1   Lesson 15 Additional Exercise 2

Your coach tells you that you cannot leave basketball practice until you have made at least 20 free throws. If you free throw probability is 80%, find the probability that you are out of practice after taking an even amount of free throws.

2   Answer

This problem can be modeled using the negative binomial distribution, where:

- $r = 20$ is the number of successful free throws (successes),

- $p = 0.8$ is the probability of making a successful free throw (success),

- We are interested in the probability that the total number of attempts X is even.

The number of attempts follows a negative binomial distribution, and we want to calculate the probability that X (the total number of attempts) is an even number.

2.1   Code

We sum the probabilities for all even values of X (e.g., 20, 22, ...) and divide this by the total probability of making 20 successful free throws. Note that 100 is an arbitrary number, however after this amount of attempts, the probabilities get infinitesimally small

The Symbulate code to solve this is:

```
# Negative binomial distribution parameters
r = 20   # Number of successful free throws
p = 0.8   # Probability of making a free throw

#Probability of leaving practice after an even number of attempts
even_attempts = sum(NegativeBinomial(r=20, p=0.8).pmf(range(20, 100, 2)))

#Total probability of making 20 successful free throws
total_probability = sum(NegativeBinomial(r=20, p=0.8).pmf(range(20, 100)))

# Probability that you leave practice after an even number of attempts
prob_even_attempts = even_attempts / total_probability

# Display the result
print(prob_even_attempts)
```

2.2   Conclusion

By using the Symbulate code above, we compute the probability that you leave practice after making 20 free throws on an even number of attempts to be about 0.50015