1. Exercise 3.4 in the text.

2. Exercise 3.8 in the text.

3. Exercise 3.34 in the text.

4. Exercise 4.5 in the text, and show your work.

5. Exercise 4.36 in the text.

6. Consider a probability distribution on the numbers $0, 1, 2, ..., 20$ with probabilities given by $P(k) = a(\frac{1}{2})^k$.

   a) Find a so that the sum of all probabilities is 1, and hence $P(k)$ is a legitimate formula for a probability distribution.

   b) Let X be a random variable with the above probability distribution. Calculate the expected value and the variance of X. Hint: It's not so nice to do this by hand. Here's a function in `R` for computing the expected value:

```
expected.value = function(){


a = 1

s = 0

for(k in 0:20){

s = s + k*a*((1/2)^k)

}

return(s)
```

```
}
```

All you need to do to use this is change the value of `a` from `a = 1` to what you got in part a), run this code in `R` and then run the command `expected.value()` to run the function. Here's another hint: you can modify this function to get the expected value of X^2 and then use the results to compute the variance of X.

c) Here is an `R` function to generate (pseudo-)random samples of size n from this distribution:

```
p_k = function(k){

a = 1
value = a*((1/2)^k)
return(value)

}

my.sample = function(n){
p = p_k(0:20)
s = sample.int(21, size = n, replace = TRUE, prob = p)-1
return(s)
}
```

To use this, first change the value of `a` in the $\texttt{p}_\texttt{k}$ function from `a = 1` to the value you got in part a). Then run the two functions in `R`. Finally,

to get a sample of size n from the distribution, run `my.sample(n)` or `samp = my.sample(n)` in order to store a sample of size n into the variable `samp`. Compute the sample mean and sample variance of a sample generated from `my.sample` using values of $n = 10, 50, 100, 500, 1000$ (remember you can use `R` functions `mean(samp)` and `var(samp)`). How do the values compare to the values you got in part b) for population mean and variance? Print all your results from the `R` console.