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CS4445

Q1 (i) $P(A \cap B) = P(A) * P(B)$

$$\frac{P(A \cap B)}{P(B)} = P(A)$$

through conditional probability

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

$\therefore$ (i) implies (ii)

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

through conditional probability

$$\frac{P(A, B)}{P(B)} = P(A)$$

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

$\therefore P(A \cap B) = P(A) * P(B) \Rightarrow P(A \cap B) = P(A) * P(B)$

$\therefore$ (i) $\Rightarrow$ (ii)

Q2

	gw	¬gw
ps	28	2
¬ps	140	30

ps – potter smith
gw – gift won

a) $P(gw|ps) = \frac{P(gw \cap ps)}{P(ps)}$

$$= \frac{\frac{28}{200}}{\frac{30}{200}} = 0.9\dot{3}\dot{3}$$

≈ 0.9333

$P(\neg ps \cap \neg gw)$ is irrelevant to calculation

2 b) $P(ps \mid gw) = \frac{P(ps \cap gw)}{P(gw)}$

$= \frac{\frac{28}{200}}{\frac{168}{200}} = 0.1\dot{6}\dot{6}$

≈ 0.1666

$P(\neg gw \cap \neg ps)$ is irrelevant to calculation

Q3. discrete speaker {Victor M, Other}
discrete DBI {True, False}
for whether sound clip has dont bodies

let umel be Speaker = Victor Mafreo
let dbi be DBI = true

$P(umel) = 0.01$, $P(dbi \mid umel) = 0.95$, $P(dbi \mid \neg umel) = 0.01$

a) $P(umel \mid dbi)$ or $P(\neg umel \mid dbi)$ is likelier

by Bayes rule

$P(umel \mid dbi) = \frac{P(dbi \mid umel) P(umel)}{P(dbi)}$

$= \frac{P(dbi \mid umel) P(umel)}{P(dbi \mid umel) P(umel) + P(dbi \mid \neg umel) P(\neg umel)}$

$= \frac{0.95 * 0.01}{0.95 * 0.01 + 0.01 * (1 - 0.01)}$

$= \frac{0.0095}{0.0095 + 0.0099}$

$= 0.4896907216 4$

≈ 0.4897

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$\therefore P(\neg umel \mid obi)$ is likelier

(0.5103 vs 0.4897)
$P(\neg umel|obi)$ $P(umel|obi)$

b) same but
$P(umel) = 0.15$, $P(obi|umel) = 0.95$, $P(obi|\neg umel) = 0.01$

same formula as before

$$P(umel|obi) = \frac{0.95 * 0.15}{0.95 * 0.15 + 0.01 * (1-0.15)}$$

$$= \frac{0.1425}{0.151}$$

$= 0.94370860927$

≈ 0.9437

$\therefore P(umel|obi) = 0.9437$
$P(\neg umel|obi) = 0.0563$

$\therefore P(umel|obi)$ is more likely than $P(\neg umel|obi)$

c) same as a, b but
$P(umel) = 0.01$, $P(obi|umel) = 0.95$, $P(obi|\neg umel) = 0.001$

$$P(umel|obi) = \frac{0.95 * 0.01}{0.95 * 0.01 + 0.001 * (1-0.01)}$$

$$= \frac{0.0095}{0.01049}$$

$= 0.90562440419$
≈ 0.9056

$\therefore$
$P(\neg umel|obi) = 0.0144$

∴ P(wet | dry) is more likely than P(¬wet | dry)

Q4

	noisy +	noisy −
cool +	62	108
cool −	38	292

i) find $P(cool+) = \frac{170}{500} = 0.34$

find $P(cool+ \mid noisy+) = \frac{62}{500} = 0.124$

~~$P(noisy+ \mid cool+) P(cool+)$~~

cool+ is independant of noisy+

if $P(cool+ \mid noisy+) = P(cool+)$

$0.124 \neq 0.34$

∴ cool+ is not independent of noisy+

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Q5 table 1 = table from Q4, 500 days
table 2 = below, 100 days, open:+
table 3 = below 2, 400 days, open:−

table 2:

open:+	noisy:+	noisy:−
cool:+	54	36
cool:−	6	4

table 3:

open:−	noisy:+	noisy:−
cool:+	8	72
cool:−	32	288

table 2: find $P(cool:+ | open:+) = 0.9$
$P(cool:+ | open:+, noisy:+) = 0.54$

from conditional independence formula
$P(cool:+ | open:+, noisy:+) = P(cool:+ | noisy:+)$
$0.9 = \frac{54}{60}$
$0.9 = 0.9$

∴ is conditionally independent

table 3: find $P(cool:+ | open:-) = 0.2$
$P(cool:+ | open:-, noisy:+) = 0.02$

from formula:
$P(cool:+ | open:-, noisy:+) = P(cool:+ | noisy:+)$

$0.02 = 8/40$
$0.02 \neq 0.2$
∴ is not conditionally independent