Sampling Distribution and Binomial Problems

Problem 1.

Repeated measurements of dust in the air in a coal mine are normally distributed with a mean of 123.917 mg and a standard deviation of 0.085 mg.

(a) What is the probability that a single measurement is larger than 124 mg?

(b) What is the probability that the mean of three measurements is larger than 124 mg?

(c) There is only a 1% chance that the mean of three sampled measurements will be larger than what value?

Problem 2.

The volume of beer actually contained in a 12 ounce bottle is normally distributed with a mean of 12.18 ounces and a standard deviation of 0.12 ounces.

(a) What is the probability that the volume of beer in a single bottle is less than 12 ounces?

(b) What is the probability that the mean volume in six bottles of beer is less than 12 ounces?

(c) A quality control worker wishes to find the volume V so that there is only a 2% chance that the mean volume of a sample of 24 bottles would be less than V. What is V?

Problem 3.

Of the nearly six million votes cast in the past election in Florida, 1.5% of all votes made on punch cards did not register a vote for president when counted by machine. A simple random sample of 600 Florida punch card ballots from this election is taken. Let X be the number of sampled ballots that do not register a vote for president.

(a) Explain why X may be modeled as a binomial random variable.

(b) Find the parameters n and p as well as the mean and standard deviation of the distribution of X.

(c) Use the normal approximation to the binomial distribution to find $P(X > 20)$.

Problem 4.

Children of one particular set of parents have a 25% chance of having type O blood. These parents have four children.

(a) What are the possible values of the number of children with type O blood?

(b) What is the probability that exactly two of the children have type O blood?

(c) What is the probability that at least two children have type O blood?

(d) What are the mean and standard deviation of the random variable that counts the number of children with type O blood?