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 $\text{Var}(M)$.
   (b) (15) Find $\text{Var}(W | M = 8)$.

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 $\text{Var}(T)$. (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.

```r
bussim <- function(nstops, nreps) {
  b <- sample(0:2, 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 -
        passengers <- passengers +
    }
    passeq0[i] <-
  }
  mean(passeq0)
}
```
Solutions:

1a. M has a geometric distribution with \( p = 1/6 \), so \( \text{Var}(M) = \frac{(1 - 1/6)}{(1/6)^2} \) 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 0.4².

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 · 0.5.

3.

```r
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)
  paseq0 <- 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]
    }
    paseq0[i] <- passengers == 0
  }
  mean(paseq0)
}
```