# MATH5835M Statistical Computing
# Exercise Sheet 1

*This does not count towards your final mark, the questions are for self-study only.*

**Exercise 1.** Let $U \sim \mathcal{U}[0,1]$ and $X = U^4$.

a) Compute the exact value of $\mathbb{E}(X)$ analytically.

b) Compute an estimate for $\mathbb{E}(X)$ using Monte Carlo estimation.

**Exercise 2.** Let $X \sim \mathcal{N}(0,1)$ and consider estimating the probability $p = P\big(\sin(X) > 1/2\big)$ using a Monte Carlo estimate. How many Monte Carlo samples are required to get an estimate for $p$ which is correct to $n$ decimal places, for $n = 1, 2, 3, 4, 5, 6$? How long would it take to compute these estimates on your computer?

**Exercise 3.** Let $X, Y \sim \mathcal{N}(0,1)$. Compute a Monte Carlo estimate for $\mathbb{E}\big(\max(X,Y)\big)$ which has a relative error of less than 1%. (Hint: The R functions `pmax()` or `ifelse()` can be used to compute the maximum of $X_j$ and $Y_j$.)