It is generally estimated that nearsightedness affects about 12% of all children. A school district has registered 170 incoming children.

(a) Determine whether the conditions for applying the Central Limit Theorem are satisfied for modeling the sampling distribution of the proportion of the 170 children who are nearsighted.

(b) Find the probability that over 15% of this sample of 170 children is nearsighted.

**Solution**

In this problem we have: \( p = 0.12 \) and \( n = 170 \).

(a) Checking the conditions for applying the Central Limit Theorem:

(i) Is the sample random: There isn’t sufficient information to tell whether the 170 incoming children are random, or representative of the population of children. We will assume yes, but interpret the results with caution.

(ii) Is \( n < 10\% \): Yes, 170 would be less than 10\% of the population of all children.

(iii) Is it large enough: Yes, since \( np = 20.4 \) and \( n(1-p) = 149.6 \), both are > 10.

All the conditions have been checked. The randomness condition may not be met.

(b) According to the CLT, the sampling distribution follows the normal model

\( N(0.12, \sqrt{\frac{0.12(0.88)}{170}}) \).

The sketch shows the model, and the area we want to find.

Compute \( z \)-score:

\[
z = \frac{0.15 - 0.12}{0.025} = 1.2
\]

From the standard normal tables, the area up to \( z = 1.2 \) is 0.8849.

Thus, the shaded area = 1 − 0.8849 = 0.1151

Answer: The probability that over 15\% of this sample is nearsighted is 0.1151. We note again, the conditions for applying the CLT were not unambiguously satisfied.

**Grading:** Total points possible = 10.

1 pt - Any reasonable attempt.

4 pt for (a): 1pt = identify \( n \) and \( p \) correctly.

1pt each for correctly checking each of 3 conditions.

5 pt for (b): 1pt = sketch of model, showing what is to be computed.

1.5pt = correct normal model, with the right mean and SD.

1pt = compute correct \( z \)-score.

1.5pt = look up normal table correctly and get the required area.