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$$1\left(\frac{1}{6}\right) + 2\left(\frac{1}{6}\right) + 3\left(\frac{1}{6}\right) + 4\left(\frac{1}{6}\right) + 5\left(\frac{1}{6}\right) + 6\left(\frac{1}{6}\right) = \frac{21}{6} = 3.5$$

Expected Value

If the possible outcomes for some experiment are a_1, a_2, \dots, a_n , and if the probabilities of these outcomes are p_1, p_2, \dots, p_n , then the expected value is

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Example: Suppose Charley goes to 2 movies 10% of all weekends, he goes to 1 movie 40% of the time, and he goes to no movies 50% of the time. What is the expected value for the number of movies he goes to during a weekend?

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Solution: $E = 0(.50) + 1(.40) + 2(.10) = .6$

Important fact about independent trials

When n independent trials are conducted of an experiment where p is the probability of success on each trial, then the expected value for the number of successes in the n trials is

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$$E = np$$

Example: You throw 5 darts at a target. Each throw has a 45% probability of hitting the target. What is the expected value for the number of hits?

Solution: $n = 5$, $p = .45$ $E = np = 5 \times .45 = 2.25$

Shooting free throws

Mark is a 70% free throw shooter. If he goes to the foul line to shoot a “one-and-one”,

- (a) what is the expected number of points he will score?
- (b) what is the expected number of shots he will take?

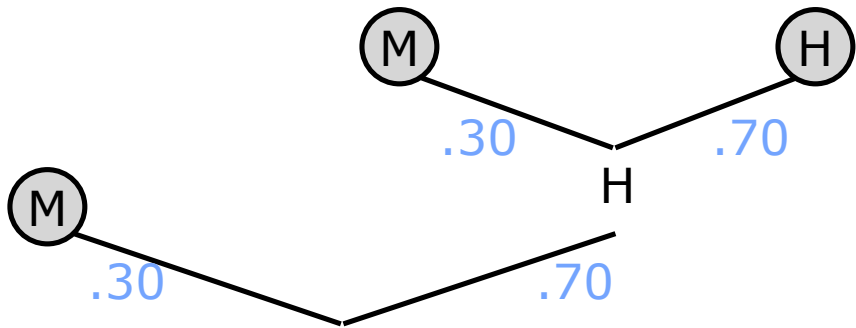
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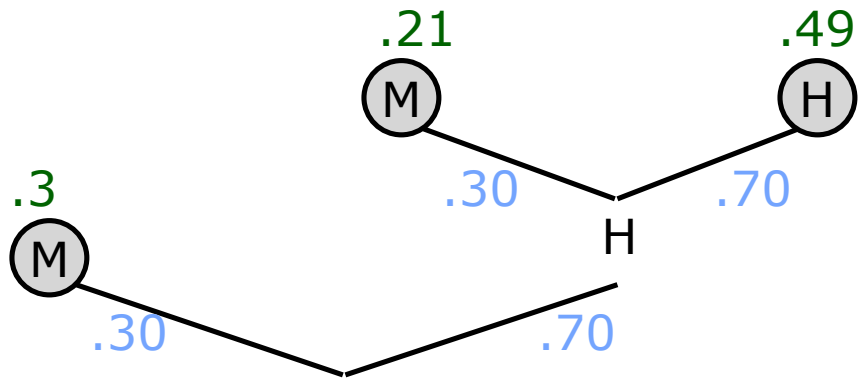


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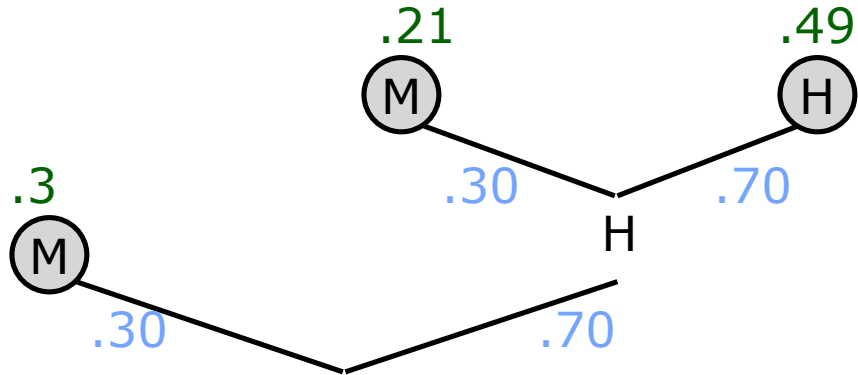
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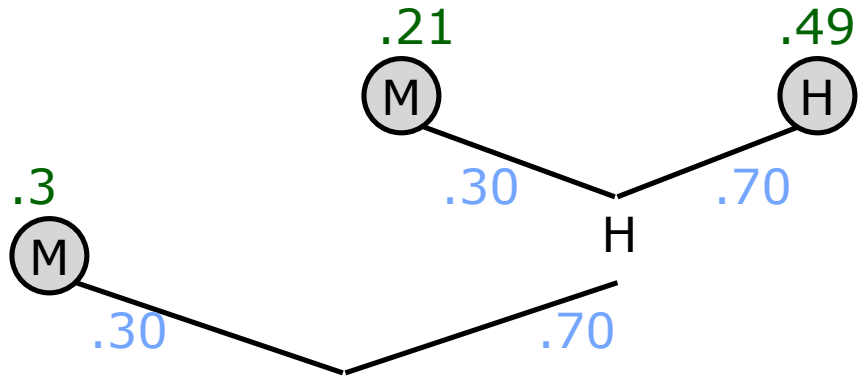
$$(a) E = 0(.3) + 1(.21) + 2(.49) = 1.19$$



