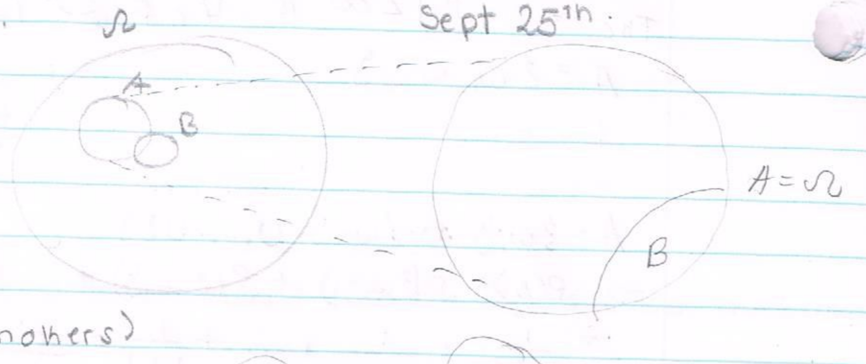
Math 241 Lecture 07 — Sept 25^{th}.

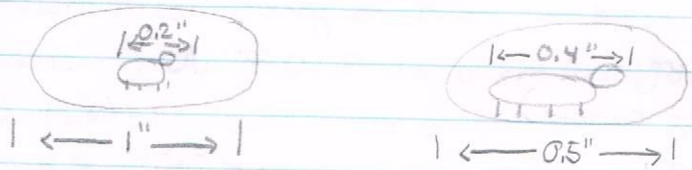


smokers $P(A) = 0.2$

lung cancer $P(B) = 0.06$

$P(AB) = 0.036$

P(lung cancer among smokers)
$= P(B|A) \propto P(AB)$ — $AB \propto B|A$



$\text{zoom factor} = \dfrac{\text{previous size}}{\text{new scope size}} = \dfrac{1''}{0.5''} = 2$

$$= \underbrace{\frac{\overset{=1}{P(\Omega)}}{P(A)}}_{\text{zoom}} P(AB) \Rightarrow P(B|A) = \boxed{\frac{P(AB)}{P(A)}}$$ Definition of Conditional probability

$$\Rightarrow P(AB) = P(A)P(B|A) \Rightarrow P(AB) = \frac{P(B|A)P(A)}{P(B)}$$ "Bayes Rule" 1763

$= \dfrac{.036}{.2} = .18$

P(smoking among those who get lung cancer) $= P(A|B)$

$= \dfrac{P(AB)}{P(B)} = \dfrac{0.036}{.06} = .6$

$P(B|A) = \dfrac{P(AB)}{P(A)} = \left(\dfrac{0.036}{0.2}\right) = 0.18$

P(lung cancer among non smokers) $= P(B|A^c) = \dfrac{P(BA^c)}{P(A^c)} = \dfrac{0.024}{0.8} = 0.3$

$P(A^c) = 1 - 0.2 = 0.8$

~~P(BA^c)~~ =

$B = AB \cup A^cB$

$P(B) = P(AB) - P(A^cB)$

$P(A^cB) = P(B) - P(AB) = .06 - .036 = 0.024$

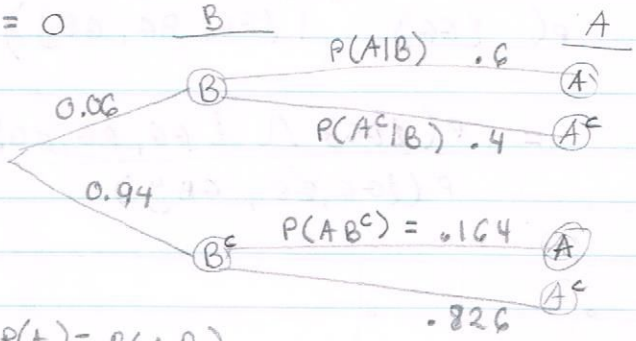
Risk Ratio

$\frac{P(B|A)}{P(B|A^c)} = \frac{.18}{.03}$ = 6 times more likely to get lung cancer if you smoke vs you don't. (risk ratio)

