

## Confidence intervals

## IB HL Stats Option

1. A sample of 64 is taken from a population where the variance is known to be 25. The sample mean is calculated as 60.
  - a) Find a 90% confidence interval for the mean of the population.
  - b) Find a 95% confidence interval for the mean of the population.
  - c) Find a 98% confidence interval for the mean of the population.
2. A survey for an election noted that 350 out of 900 people stated they would vote for the Greens, and the remaining 650 people would vote for the Blues. Find an approximate 95% confidence limits for the proportion of the population that will vote for the Greens.
3. The amount of brain cells burnt off daily by IB students has been analysed in the past and it is known to follow a normal distribution with a variance of 14400.

The statistician who did the original testing has lost the mean. So she takes a random sample of 400 students worldwide and discovers that the average brain cells being burnt off daily of the sample is 138.

Calculate a 95% confidence interval to show for the mean number of brain cells being burnt off daily by IB students.

4. In a survey of 500 employees at Apricot computers it was found that 340 of them felt they were adequately paid.
  - a) Calculate an approximate 98% confidence interval to show the proportion,  $p$ , of all the Apricot workers who feel adequately paid.
  - b) Estimate the sample size required to produce a 98% confidence interval with a width of 0.15 for  $p$ .

5. Batteries in an E-Pod are known to follow an exponential density function with a mean probability of 4 thousand hours.
- Write down the variance of the density function, giving your answers in thousands of hours.
  - E-pod's manufacturers, Apricot, test the battery life of 100 E-pods. Find a 99% confidence interval for the mean life a battery under these tests.
  - Apricot wishes to produce figures that state they are 99% certain that all the batteries of their E-pods are between 3900 and 4100 hours. Calculate the value of the sample size required to provide this information.
  - Using your answer to c), do you believe that Apricot will be able to make the claim that they are 99% certain that all the batteries of there E-pods are between 3900 and 4100 hours?
6. A die is rolled until three fives are obtained. When the three fives have been obtained the game is over and the number of rolls recorded.
- Find a suitable model for this distribution and hence find the mean and variance of the distribution.
  - 50 samples of this distribution are recorded. Find a 90% confidence interval for the mean number of throws required per game.
7. A uniform continuous probability distribution is such that  $X \sim U(2, 10)$ .  
Thirty samples are taken from this distribution. Construct a 95% confidence interval for the mean of the samples.
8. Dandelions grow randomly on a large field, such that in any square metre the average number of dandelions is 6.4.

A bored mathematician on his holidays takes 40 samples, each of a metre square. State the probability distribution that this model follows, and hence find the 90% confidence interval for his sample mean.

## Answers

1. a)  $58.97 - 61.03$   
b)  $58.775 - 61.225$   
c)  $58.546 - 61.454$
2.  $0.357 - 0.421$
3.  $126.24 - 149.76$
4. a)  $0.631 - 0.729$   
b)  $n = 210$
5. a)  $\sigma^2 = 1.6 \times 10^7$   
b)  $2970 - 5030$   
c)  $n = 10650$   
d) The sample size is far too large to do a sample.
6. a) Negative binomial  $\mu = 18$   $\sigma^2 = 90$   
b)  $47.8 - 52.2$
7.  $5.17 - 6.83$
8.  $5.74 - 7.06$