Midterm 2: Takehome

Problem 6

The lengths of a certain breed of cat are normally-distributed with mean 62 cm and standard deviation 5 cm.

(a) What is the probability that a randomly-selected cat is at least 60 cm long? Give both R code and output.

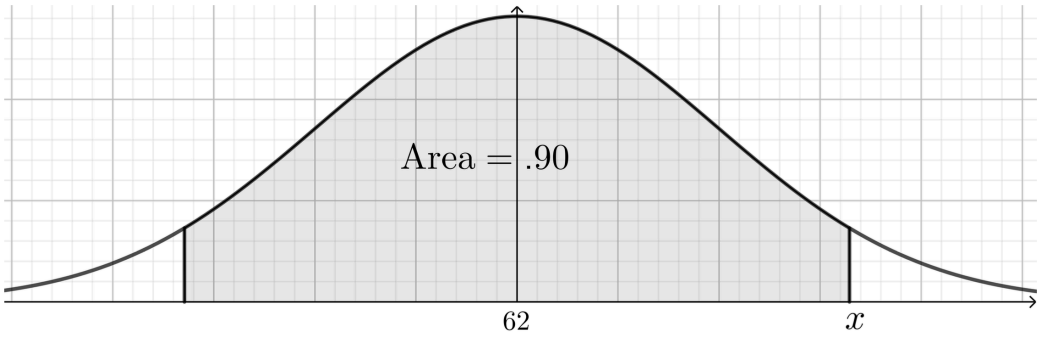
Answer:

```
1 - pnorm(60, 62, 5)
```

```
[1] 0.6554217
```

The probability of a randomly-selected cat is at least 60 cm long is about 66%.

(b) The graph below shows this distribution. Do not assume that it is drawn exactly to scale.



The shaded area is symmetric about the mean, has area 0.90, and ends at $\pm x$. What is x? Carefully explain your process.

Answer:

Essentially, we are trying to find the Z-Score corresponding with x. Therefore we need to use R's *qnorm* function.

However, the percentile given in $qnorm(x, \mu, \sigma)$ has to be everything to the left of x, which could be calculated so:

$$0.9 + \frac{1 - 0.9}{2} = 0.95$$

With knowing the area under the curve to the left of x, we can then find x using R:

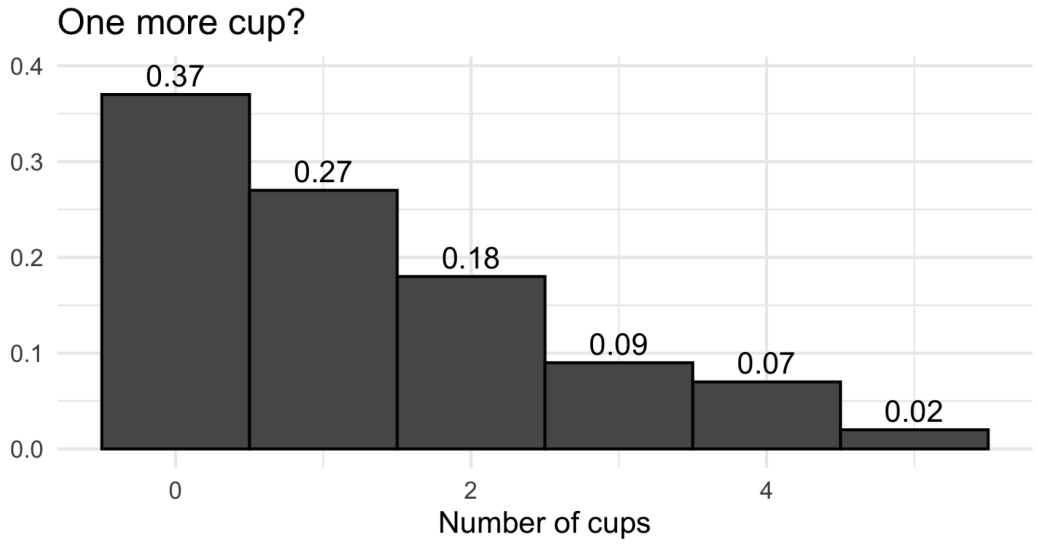
```
qnorm(0.95, 62, 5)
```

```
[1] 70.22427
```

which is about 70.2.

Problem 7

A study asks a random sample of Americans how many cups of co ee they drink on a typical weekday. The results are summarized in the following histogram, where the vertical axis represents proportions of respondents.



(a) What is the probability that a randomly-selected person drinks at least 2 cups of coffee per day?

Answer:

To find the probability of a random person drinking **at least** 2 cups is:

$$P(2) + P(3) + P(4) + P(5)$$

Which is:

$$0.18 + 0.09 + 0.07 + 0.02 = 0.36$$

So the probability is 36%.

(b) Let X be a random variable representing the number of cups reported by a randomly-selected individual in the sample. Use R to compute the expected value of X. Include all code used, making sure that your work is clear.

Answer:

```
no_cups <- c(0,1,2,3,4,5)
p_cups <- c(0.37,0.27,0.18,0.09,0.07,0.02)

m <- sum(p_cups * no_cups)

m
```

```
[1] 1.28
```

Therefore, the expected value of X is 1.28

(c) Use R to compute the variance and standard deviation of X. Include all code used, making sure that your work is clear.

Answer:

```
no_cups <- c(0,1,2,3,4,5)
p_cups <- c(0.37,0.27,0.18,0.09,0.07,0.02)

m <- sum(p_cups * no_cups)

variance <- sum((no_cups - m) ^ 2 * p_cups)
variance
```

```
[1] 1.7816
```

The variance of X is about 1.78.

```
no_cups <- c(0,1,2,3,4,5)
p_cups <- c(0.37,0.27,0.18,0.09,0.07,0.02)

m <- sum(p_cups * no_cups)

std <- sqrt(sum((no_cups - m) ^ 2 * p_cups))
std
```

```
[1] 1.334766
```

The standard deviation of X is about 1.33.