Name: ____________________________

Directions: MAKE SURE TO COPY YOUR ANSWERS TO A SEPARATE SHEET FOR SENDING ME AN ELECTRONIC COPY LATER.

1. Consider the coin/die game, p.83.

(a) (15) Find $Var(M)$.

(b) (15) Find $Var(W \mid M = 8)$.

2. Consider the bus ridership example once again, in this case in Sec. 3.16.

(a) (20) Find $P(T = 5)$.

(b) (15) Find $p_{B_1,T}(1, 3)$.

(c) (15) Find $Var(T)$. (You may find that some of the computation has already been done for you in the text.)

3. (20) Below is a revised version of the bus ridership simulation on p.26. It computes the same quantity, but in a somewhat more efficient manner. Fill in the blanks.

```
bussim <- function(nstops,nreps) {
   b <- sample(0:2, ________ ,  // blank (a)
      replace=TRUE,prob=c(0.5,0.4,0.1))
   b <- matrix(b,nrow=nreps)
   passeq0 <- vector(length=nreps)
   for (i in 1:nreps ) {
      passengers <- 0
      for (j in 1:nstops) {
         if (passengers > 0)
            passengers <- passengers -
               ________  // blank (b)
         passengers <- passengers +
            ________  // blank (c)
      }
      passeq0[i] <- ________  // blank (d)
   }
   mean(passeq0)
}
```

Solutions:

1a. M has a geometric distribution with p = 1/6, so $Var(M) = (1-1/6)/(1/6)^2$ from our section on that distribution.

1b. As noted in the example, give M = k, W has a binomial distribution with k trials and success probability 0.5. That distribution has variance $k \cdot 0.5(1-0.5)$, from our text section on that distribution.

2a. Ask the famous question, "How can it happen?" The only way is $B_1 = 1$ and $B_2 = 1$, which has probability 0.4^2 .

2b. We are being asked for $P(B_1 = 1 \text{ and } T = 3)$. Again, "How can it happen?" Here we must have $B_1 = 1$ and $B_2 = 0$, which has probability $0.4 \cdot 0.5$.

3.

```
}m <- function(nstops,nreps) {
   b <- sample(0:2,nreps*nstops,
      replace=TRUE,prob=c(0.5,0.4,0.1))
   b <- matrix(b,nrow=nreps)
   passeq0 <- vector(length=nreps)
   for (i in 1:nreps ) {
      passengers <- 0
      for (j in 1:nstops) {
         if (passengers > 0)
            passengers <-
               passengers - rbinom(1,passengers,0.2)
         passengers <- passengers + b[i,j]
      }
      passeq0[i] <- passengers == 0
   }
   mean(passeq0)
}
```