PSTAT 10 Worksheet 6

Due 7/10/24 at 11:59 pm

Problem 1: Estimating a binomial expectation

Let X be the r.v. that indicates the number heads after flipping a *biased* coin $n = 10$ times, where the probability of heads is $p = 0.3$.

1. In mathematical notation, write down the distribution of X. It should include the $\sim$ symbol.
2. Estimate the expectation of X through simulating 10,000 replications

Problem 2: Plotting the binomial pmf

Recall the pmf of a discrete r.v. X is given by

$$f(k) = \mathbb{P}(X = k)$$

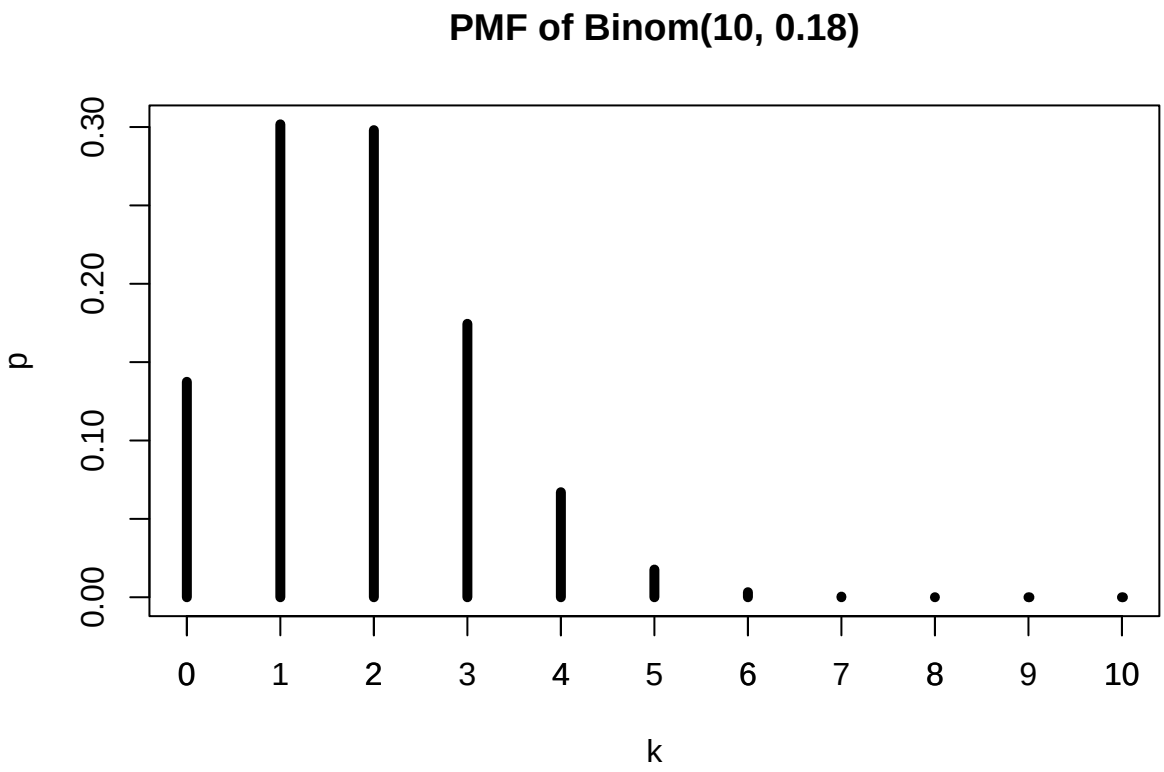
.

Just to reiterate the notation, f is a function of k, the outcome of a random experiment of which X is a numerical value (e.g. number of heads); f is the pmf of X.

The plot of a pmf gives a good idea of the "shape" of a distribution; it is often informative to look at the plot. Recreate the following plot of the pdf of $X \sim Binom(10, 0.18)$.

Hint: dbinom is vectorized. I used the parameters type = "h" and lwd = 5 in my plot.

```
plot(0:10, dbinom(0:10, size = 10, prob = 0.18),
     main = "PMF of Binom(10, 0.18)",
     ylab = "p", xlab = "k", type = "h", lwd = 5)
axis(side = 1, at = 0:10)
```



Problem 3: Rolls until 15

Roll a fair six-sided die 15 times. How many rolls did it take until the cumulative sum of scores equals or exceeds 15?

For example: I rolled

```
## [1] 2 6 3 1 2 6 4 6 6 4 6 2 3 2 5
```

After 5 rolls, my cumulative score is $2 + 6 + 3 + 1 + 2 = 14$. But after 6 rolls, my cumulative score is $14 + 6 = 20$. It took me 6 rolls for a score that equals or exceeds 15.

What is the expected number of rolls it takes for the score to equal or exceed 15? Estimate using 10,000 replications.

Hint: My solution uses the `cumsum` function along with `which`.