(b) what is the expected number of shots he will take?

Solution:

$$(b) E = 1(.3) + 2(.21 + .49) = .3 + 1.4 = 1.7$$

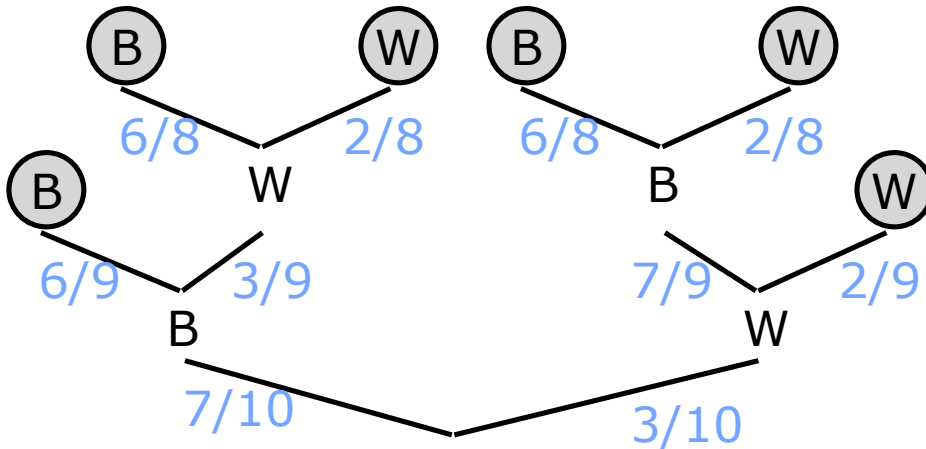


Socks in a drawer

Bill's dresser drawer contains 7 blue socks and 3 white ones. He pulls out socks one at a time until he has a matching pair. Draw a tree.

