1. Marie gives away children toys

Problem 1. Marie gives away children toys

7/7 points (graded)

Marie distributes toys for toddlers. She makes visits to households and gives away one toy only on visits for which the door is answered **and** a toddler is in residence. On any visit, the probability of the door being answered is $3/4$, and the probability that there is a toddler in residence is $1/3$. Assume that the events “Door answered" and “Toddler in residence" are independent and also that events related to different households are independent.

1. What is the probability that she has not distributed any toys by the end of her second visit?

0.5625 ✔ **Answer:** 9/16

2. What is the probability that she gives away the first toy on her fourth visit?

0.10546875 ✔ **Answer:** 27/256

3. Given that she has given away her second toy on her fifth visit, what is the conditional probability that she will give away her third toy on her eighth visit?

0.140625 ✔ **Answer:** 9/64

4. What is the probability that she will give away the second toy on her fourth visit?

0.10546875 ✔ **Answer:** 27/256

5. Given that she has not given away her second toy by her third visit, what is the conditional probability that she will give away her second toy on her fifth visit?

0.125 ✔ **Answer:** 1/8

6. We will say that Marie “needs a new supply"" immediately **after** the visit on which she gives away her last toy. If she starts out with three toys, what is the probability that she completes at least five visits before she needs a new supply?

0.953125 ✔ **Answer:** 243/256

7. If she starts out with exactly six toys, what is the expected value of the number of houses with toddlers that Marie visits without leaving any toys (because the door was not answered) before she needs a new supply?

2 ✔ **Answer:** 2

Solution:

A successful (i.e., the door is answered, and a toddler is present in the residence) visit (“trial//) occurs with probability $p = \frac{3}{4} \cdot \frac{1}{3} = \frac{1}{4}$.

1. This is the probability that the first two trials were failures, which happens with probability

$$(1-p)(1-p) = \frac{3}{4} \cdot \frac{3}{4} = \frac{9}{16}.$$

2.