**Topic 4: Sampling Distributions Exercises**

**Q1**

Given a normal distribution with *μ = 100* and *σ = 12*, if you select a sample of *n = 36*, what is the probability that  is

1. Less than 95?
2. Between 95 and 97.5?
3. Above 102.2?
4. There is a 65% chance that  is above what value?

**Q2**

The diameter of a brand of Ping-Pong balls is normally distributed, with a mean of 1.30 inches and a standard deviation of 0.05 inch. If you select a random sample of 25 Ping-Pong balls,

1. What is the sampling distribution of the mean?
2. What is the probability that the sample mean is less than 1.28 inches?
3. What is the probability that the sample mean is between 1.31 and 1.33 inches?
4. The probability is 60% that the sample mean will be between what two values, symmetrically distributed around the population mean?

**Q3**

Time spent using e-mail per session is normally distributed with= 8 minutes and = 2 minutes. If you select a random sample of 16 sessions,

1. What is the probability that the sample mean is between 7.8 and 8.2 minutes?
2. What is the probability that the sample mean is between 7.5 and 8 minutes?
3. If you select a random sample of 100 sessions, what is the probability that the sample means is between 7.8 and 8.2 minutes?
4. Explain the difference in the results of (a) and (c).

**Q4**

In a recent survey concerning the age (to the nearest year) and weight (to the nearest 10 lb) of first-year university students, the following probability distribution was obtained:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Age | Weight | | | | |
| 100 | 110 | 120 | 130 | 140 |
| 19 | 0.02 | 0.09 | 0.09 | 0.01 | 0.02 |
| 20 | 0.06 | 0.15 | α | 0.05 | 0.03 |
| 21 | 0.02 | 0.06 | 0.11 | 0.04 | 0.05 |

A sample of 36 first-year students is taken. Find the approximate chance that their total weight is at most 4350 lb.

**Q5**

At the CityU Computer Service Centre, the loading time for e-Portal page on Internet Explorer is normally distributed with mean 3 seconds.

A random sample of 5 computers is drawn. What is the chance that their total loading time is at least 15 seconds?

**Q6**

Suppose there is a population with population size N = 3. The variable of interest is the salary (X) of individuals. The values of X are 18, 20 and 22 (in thousand dollars).

1. Find the mean (μ) and standard deviation (σ) for the population distribution.

In the process of developing sampling distribution, all possible samples (taken with replacement) of size n = 2 are obtained. The sample mean () is considered as the sample statistic.

1. What are the possible values of this sample mean random variable? Develop the probability distribution of the sample mean.
2. Show that the sample statistic  is an unbiased estimator of μ.
3. Denote  the standard deviation of , verify the following relationship: .
4. Does the sampling distribution of  follows a Normal Distribution? Explain.

**Q7**

To investigate the length of time working for an employer, researchers at the CityU sampled 344 business students and asked them a question: Over the course of your lifetime, what is the maximum number of years you expect to work for any one employer? The resulting sample had sample mean =19.1 years and sample standard deviation s=6 years. Assume the sample of students was randomly selected from the 5800 undergraduate students in CityU.

1. What are reasonable estimators of population mean and population standard deviation?
2. What is the sampling distribution of ? Why?
3. If the population mean was 18.5 years, what is P(≥19.1 years)?
4. If the population mean was 19.5, what is P(=19.1 years)?
5. If P(≥19.1 years) = 0.5, what is the population mean?
6. If P(≥19.1 years) = 0.2, without calculation, can you tell that the population mean is greater or less than 19.1 years? Explain.