Deacon's Challenge No. 24 Answer

In a random sample of 100 pathology request cards, 36 were found to have an error associated with either their name or date of birth. What is the probability that more than 42% of pathology request cards have such errors?

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Examination of each request card has only two possible results – error or no error. This is an example of the binomial distribution. For a sample of 100 cards the possible total errors (*a*) are 0,1,2,3...100. The proportion of cards found with an error (*a*/*n*) will depend on the probability of an error occurring (*p*) i.e. *a*=*np*. If p is not known, then provided the number of cards examined (*n*) is reasonably large (>30) and *p* is not too close to zero or 1 then *a*/*n* approximates to *p*. The estimate a/n of the unknown probability, *p*, together with its standard error is given by:

$$\frac{a}{n} \pm \sqrt{\frac{a/n\,(1 - a/n)}{n}}$$

$$\text{Estimate of } p = \frac{a}{n} = \frac{36}{100} = 0.36$$

$$\text{Standard error of } p = \sqrt{(0.36 \times 0.64/100)} = \sqrt{0.00230} = 0.048$$

To find the probability of finding 42% errors ($a/n = 42/100 = 0.42$) calculate the *z* value in the usual way:

$$z = \frac{(a/n) - p}{\text{Standard error}} = \frac{0.42 - 0.36}{0.048} = \frac{0.06}{0.048} = 1.25$$

From tables of *z*, the probability of obtaining a *z* value greater (i.e. use one-tailed) than 1.25 (i.e. finding more than 42% cards with errors) is **0.11**. ■

Question No. 25

A centrifugal analyser is designed so that the light travels on a longitudinal path through the rotating cuvette (which has a constant cross-section C cm^2) rather than perpendicularly through the sides of the cuvette as is more usual. A solution of a light absorbing compound Y, volume d µL at a concentration of y mmol/L, is diluted with a volume D µL of an optically clear reagent.

Using the Beer-Lambert equation, prove that the absorbance of light through the diluted solution of Y is independent of the volume of diluent (D) when absorbance is measured longitudinally in this system.

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