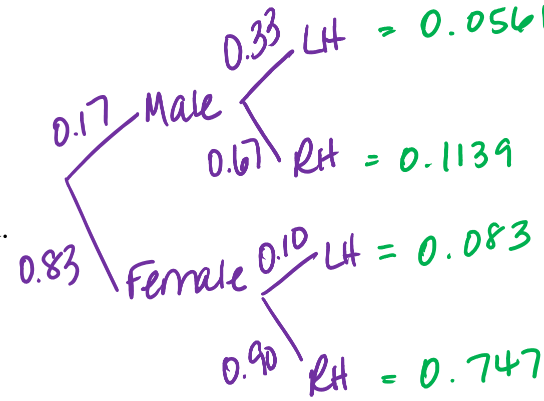
Algebra 2 Trig H
Tree diagrams

1. Make a tree diagram based on the survey results to help you answer questions about probability.



- Of all the respondents, 17% are male.
- Of all the male respondents, 33% are left handed.
- Of all the female respondents, 90% are right handed.

a. Find P(a female respondent is left handed).

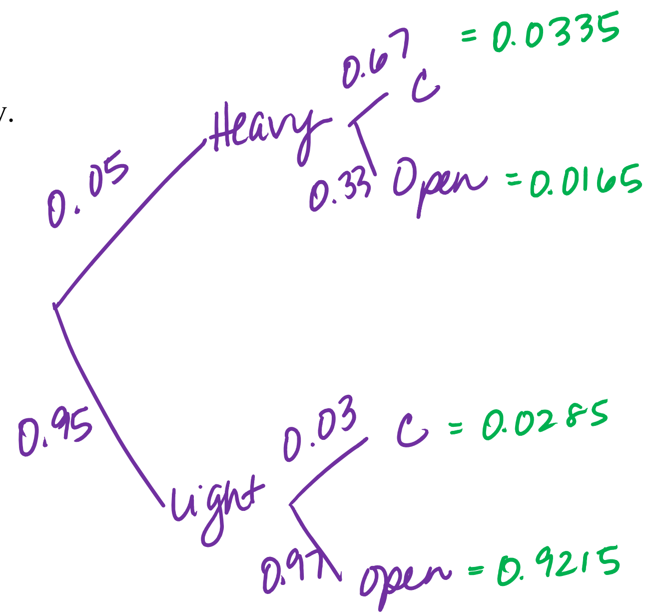
0.10

b. Find P(a respondent is both male and right handed).

$0.17 \cdot 0.67 = 0.1139$

2. A student in Buffalo, NY made the observations below.

Make a tree diagram to help you answer questions about probability.



- Of all snowfalls, 5% are heavy (at least 6 in.)
- After a heavy snowfall, schools are closed 67% of the time.
- After a light (less than 6 in.) snowfall, schools are closed 3% of the time.

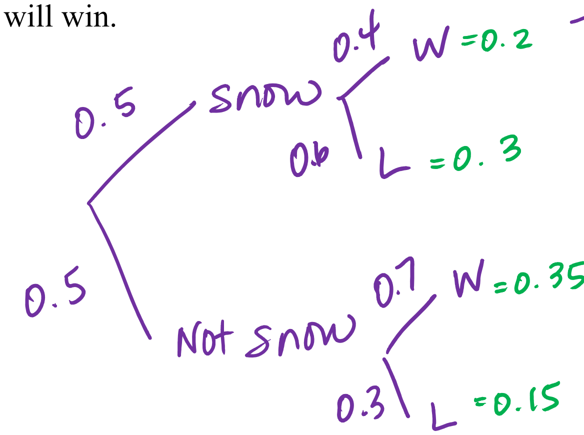
a. Find the probability that the snowfall is light and the schools are open.

$0.95 \cdot 0.97 = 0.9215$

b. Find the probability that a school is open given a heavy snowfall.

0.33

3. A football team has a 70% chance of winning when it doesn't snow, but only a 40% chance of winning when it snows. Suppose there is a 50% chance of snow. Make a tree diagram to find the probability that the team will win.

