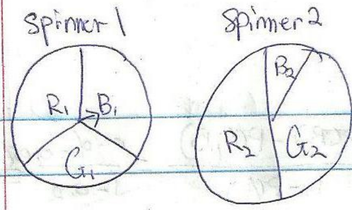
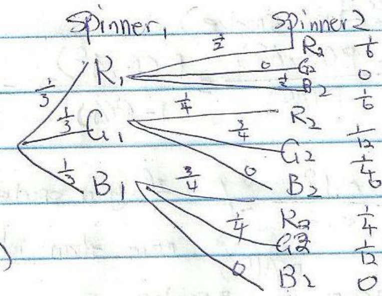



$P(R_1 R_2)$

$= P(R_1)P(R_2)$

$\frac{1}{6} = \frac{1}{3}(\frac{1}{6} + \frac{1}{12} + \frac{1}{4}) = \frac{1}{6}$

$R_1 R_2$ is independent.

$P(R_1 G_2) = P(R_1)P(G_2)$

$0 \ \frac{1}{3}(0 + \frac{3}{4} + \frac{1}{12}) = \frac{5}{18}$

$R_1 G_2$ is dependent

9/25 Lec 7

$P(A) = \frac{4}{52} = \frac{1}{13}$ $\Rightarrow$ A, ♡ independent

$P(A|♡) = \frac{1}{13} = P(A)$

$n = 1000$

200 ~~Student~~ smoker (A)

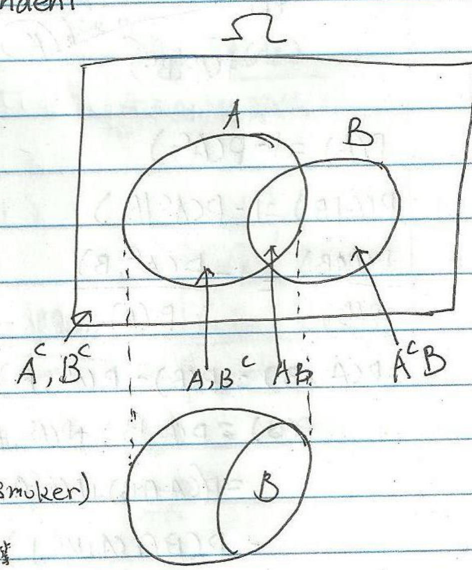
~~3~~60 lung ~~Caner~~ ~~Cancer~~ cancer (B)

36 smoker & lung cancer (A, B)

$P(A) = 0.2$

$P(B) = 0.06$

$P(A, B) = 0.036$




P(lung ~~Cancer~~ caner | smoker)

$P(B|A)$

$P(B|A) \propto P(B, A)$

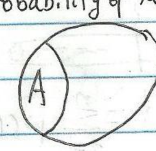
~~Zoom~~

$P(B|A) = \cancel{\propto} P(B, A) = \frac{P(\Omega)}{P(A)}$

$\frac{0.036}{0.2} = 0.18 \leftarrow P(B|A) = \frac{P(B,A)}{P(A)}$ ~~Bange Rule~~ ~~Basic~~ Bayes's Rule

$P(B,A) = P(B|A)P(A)$

$P(A|B) = \frac{P(A,B)}{P(B)} = \frac{0.36}{0.06} = 0.6$ Probability of lung ~~Cancer~~ caner cancer giving smoker

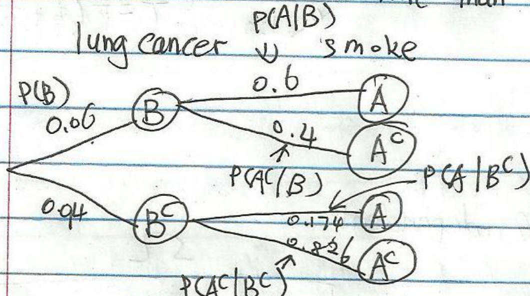



$$\boxed{\begin{aligned} P(A,B) &= P(A|B)P(B) \\ P(B|A) &= \frac{P(A|B)P(B)}{P(A)} \end{aligned}}$$ double Bayes's ~~basic~~ Rule.