$P(A|A) = 1$

$P(A|A^c) = 0$

Tree



Joint

$AB = .036$

$A^cB = .024$

$AB^c = .164$

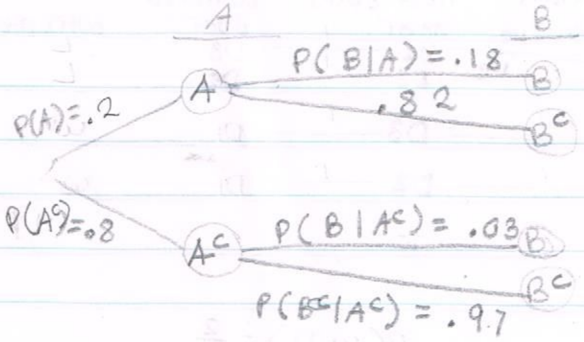
$A^cB^c = .776$

1

$P(AB^c) = P(A) - P(AB)$

$= .2 - .036 = .164$

Tree Inversion



$P(AB) = .036$

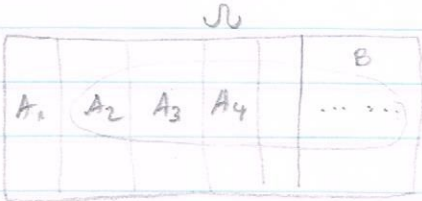
$P(AB^c) = .164$

$P(A^cB) = .024$

$P(A^cB^c) = .776$

1

Consider $A_1, A_2, \dots$ are mutually exclusive + collectively exhaustive and event B



$P(B) = P(B \cap \Omega)$

$= P(B \cap (A_1 \cup A_2 \cup \dots))$

$= P((B \cap A_1) \cup (B \cap A_2) \cup \dots)$

$= P(B \cap A_1) + P(B \cap A_2) + \dots$

$$\boxed{P(B) = \sum_{i=1}^{\infty} P(BA_i)}$$

Law of total probability

$(B \cap A_i) \cap (B \cap A_i)$

$= B \cap B \cap A_1 \cap A_2 = \emptyset$

• 2 kids, 1 is a girl. P(other is a girl)

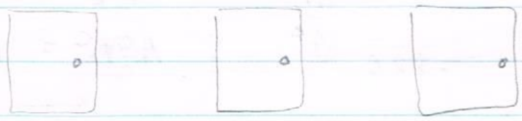
Ω

GG	BG
GB	BB

P (other is a girl | if 1 is a girl)

$P(\{GG\} \mid \{GG, BG, GB\}) = \frac{1}{3}$

$\forall i \; P(\omega_i) = \frac{1}{4}$ $\quad = \dfrac{P(\{GG\} \cap \{GG, BG, GB\})}{P(\{GG, BG, GB\})} = \dfrac{\frac{1}{4}}{\frac{3}{4}} = \boxed{\frac{1}{3}}$



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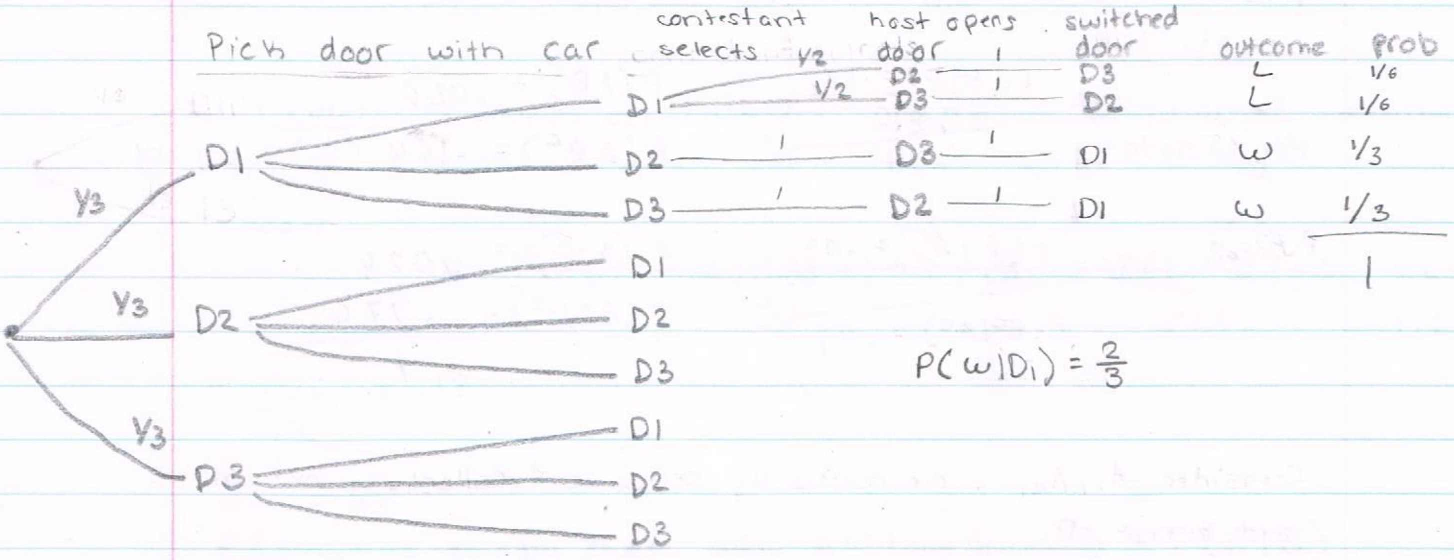
3 doors : 2 goats , 1 car

The probability of switching is $\frac{2}{3}$



$P(W \mid D_1) = \frac{2}{3}$