Name: _____

Directions: **Work only on this sheet** (on both sides, if needed). MAKE SURE TO COPY YOUR ANSWERS TO A SEPARATE SHEET FOR SENDING ME AN ELECTRONIC COPY LATER.

1. This problem concerns the bus ridership example, which begins in Sec. 2.11 and is analyzed via simulation in Sec. 2.12.4.

(a) (25) Find $E(B_1)$.

(b) (20) Suppose the company charges \$3 for passengers who board at the first stop, but charges \$2 for those who join at the second stop. (The latter passengers get a possibly shorter ride, thus pay less.) So, the total revenue from the first two stops is $T = 3B_1 + 2B_2$. We want to find E(T), and the question is whether we can calculate it by first writing

$$E(T) = 3E(B_1) + 2E(B_2) \tag{1}$$

then using our answer from (a) above, and then reasoning that $E(B_2) = E(B_1)$. Which of the following is correct?

(i) The method proposed above is valid. (If you choose this answer, you must also state the numbers of the relevant "mailing tubes.")

(ii) The above method is invalid, because $E(B_2)$ is not necessarily equal to $E(B_1)$.

(iii) $E(B_2) = E(B_1)$, but the above method is invalid for other reasons.

(c), (d) (20) (Note that the following concerns both part (d) and part (d).) Suppose on p.24 we wish to add code to find $E(L_{10})$, not just $P(L_{10} == 0$ as we are already doing. We'll need to insert two new lines of code for this (not counting another **print()** call after line 17). State what these two lines are, for your answers to (c) and (d). Include a comment, saying *where* the insertions should be made. Example: If the code **x <– y + 3** should go between lines 8 and 9, write

```
x <- y + 3  # insert between lines 8 and 9
```

2. Twenty tickets are sold in a lottery, numbered 1 to 20, inclusive. Five tickets are drawn for prizes.

(a) (25) Find the probability that two of the five winning tickets are even-numbered. (You may call built-in R functions, e.g. **sqrt()** in your answer.)

(b) (10) Find the probability that two of the five winning tickets are in the range 1 to 5, two are in 6 to 10, and one is in 11 to 20. (You may call built-in R functions, e.g. **sqrt()** in your answer.)

Solutions:

1.a

$$E(B_1) = 0 \cdot P(B_1 = 0) + 1 \cdot P(B_1 = 1) + 2 \cdot P(B_1 = 2) = 0.4 + 2 \cdot 0.1 \tag{2}$$

1.b Answer (i) is correct, using (3.13) (taking $U = 3B_1$ and $V = 2B_2$) and then (3.14).

1.c,d

```
totl10 <- 0  # insert between 3 and 4
totl10 <- totl10 + passengers  # insert between 15 and 16
```

2.a

```
choose(10,2) * choose(10,3) / choose(20,5)
```

2.b

```
choose(5,2) * choose(5,2) * choose(10,1) / choose(20,5)
```