

## STA 4102/5106: Homework Assignment #9

(Wednesday, November 12)

Due: Wednesday, November 19

1. Use importance sampling to estimate the quantity:

$$\theta = \int_0^{\infty} x \frac{e^{-(y-x)^2/2} e^{-3x}}{Z} dx$$

where  $Z = \int_0^{\infty} e^{-(y-x)^2/2} e^{-3x} dx$  and  $y = 0.5$ . Plot the convergence of your estimator versus the sample size. (Note: you can consider  $3e^{-3x}$  as the density for the importance sampling.)

2. Use the technique of importance sampling via tilted densities to estimate the quantity

$$\theta = \Pr\{X > a\}$$

where  $X$  is a standard normal random variable. Generate estimates for  $a = 1, 2, 3, 4, 5$ .

3. **(STA 5106 Students Only)** Write a matlab program to estimate the following moments of a random variable

$$f(x) = \frac{e^{-|x|^{3/4}}}{\int_{-\infty}^{\infty} e^{-|x|^{3/4}} dx}$$

You can use importance sampling (by choosing the standard normal distribution as the sampling distribution) for this estimation. Estimate:

(a) Mean:  $\mu = \int x f(x) dx$ .

(b) Variance:  $\sigma^2 = \int (x - \mu)^2 f(x) dx$ .

In each case, plot the convergence of the estimator.