P(lung ~~cancer~~ caner | no smoke)

$P(B|A^c) = \frac{P(B,A^c)}{P(A^c)} = \frac{P(B,A^c)}{1-P(A)} = \frac{P(B)-P(A,B)}{1-P(A)} = \frac{0.06-0.036}{1-0.2} = 0.3$

$\frac{P(B|A)}{P(B|A^c)} = \frac{0.18}{0.3} = 6$ If you smoke, you get lung cancer is 6 times more than who no smoke.




$P(A,B) = 0.036$

$P(A^c,B) = 0.24$

$P(A,B^c) = P(A) - P(A,B)$
$= 0.2 - 0.036 = 0.164$

$P(A^c,B^c) = \underline{0.776}$
$1$

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

$P(A|B) = 1 - P(A^c|B)$

$\frac{P(A,B)}{P(B)} = 1 - \frac{P(A^c,B)}{P(B)}$

$P(A,B) = P(B) - P(A^c,B)$

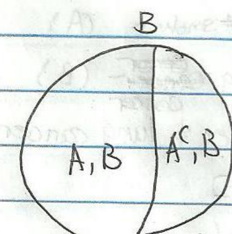
$P(B) = P(A,B) + P(A^c,B)$

$= P((A\cap B)\cup(A^c\cap B))$

$= P(B\cap(A\cup A^c))$

$= P(B\cap\Omega)$

$= P(B)$




$A\cap B$

$A^c\cap B$

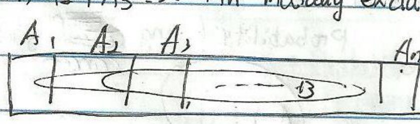
$(A\cap B)\cap(A^c\cap B)=\emptyset$

$A\cap B\cap A^c\cap B$

$B\cap A\cap A^c\cap B$

$B\cap\emptyset\cap B=\emptyset$

$A_1, A_2, A_3 \dots A_n$ mutually exclusion, call exhause

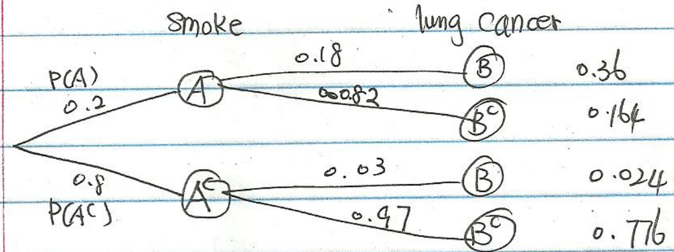


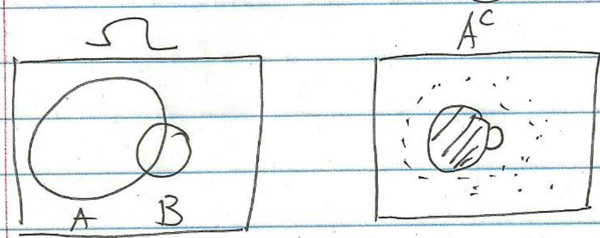

$= P((B\cap A_1)\cup(B\cap A_2)\cup(B\cap A_3)\cup\dots\cup P(B\cap A_n))$

$= P(B\cap(A_1\cup A_2\cdots A_n))$

~~P(B~~ $\underbrace{P(B) = \sum_{i=1}^{n} P(B,A_i)}$ $= P(B,A_1) + P(B,A_2) \cdots P(B,A_n)$

Law of ~~Ta~~ Total probability.




$$P(A_i \mid B) = \frac{P(A_i, B)}{P(B)} = \frac{P(B \mid A_i)P(A_i)}{P(B)} = \frac{P(B \mid A_i)P(A_i)}{\sum_{i=1}^{n} P(B \mid A_i)P(A_i)}$$

P(other is girl | one of two is a girl)

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

$= \frac{P(\{GG\} \cap \{GG, BG, GB\})}{P(\{GG, BG, GB\})} = \frac{P(\{GG\})}{\;} = \frac{\frac{1}{4}}{\frac{3}{4}} = \frac{1}{3}$

$\Omega$

| | |
|---|---|
| GG | BG |
| GB | BB |

Mandy Hold Game