ECE 595: Homework 1
Yi Qiao, Class ID
(Spring 2019)

Exercise 2

(a) For a guassian distribution:

$$
\begin{aligned}
E[x] &= \int_{-\infty}^{\infty} x \frac{1}{\sqrt{2\pi\sigma^2}} e^{-\frac{(x-\mu)^2}{2\sigma^2}} dx \\
&= \int_{-\infty}^{\infty} (x+\mu) \frac{1}{\sqrt{2\pi\sigma^2}} e^{-\frac{x^2}{2\sigma^2}} dx \\
&= \int_{-\infty}^{\infty} x \frac{1}{\sqrt{2\pi\sigma^2}} e^{-\frac{x^2}{2\sigma^2}} dx + \int_{-\infty}^{\infty} \mu \frac{1}{\sqrt{2\pi\sigma^2}} e^{-\frac{x^2}{2\sigma^2}} dx \\
&= 0 + \mu \frac{1}{\sqrt{2\pi\sigma^2}} \times \sigma\sqrt{2\pi} \\
&= \mu
\end{aligned}
\tag{1}
$$

$$
\begin{aligned}
Var[x] &= \int_{-\infty}^{\infty} (x-\mu)^2 \frac{1}{\sqrt{2\pi\sigma^2}} e^{-\frac{(x-\mu)^2}{2\sigma^2}} dx \\
&= \frac{1}{\sqrt{2\pi\sigma^2}} \int_{-\infty}^{\infty} x^2 e^{-\frac{x^2}{2\sigma^2}} dx \\
&\quad let \ y = \frac{x}{\sigma}, \ then \ dy = \frac{1}{\sigma} dx \\
&= \frac{\sigma^3}{\sqrt{2\pi\sigma^2}} \int_{-\infty}^{\infty} y^2 e^{-\frac{y^2}{2}} dy \\
&= \sigma^2
\end{aligned}
\tag{2}
$$

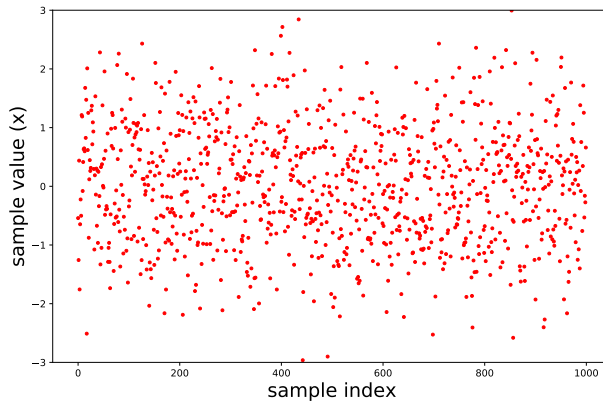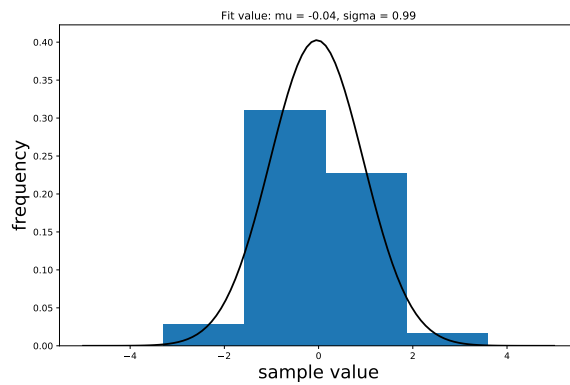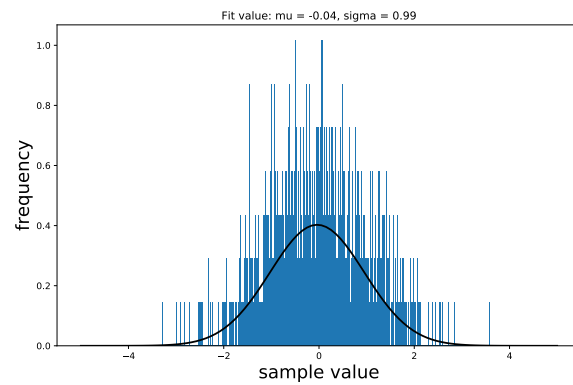**(b)** Data generated and plotted as follows.

Figure 1: Gussian random data.

(c)
(i)..(iv) plots shown below

(a) 4 bins

(b) 1000 bins

(v) TODO: fill this

Problem 2

Type your second problem here.

Problem 3

Type your third problem here.