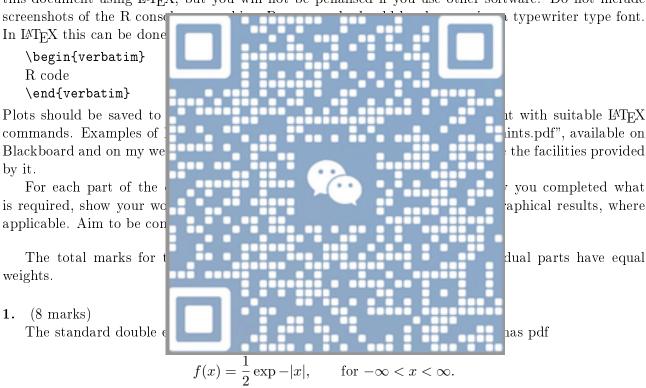
## MATH4/68091 Statistical Computing Coursework 1

## Deadline: 11:00am Monday 28 October 2024

Please submit via Blackboard. Late submissions may be penalised according to the Department's procedures. Note also that I do not have the authority to grant extensions to the deadline.

By submitting the coursework you declare that you are its sole author. In particular, you should not collaborate with your peers.

Your submitted solutions should all be in one "pdf" document. You are strongly advised to produce this document using LATEX, but you will not be penalised if you use other software. Do not include



- (a) Find the cdf of the standard double exponential distribution.
- (b) Describe in detail the steps of the inverse PIT (inverse cdf) method to obtain a random sample of size n from f(x).
- (c) Write an R function implementing your procedure from part (b) for generating random samples from f(x).
- (d) Run your function from part (c) to generate a random sample of size n = 5000 from f(x). Construct a histogram of the generated data, superimpose the pdf f(x) and comment on the goodness-of-fit.

## **2.** (12 marks)

Suppose that we want to simulate random data from the standard Normal distribution, N(0,1), whose pdf is given by

$$f(x) = \frac{1}{\sqrt{2\pi}}e^{-x^2/2}, \quad \text{for } -\infty < x < \infty.$$

It is proposed to develop a rejection sampling algorithm, where the proposal distribution is the standard double exponential distribution from Q1 with pdf

$$g(x) = \frac{1}{2}e^{-|x|}, \quad \text{for } -\infty < x < \infty.$$

(a) Define the constant K by

$$K = \sup_{x} \left( \frac{f(x)}{g(x)} \right).$$

Show that 
$$K = \sqrt{\frac{2e}{\pi}}$$
.

