Deacon's Challenge No. 13 Answer

Your on-call laboratory service uses 30 different methods, each of which has a 1% probability of failing QC criteria during the course of a night. Assuming that QC of any method is independent of that of the other methods, what is the probability that on any one night all methods will pass the QC criteria?

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The probability of a channel failing QC is 1% = 0.01

There are only two possible outcomes: pass or fail.

Therefore the probability of a channel passing QC is 1 - 0.01 = 0.99

This problem is analogous to flipping a coin. The joint probability of two independent events is the product of their individual probabilities.

Thus if a coin is tossed once the probability of 'heads' is 0.5. If the coin is tossed again then the probability of it landing 'heads' on both occasions is 0.5 x 0.5 = 0.25. Similarly if the probability of one channel passing QC is 0.99, then the probability of two channels passing is 0.99 x 0.99 = 0.98. The chance of three different channels passing is given by 0.99 x 0.99 x 0.99 = 0.97 i.e. $(0.99)^3$. The general rule is:

Probability of event occurring on n occasions = (probability of event occurring on a single occasion)^n

Therefore the probability of 30 channels passing QC = $(0.99)^{30}$ = 0.74

If your calculator does not have the facility to calculate x^y then the result can be easily calculated using logs:

$$\text{Log}_{10}(\text{probability of 30 channels passing}) = 30 \times \text{Log}_{10}\, 0.99$$

$$= 30 \times 0.00436 = -0.131$$

$$\text{Probability of 30 channels passing} = \text{antilog}(-0.131) = 0.74$$

Question No. 14

A 0.5 mL sample of urine is extracted into dichloromethane. An aliquot of the extract is analysed by HPLC and found to give an apparent original concentration of 320 nmol/L of analyte Y. 100 mL of Y standard with a concentration of 880 nmol/L is added to a further 0.5 mL sample of the same urine and the sample mixed. 0.5 mL of the mixed sample is then processed as before, giving a measured concentration of 405 nm/L. Calculate the recovery of analyte Y.

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