Hand your completed quiz in before the due date. Do not forget to write down your **name and student ID number**. Marks will be awarded for this quiz based on the clarity of your answers. The marker will pay close attention to the logic of your answers. **Please show all your working.**

Q.1 Consider the set of odd single-digit integers \{1, 3, 5, 7, 9\}.

(a) Make a list of all samples of size 2 that can be drawn from this set of integers. [Sample with replacement; that is, the first number is drawn, observed, and then returned to the sample set before the next drawing.]

(b) Construct the sampling distribution of sample means for samples of size 2 selected from this set.

Q.2 If a population has a standard deviation \(\sigma = 25\), what is the standard deviation for the mean if samples of size 16 are selected? Samples of size 36? Samples of size 100?

Q.3 Consider the set of integers \(A = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}\). We choose a sample of size \(n\) with replacement from the set \(A\) 1000 times, and compute the mean \(\bar{x}\) for each sample.

(a) Replace \(n\) with 1 in the following R-code. Check that you get a histogram for \(\bar{x}\) of sample size \(n = 1\).

**R-code**
```r
generate <- function(n, replace) { 
  sample(values, n, replace) 
}
```

(b) See what happens if you change \(n\) to 2, 3, and 10.

(c) Change the set \(A\) to the set \(B = \{1, 1, 1, 3, 4, 10, 10, 10, 10\}\) and do the same experiment. (Replace \(c(1, 2, 3, 4, 5, 6, 7, 8, 9, 10)\) with \(c(1, 1, 1, 3, 4, 10, 10, 10, 10)\).

Q.4 We pick 10000 samples, each of size \(n\), from the normal probability distribution with mean \(\mu\) and standard deviation \(\sigma\).

(a) Check that the following R-code constructs a frequency histogram for the sample means for \(n = 20\), \(\mu = 80\), and \(\sigma = 15\).

**R-code**
```r
b <- numeric(10000)
for (i in 1:10000) {b[i] <- mean(rnorm(20, 80, 15))}
hist(b, breaks=100)
```

(b) See what happens if \(n = 20\), \(\mu = 80\), and \(\sigma = 1\), and compare to part (a).

(c) Do the same experiment with \(n = 1000\), \(\mu = 80\), and \(\sigma = 15\), and compare to part (a).

Q.5 A certain population has a mean of 500 and a standard deviation of 30. Many samples of size 36 are randomly selected and the means calculated.

(a) What value would you expect to find for the mean of all these sample means?
(b) What value would you expect to find for the standard deviation of all these means?

(c) What shape would you expect the distribution of all these sample means to have?

Q.6 Consider a normal population with \( \mu = 43 \) and \( \sigma = 5.2 \). Calculate the z-score for an \( \bar{x} \) of 46.5 from a sample of size 16.

Q.7 A random sample of size 36 is to be selected from a normal population that has a mean \( \mu = 50 \) and a standard deviation \( \sigma = 10 \).

(a) Find the mean of this sampling distribution.

(b) Find the standard deviation of this sampling distribution.

(c) What is the probability that this sample mean will be between 45 and 55?

(d) What is the probability that the sample mean will have a value greater than 48?