Data Analysis & Graphics Using R – Solutions to Exercises (March 21, 2004)

*Exercise 3*
Create a function that does the calculations of exercise 2.

```
> avfun <- function(m = 50, n = 25) {
+     for (i in 1:25) {
+         y <- rnorm(50)
+         av[i] <- mean(y)
+     }
+     sd(av)
+ }
```

It is of course interesting to run the function several times, and see how the value that is returned varies.

*Exercise 7*
The function `pexp(x, rate=r)` can be used to compute the probability that an exponential variable is less than `x`. Suppose the time between accidents at an intersection can be modeled by an exponential distribution with a rate of .05 per day. Find the probability that the next accident will occur during the next 3 weeks.

```
> pexp(21, 0.05)

[1] 0.6500623
```

*Exercise 8*
Use the function `rexp()` to simulate 100 exponential random numbers with rate .2. Obtain a density plot for the observations. Find the sample mean of the observations. Compare with the the population mean. (The mean for an exponential population is 1/rate.)

```
> z <- rexp(100, 0.2)
> plot(density(z, from = 0))
> mean(z)

[1] 4.828646
```

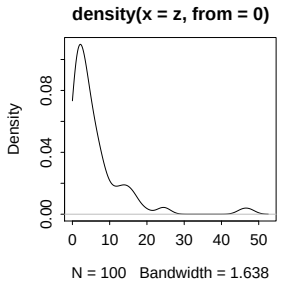


Figure 1: Density plot, for 100 random values from an exponential distribution with `rate` = 0.2

Compare `mean(z)` with $1/0.2 = 5$.

Notice the use of the parameter setting `from=0`, to prevent `density()` from giving a positive probability density estimate to negative values.

*Exercise 10*
The following data represent the total number of aberrant crypt foci (abnormal growths in the colon) observed in 7 rats that had been administered a single dose of the carcinogen azoxymethane and sacrificed after six weeks:

```
87 53 72 90 78 85 83
```

Enter these data and compute their sample mean and variance. Is the Poisson model appropriate for these data. To investigate how the sample variance and sample mean differ under the Poisson assumption, repeat the following simulation experiment several times:

```
x <- rpois(7, 78.3)
mean(x); var(x)
```

```
> y <- c(87, 53, 72, 90, 78, 85, 83)
> mean(y)

[1] 78.28571

> var(y)

[1] 159.9048
```

Then try

```
> x <- rpois(7, 78.3)
> mean(x)

[1] 82.57143

> var(x)

[1] 62.61905
```

It is unusual to get as big a difference between the mean and the variance as that observed for Ranjana Bird's data, making it doubtful that these data are from a Poisson distribution.