

MP468C — Computational Physics 2 — Lab 04

1. Consider the integral

$$I = \int_0^2 e^{-x} \cos\left(\frac{x^3}{10}\right)$$

- (a) Compute this integral using Monte carlo integration with **uniform** sampling, using only  $N = 10^4$  points.  
Provide an estimate of your error.  
By repeating the calculation many times, obtain different estimates for  $I$ . Show a histogram of your different estimates. Explain whether/how this histogram is consistent with your error estimate.  
Please show (submit) formulae used.
- (b) Set up the integral for **importance** sampling. Compute the integral using random numbers generated by `numpy.random.exponential()`. Again, use only  $N = 10^4$  points.  
Provide an estimate of your error, and a histogram of different runs for your approximate  $I$ .  
Comment on the difference from uniform sampling.