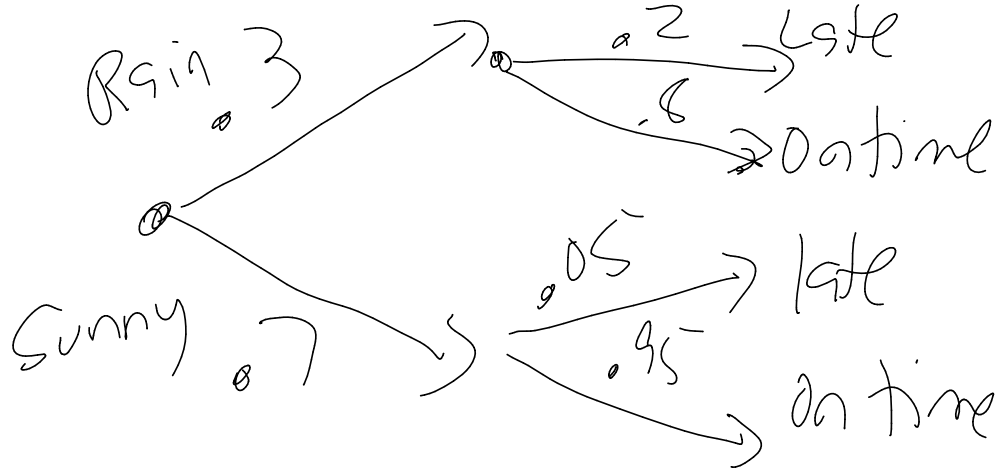
Rec Week 11/9/2020 - Probability #1

Friday, November 6, 2020 4:52 PM

Conditional Probability

Given that it is raining, Sue is late 20%.
Given that it is sunny, Sue is late 5%.
It rains 30% of the time.
One a randomly chosen day, what's the probability Sue is late.

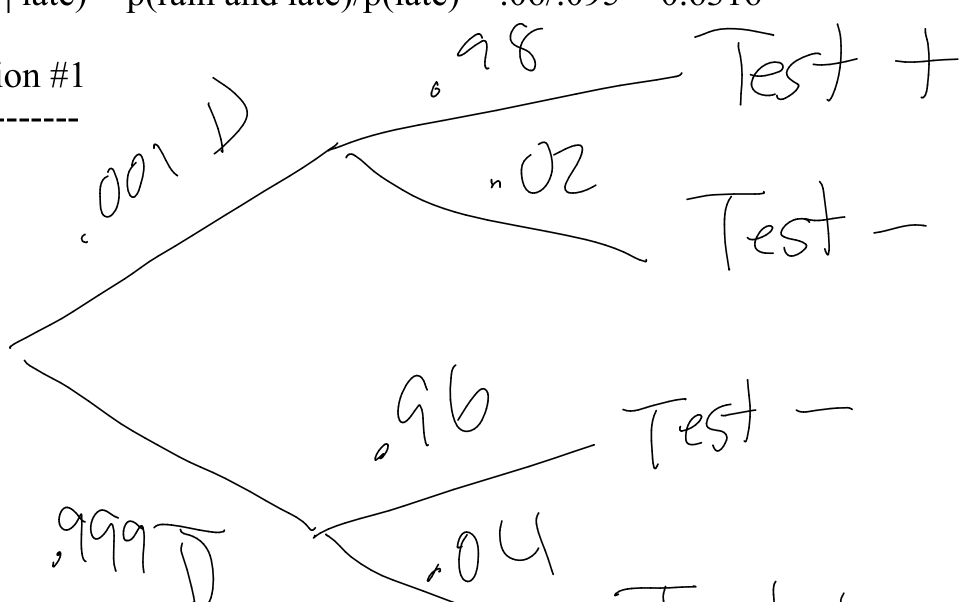


p(rain and late) = .3 x .2 = 0.06
p(sunny and late) = .7 x .05 = 0.035
p(late) = p(rain and late) + p(sunny and late) = .095

I could also ask, given that she was late, what is the probability it was raining day.

p(rain | late) = p(rain and late)/p(late) = .06/.095 = 0.6316

Question #1



.999 D .04 Test+

p(have | tested positive) = p(have and test +)/p(testpostive)
= .00098/.04094 = 0.02394 ~ 2.4%

p(testpostive) = p(testpositive and have) + p(testpostive and don't have)
= .001 x .98 + .999 x .04 = 0.04094
p(testneg) = 1 - p(testpositive) = 1 - .04094 = 0.95906

p(have | test negative) = p(have and test -)/p(testneg)
= .00002/.95906 = 2.085E-5

Binomial Probability Distribution

If we run n trials and our probability of success on a single trial is p, our probability of getting exactly k success is $\binom{n}{k} p^{k} (1-p)^{n-k}$

Question #2
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p = .8, n = 15

$$\binom{15}{13} .8^{13} .2^{2} + \binom{15}{14} .8^{14} .2^{1} + \binom{15}{15} .8^{15} .2^{1} \cong .398$$

Definitions of Independent, Mutually Exclusive Events
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if A and B are independent, then p(A) = p (A | B)
p(B) = p (B | A)
knowing about A doesn't change the probability of B and vice versa.

if A and B are mutually exclusive, the p(A and B) = 0.

p(A) = 4/9, p(A and B) = 2/5, p(A | B) = 1/2

p(A | B) = 1/2 = p(A and B)/p(B) = (2/5)/p(B) p(A) = 4/9, p(A and B) = 2/5, p(A | B) = 1/2

p(A | B) = 1/2 = p(A and B)/p(B) = (2/5)/p(B)

$$\frac{1}{2} = \frac{\frac{2}{5}}{p(B)} \qquad p(B) = \frac{\frac{2}{5}}{\frac{1}{2}} = \boxed{\frac{4}{5}}$$

p(B | A) = p(B and A)/p(A) = (2/5)/(4/9) = 9/10

p(B | not A) = p(B and notA)/p(not A)
p(not A) = 1 - p(A) = 1 - 4/9 = 5/9
p(B) = p(B and A) + p(B and notA)
4/5 = 2/5 + p(B and notA)
p(B and notA) = 2/5

p(B | not A) = p(B and notA)/p(not A)
= (2/5)/(5/9) = 18/25

Question 4
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n = 9, p = .2 binomial distribution

p(0 shots) = $\binom{9}{0} .2^0 .8^9$

$$p(1\text{ shot}) = \binom{9}{1} .2^1 .8^8$$

$$p(2\text{ or more}) = 1 - (.8)^9 - 1.8(.8)^8$$
$$\approx .56379$$

Expected Value = \$1000 x .56379 = \$563.79