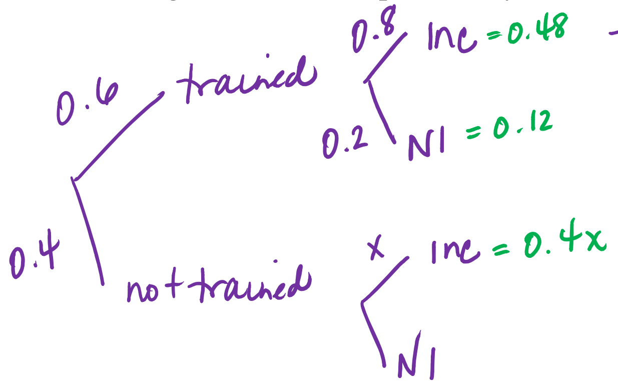


The team can win 2 ways.

$\underset{\text{w/ snow}}{0.5 \cdot 0.4} + \underset{\text{w/o snow}}{0.5 \cdot 0.7}$

$= 0.55$

4. Sixty percent of a company's sales representatives have completed training seminars. Of these, 80% have had increased sales. Overall, 56% of the representatives (whether trained or not) have had increased sales. Use a tree diagram to find the probability of increased sales, given that a representative has not been trained.



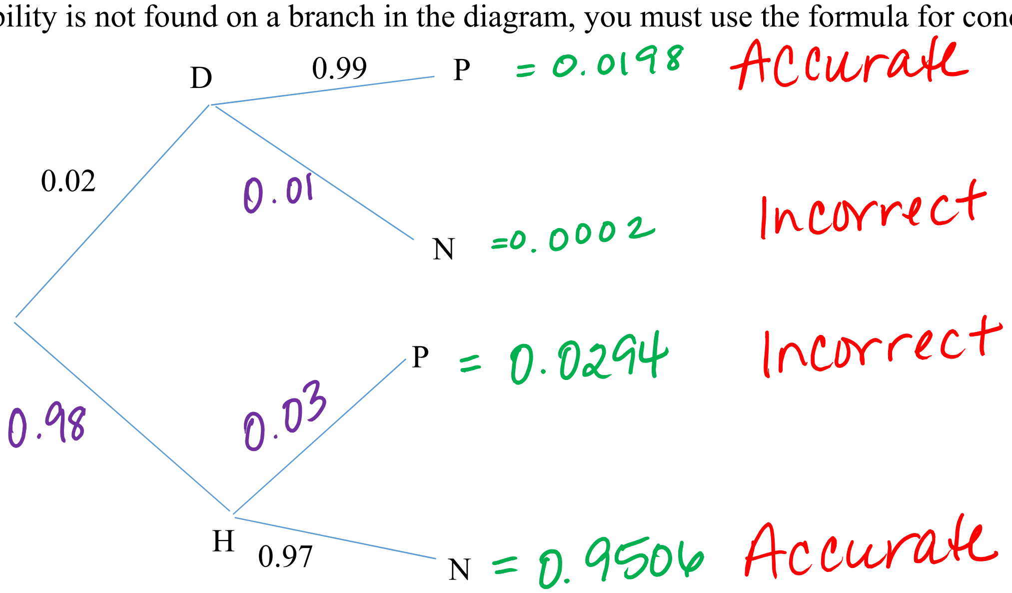
There are 2 ways to have increased sales.

Trained Not trained

$0.6 \cdot 0.8 + 0.4 \cdot x = 0.56$

$x = 0.2$

5. You can use a tree diagram to find the conditional probability P(P | D), which is the probability that a person with a disease will test positive for it. In this case, P(P | D) = 0.99. Scientists also look at P(H | P), the probability of a "false positive", which is the probability that a person who tests positive is actually healthy. Since this probability is not found on a branch in the diagram, you must use the formula for conditional probability.



