HWA – Exam Question

Q5) Past study in a contaminated waterbody has revealed that the percentage contamination level of the surface water exceeding a critical value has been determined at 24.75%.

a) Based on a study of a random sample of 40 containers of the same size, it is observed that the sample percentage of contaminated containers is 21.65%. Does this indicate that some efforts have gone into cleaning of the waterbody?

$$P_o = 0.2475, \qquad p = \hat{P} = 0.2165, \qquad n = 40, \qquad P_o > \hat{P}$$

$$P_o - 1.654\sqrt{\frac{P_o(1-P_o)}{n}} = 0.2475 - 1.654\sqrt{\frac{0.2475(1-0.2475)}{40}} = 0.1353, \quad 0.1353 < \hat{P} < 1$$

Yes, it appears there was an effort made to clean the waterbody.

b) An independent organization conducted a similar parallel study and it revealed that the percentage contamination level was 22.78% based on a sample size of 25. Does this corroborate the decision reache in A?

$$P_o = 0.2475, \qquad p = \hat{P} = 0.2278, \qquad n = 25, \qquad P_o > \hat{P}$$

$$P_o - 1.654\sqrt{\frac{P_o(1-P_o)}{n}} = 0.2475 - 1.654\sqrt{\frac{0.2475(1-0.2475)}{25}} = 0.1055, \quad 0.1055 < \hat{P} < 1$$

Yes, it corrobates the decision in A.

c) Can you combine the two data sets and come up with a better understanding about the level of contamination of the water body?

$$n_a = 40, \qquad \hat{P}_a = 0.2165, \qquad n_b = 25, \qquad \hat{P}_b = 0.2278$$

$$\frac{n_a\hat{P}_a + n_b\hat{P}_b}{n_a + n_b} = \frac{40(0.2165) + 25(0.2278)}{40 + 25} = \frac{14.355}{65} = 0.2208, \qquad \text{approx. } 22.1\%$$