1   Lesson 15 Example 3

In Major League Baseball's Home Run Derby, each contestant is allowed to keep swinging the bat until they have made 10 "outs". (An "out" is anything that is not a home run.) If Barry Bonds has a 70% chance of hitting a home run on any given swing, what is the probability that he hits at least 10 home runs before his turn is up?

2   Answer

2.1   Calculation and Code

This problem can be modeled using the negative binomial distribution, which models the number of successes (home runs) before a fixed number of failures (outs). In this case:

- $r = 10$ is the number of failures (outs),

- $p = 0.7$ is the probability of success (hitting a home run),

- We want to find the probability that Barry hits at least 10 home runs before making 10 outs.

Using the probability mass function (PMF) of the negative binomial distribution, we can sum the probabilities for hitting fewer than 10 home runs (from $k = 10$ to $k = 19$) and subtract this from 1.

The Symbulate code for this is as follows:

```
from symbulate import *

# Negative binomial distribution parameters
r = 10   # Number of outs
p = 0.7   # Probability of hitting a home run

# Probability of hitting at least 10 home runs before 10 outs
prob = 1 - sum(NegativeBinomial(r=10, p=0.7).pmf(range(10, 20)))

# Display the result
print(prob)
```

2.2   Result

Using this code, we calculate the probability that Barry Bonds hits at least 10 home runs before making 10 outs to be approximately 0.03255, or 3.255%.