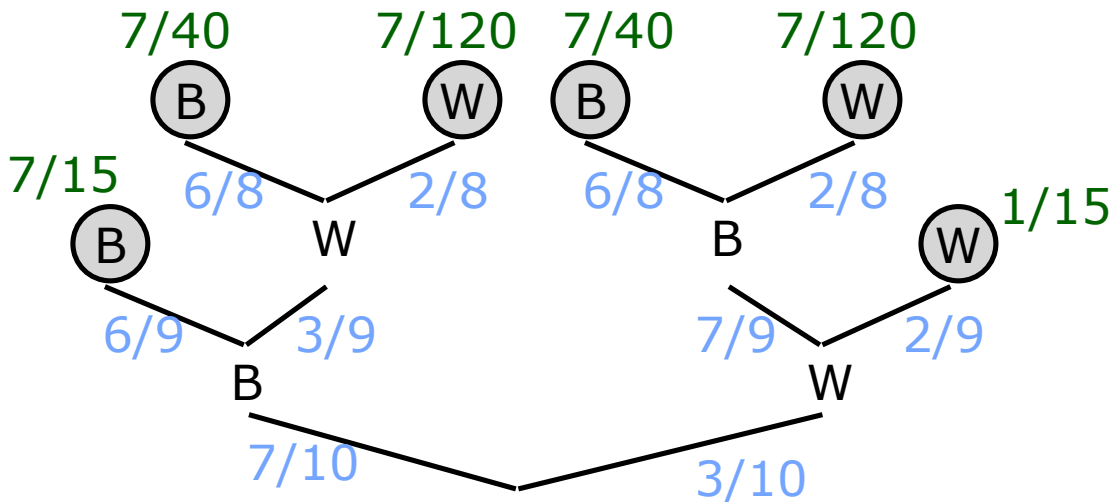
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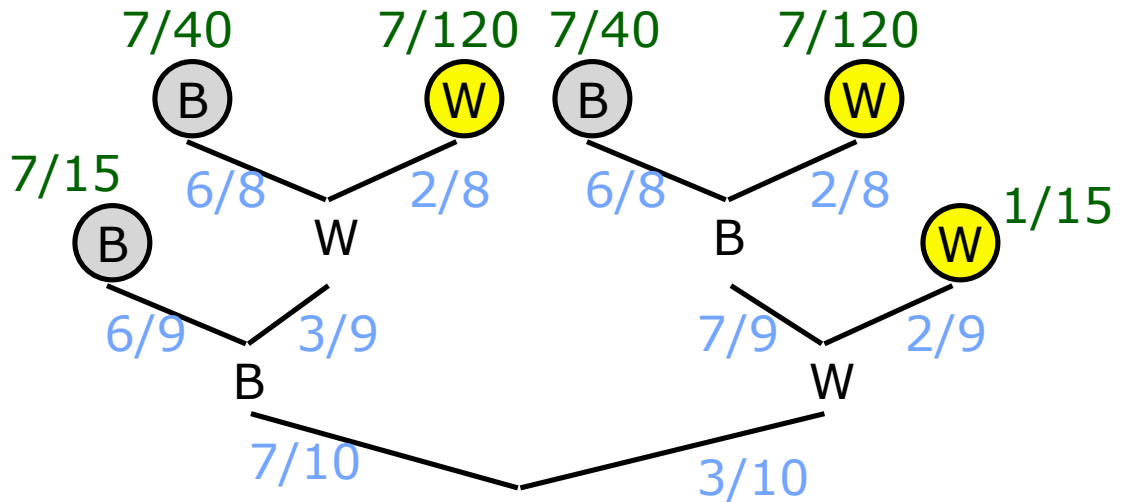
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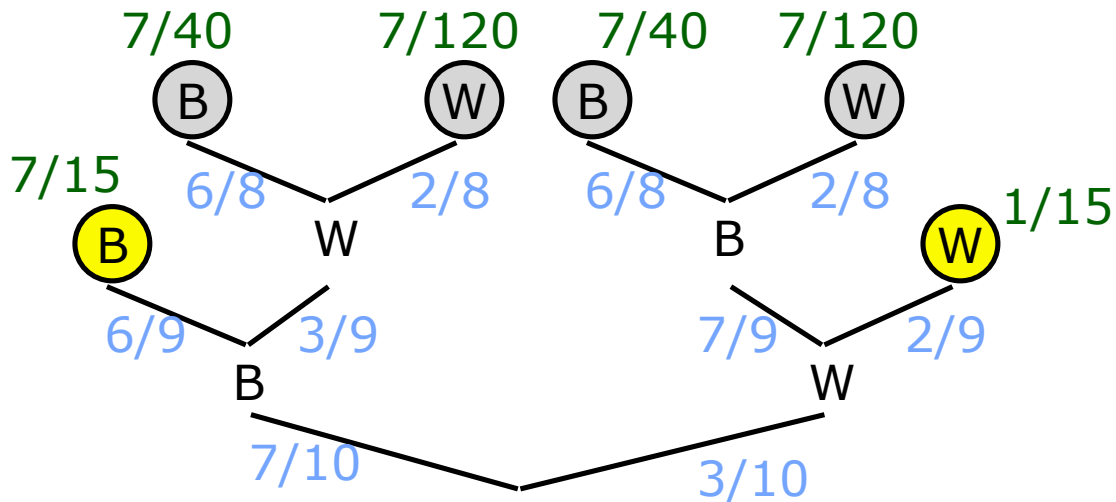
What is the probability he gets a pair of white socks?

Solution: $7/120 + 7/120 + 1/15 = 11/60$



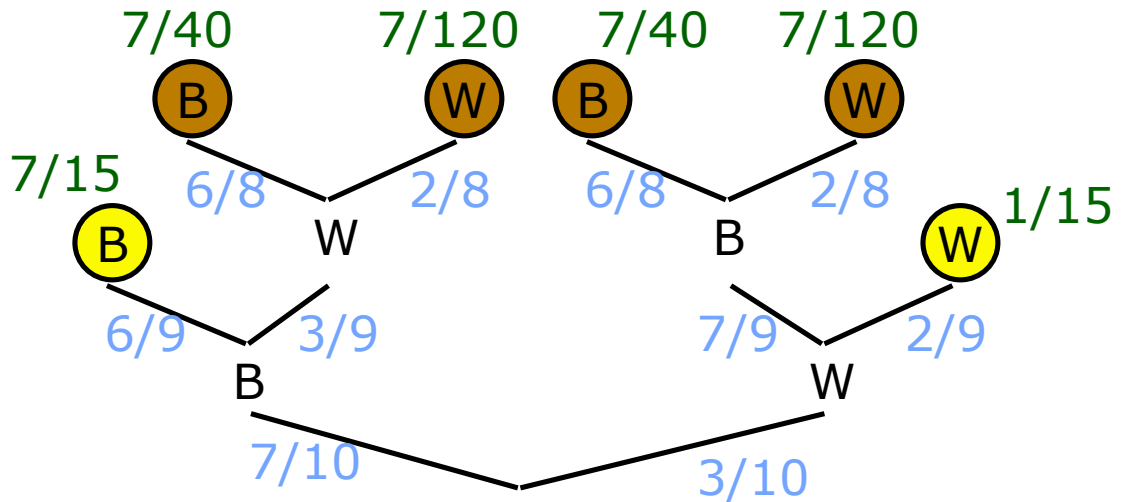
What is the probability he gets a match with the first two socks?

