

# IT461 Assignment 1: Generating random variables

- (1) Use simulation to approximate the following integrals. Compare with exact answers whenever answers are known
- a)  $\int_0^1 (1 - x^2)^{3/2} dx$
  - b)  $\int_0^\infty x(1 + x^2)^{-2} dx$

- (2) For the uniform random variables  $U_1, U_2, \dots$  define

$$N = \min\{n : \sum_{i=1}^n U_i > 1\}$$

Estimate  $\mathbb{E}(N)$  by generating 100, 1000 and 10000 values of  $N$ .

- (3) Give two algorithms to generate the random variable  $X$  such that  $P(X = 1) = 0.3, P(X = 2) = 0.2, P(X = 3) = 0.35, P(X = 4) = 0.15$ . Write code to implement these algorithms.
- (4) Write a program that generates a random variable having density

$$f(x) = 30(x^2 - 2x^3 + x^4) \quad 0 \leq x \leq 1$$

- (5) Write a program to simulate the first 10 time units of a non homogeneous Poisson process having intensity

$$\Lambda(t) = \begin{cases} \frac{t}{5} & 0 \leq t < 5 \\ 1 + 5(t - 5) & 5 \leq t \leq 10 \end{cases}$$

- (6) Write a program to generate a normal random variable with mean 0 and variance 1 using the polar method.