1. (a) Since we are looking at a mixed distribution it is non-normal. It has a scew to it caused by the quotient which is still normal and the numerator which is also normal. That mixed distribution produces scew which isn't represented by a normal distribution well.

   (b)
   $$x = rnorm(5000, 50, 10)$$
   $$y = rnorm(5000, 20, 2)$$
   $$r = (x * y)/(x + y)$$

   (c)
   $$prob = length(r[14 < r \& r < 16])/length(r)$$
   $$prob =$$

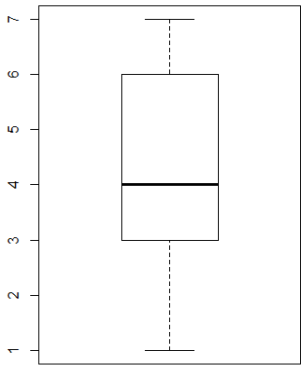
   (d)
   $$prob = .4652$$

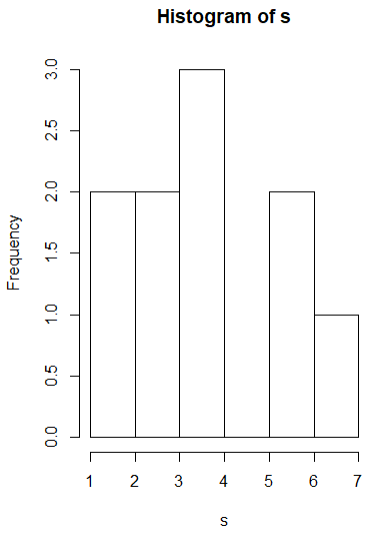
   (e)
   $$\bar{X} = 14.14264$$
   $$\hat{\sigma} = 1.321788$$

   (f)
   $$quantile(r, .025) = 11.53732$$
   $$quantile(r, .975) = 16.71033$$
   $$[11.53732, 16.71033]$$

2. I took one of my mood scales, in particular suicidal ideation rated on scale out of ten every day.
   s = c(4,3,4,6,4,7,3,2,1,6)

3. (a) Boxplot and Histogram





(b)

$$\begin{aligned} ssample &= matrix(rpois(50000, mean(s)), ncol = 10) \\ x &= apply(ssample, 1, sd) \\ bias &= mean(x) - sd(s) \\ bias &= .06025199 \end{aligned}$$

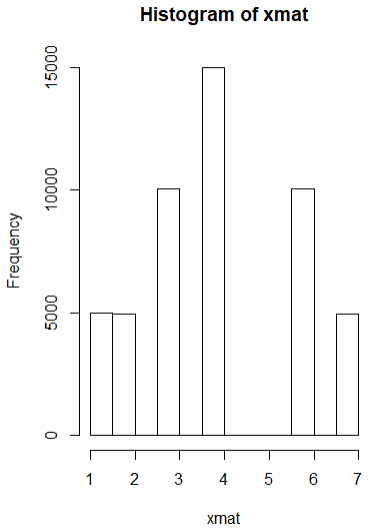
(c)

$$\begin{aligned} ssample &= matrix(rpois(50000, mean(s)), ncol = 10) \\ x &= apply(ssample, 1, mean) \\ bias &= mean(x) - mean(s) \\ bias &= -0.00754 \end{aligned}$$

(d)

$$\begin{aligned} quantile(x, .025) &= 2.8 \\ quantile(x, .975) &= 5.2025 \end{aligned}$$

4. (a) mean = 5.075086 sd = 5.37318



(b) quantile(xmat,.025) = 1.23879 quantile(xmat,.975) = 6.75321

5. (a) Take $\bar{X}$. Which may be consistent for μ but could be biased based on the underlying data. The real distribution could be really strange and our sample size is small so consistency doesn't matter a whole lot.