Find:

a. P(N)

$= 0.02 \cdot 0.01 + 0.98 \cdot 0.97 = 0.9508$

b. P(H and N) $= 0.9506$

c. P(H | N)

$= 0.9506 / 0.9508 = 0.9999$

d. P(D | N)

$1 - 0.9999 = 0.0002$

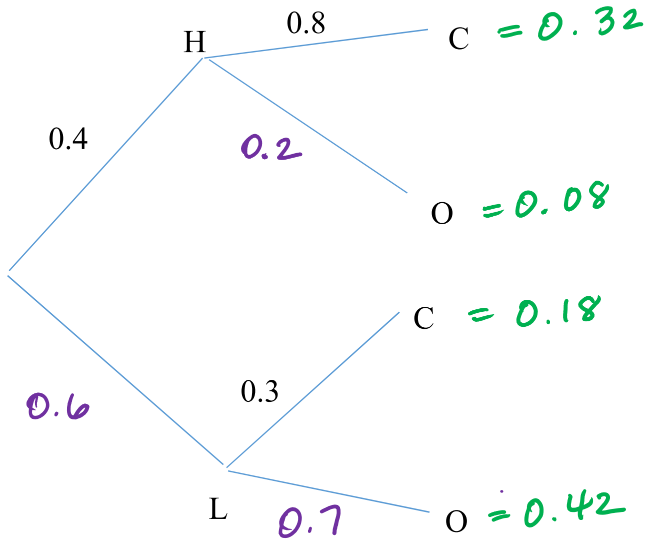
e. Explain the difference between P(P | D) and P(D | P) for the test. What is the best use for this test?

P(P|D) is the probability a person tests positive given they have the disease. P(D|P) is the probability a person has the disease given the test is positive.

Considering people are tested to determine if they have a disease, P(D|P) should be accurate, while P(P|D) validates the test.

Homework

1. The tree diagram relates snowfall and school closings. Find each probability.
   H = heavy snowfall, L = light snowfall, C = schools closed, O = schools open.



a. P(C) = p(O) after ⤵ found

$0.4 \cdot 0.8 + 0.6 \cdot 0.3 = 0.5$

b. P(H and O)

$0.4 \cdot 0.2 = 0.08$

c. P(H | C)

$0.4 \cdot 0.8 / 0.5 = 0.64$

d. P(L | O)

$(0.6 \cdot 0.7) / 0.5 = 0.84$

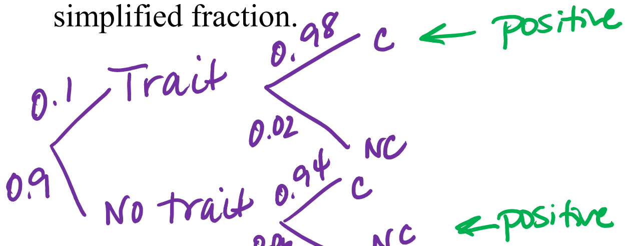
e. P(L | C)

$0.6 \cdot 0.3 / 0.5 = 0.36$

f. P(H | O)

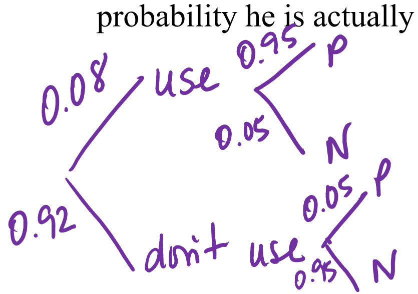
$0.4 \cdot 0.2 / 0.5 = 0.16$

2. The probability that somebody has a certain trait is 0.10. When people are tested for the trait, the test is not always accurate. If somebody has the trait, the probability that the test is correct is 0.98. If somebody does not have the trait, the probability that the test is correct is 0.94. If somebody tests positive for the trait, what is the probability that they actually have the trait? Give your answer as a simplified fraction.



$$\frac{0.1 \cdot 0.98}{0.1 \cdot 0.98 + 0.9 \cdot 0.06} = 0.645$$

3. The drug test for baseball players is 95% accurate in testing for those who use banned drugs (it will miss about 5%). However, the test also yield 5% "false positives" – that is, someone who does not use the banned substances will incorrectly test positive with probability 5%. Assume that 8% of the players do use banned drugs. Suppose a player tests positive for the use of a banned substance. What is the probability he is actually a drug user? (Give your answer as a decimal rounded to three decimal places.)



$$\frac{0.08 \cdot 0.95}{0.08 \cdot 0.95 + 0.92 \cdot 0.05} = 0.623$$