Solution: $7/15 + 1/15 = 8/15$



What is the expected number of socks he will pull from the drawer?

Solution: $E = 2(8/15) + 3(7/15) = 37/15 = 2.4667$



Free throws again

A basketball player hits 70% of his free throws. If his attempts are considered independent trials and he makes 5 attempts in a game, **what is the probability he hits exactly 4 shots?**

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Solution:

Probability of 4 successes in 5 trials with success probability equal to .7

$$= C(5,4) (.7)^4 (.3) = .36015$$

Free throws again

A basketball player hits 70% of his free throws. If his attempts are considered independent trials and he makes 5 attempts in a game, **what is the probability he hits at least 4 shots?**

Solution:

Probability of 5 hits = $(.7)^5 = .16807$

$P(\text{at least 4 hits}) = P(4 \text{ hits}) + P(5 \text{ hits})$

$$= .36015 + .16807 = .52822$$

Free throws again

A basketball player hits 70% of his free throws. If his attempts are considered independent trials and he makes 5 attempts in a game, **what is the expected value for the number of shots he hits?**

Solution:

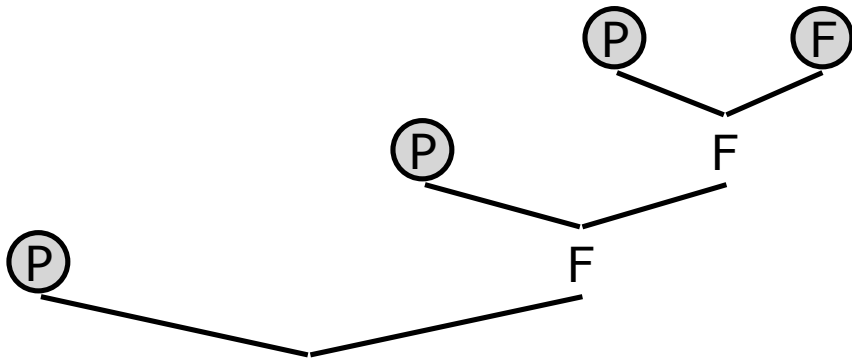
$$E = np = 5 \times .7 = 3.5$$

Qualifying Exam

Tanya wants to pass a qualifying exam, and she is allowed up to 3 attempts at passing the exam. Each time she takes the exam there is a 40% chance she will pass. What is the expected number of times she will take the exam?

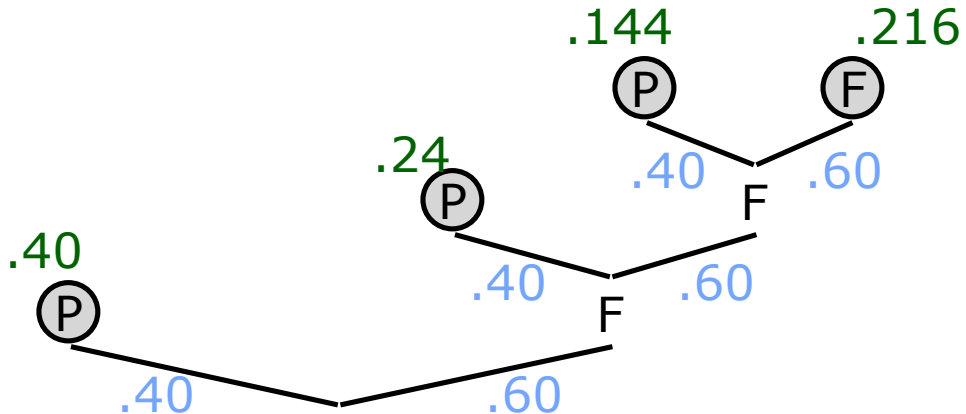
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Solution:

$$\begin{aligned} E &= 1(.40) + 2(.24) + 3(.144 + .216) \\ &= .40 + .48 + 1.08 \\ &= 1.96 \end{aligned}$$

