**Multiple Choice (questions 5 & 6)**

**5)** A newborn baby has extremely low birth weight (ELBW) if it weighs less than 1000 grams. A study of the health of such children in later years examined a random sample of 219 children. Their mean weight at birth was $\bar{x}$ = 810 grams. This sample mean is an *unbiased estimator* of the mean weight $\mu$ in the population of all ELBW babies, which means that
(a) in all possible samples of size 219 from this population, the mean of the values of $\bar{x}$ will equal 810.
(b) in all possible samples of size 219 from this population, the mean of the values of $\bar{x}$ will equal μ.
(c) as we take larger and larger samples from this population, $\bar{x}$ will get closer and closer to μ.
(d) in all possible samples of size 219 from this population, the values of $\bar{x}$ will have a distribution that is close to normal.
(e) the person measuring the children's weights does so without any systematic error.

**6)** The number of hours a light bulb burns before failing varies from bulb to bulb. The distribution of burnout times is strongly skewed to the right. The central limit theorem says
(a) as we look at more and more bulbs, their average burnout time gets even closer to the mean μ for all bulbs of this type.
(b) the average burnout time of a large number of bulbs has a distribution of the same shape (strongly skewed) as the population distribution.
(c) the average burnout time of a large number of bulbs has a distribution with similar shape but not as extreme (skewed, but not as strongly) as the population distribution.
(e) the average burnout time of a large number of bulbs has a distribution that is exactly normal.