General Question Types

- Sampling distribution of a statistic:

  Three quarters of the members of a cycle club own more than one bike.
  A random sample of 10 members is taken from the club.
  The random variables X_i: $i = 1, 2, 3, \ldots, 10$ are defined as

  $$X_i = \begin{cases} 1 \text{ if the } i\text{th member owns more than one bike} \\ 0 \text{ if the } i\text{th member does not own more than one bike.} \end{cases}$$

  a) Write down the distribution for $\sum_{i=1}^{10} X_i$.

  b) Find $\mathrm{P}\left(\sum_{i=1}^{10} X_i \leq 7\right)$.

  c) Give the values of $\mathrm{E}\left(\sum_{i=1}^{10} X_i\right)$ and $\mathrm{Var}\left(\sum_{i=1}^{10} X_i\right)$.

> Binomial, E is np, Var is npq

- Sampling distribution of mean:

2. The contents of bottles of water are normally distributed with mean 600ml and standard deviation of 7.2ml.
   a. Give the distribution of the mean content of a random sample of 6 bottles. b. Find the probability that the meean content of a random sample of 6 bottle is less than 597ml.

- Central limit theorem:

3. X ~ Po(7). A random sample of 72 obseervations of X is taken.
   a. State the approximation distribution of the sample mean. b. Find the probability that the sample mean is greater than 6.5.

- Unbiased estimate of population mean:

4. Calculate unbiased estimates of mean and variance of the population the samples were drawn from:
   - n = 50; ∑x = 423; $\sum x^2$ = 4956

> On average, sample mean will give the true value of the population mean. Variance of sample tends to understimate the variance. s^2 = n/(n-1) * (biased estimator)

- Confidence interval of mean of normal distribution:

5. Give 90% confidence interval for the mean for samples with following summary statistics:
   a. n = 50, ∑x=357 and $\sum x^2$ = 12712