AS Statistics Statements

Teachers Notes and Solutions

True? False? Or Sometimes True?

A – True

A normal distribution always has a bell shape. In reality it is often thinner and taller than the diagram shows but it must be symmetric and have the classical bell shape tailing off to infinity in both directions.

B – Sometimes

The probability of success can take any value between 0 and 1 as long as the probability of each event is the same and each event is independent. Therefore it can be 0.5 but it could also be 0.2 or 0.05 or 0.68

C – True

The standard error is an average of how far the mean values of samples lie away from the population mean. The standard error is standard deviation divided by the square root of the size of the sample

D – Sometimes

In a histogram it is the area of the bars that must be proportional to the frequency. Therefore in a histogram that has each class width the same the height would also be proportional but it would not be the case where the bar widths are unequal

E – True

Because of the amount of values in the tail the mean, which takes into account all the values, will be further into the tail. Therefore the median, which is the middle value, will be less.

F – Sometimes

This is true if events A and B are mutually exclusive such as throw a 3 on dice or throw a 6 on a dice but false if the events are not mutually exclusive. E.g. throw a six on a dice or throw an even number on a dice. For events that are not mutually exclusive the probability of event A or event B is P(A)+ P(B) – P(AB). For the example given the probability of a 3 or a 6 is $\frac{1}{6}+\frac{1}{6}=\frac{2}{6}$ and the probability of throwing a 6 or an even number is $\frac{1}{6}+\frac{3}{6}-\frac{1}{6}=\frac{3}{6}$

G – False

A normal distribution has 68% of the distribution within 1 standard deviation of the mean. Although this is only an approximation 50% is far too far wide of the mark and would invalidate any comparison with the normal distribution.

H – True

This is true because the distribution is symmetrical and therefore the mean and the median will be the same.

I – False

It is not the mean but the MEDIAN that is about 60g. Because this is a negatively skewed distribution the mean value will be less than the median.

J – False

The standard error is standard deviation divided by the square root of the size of the sample so it will decrease if the size of the sample increases. A bigger sample is unlikely to mean that there will be more variation, instead there is likely to be less.

K – Sometimes

The bars of a histogram can be of equal width but can also be of unequal width. It is the area of the bars that must be proportional to the frequency so the width and height can be varied to suit the situation. For example when looking at the ages of workers in a factory it may be best to look at groups of unequal width: aged 16 to 20, 21 to 30, 31 to 50, 50 to 65 and over 65.

L – False

A sampling distribution is the probability distribution that occurs with repeated sampling of the population, of a given statistic (e.g. the mean, a numerical quantity calculated from the data values in a sample).

M – False

How the sample is chosen is of paramount importance for it must be a random sample. For unbiased estimates the statistic used to estimate a population parameter is *unbiased* if the mean of the sampling distribution of the statistic is equal to the true value of the parameter being estimated, if random samples are not used then if is unlikely you would get an unbiased estimate even with a very large sample

N – False

A confidence interval does not give definite limits to where the mean must lie. It just gives an indication of how confident we can be that the mean lies between two points. In this case we are 95% confident that the mean lies between 60 and 70 but occasionally it will lie outside this range.

O – False

The diagram displayed weak NEGATIVE correlation

P – False

A double six is just one possible combination out of the 36 possible combinations so it is as equally likely as any other combination. Additional questions that could be asked here are "Is a total of 12 less likely than any other total? – Here the totals of 2 or 12 both have a probability of 1/36 while all other totals have a greater probability because they have more possible combinations making up the total: e.g. a total of 9 can be obtained by (3,6) (4,5) (5,4) (6,3) so probability of a total of 9 is 4/36 (1/9)