THOMPSON RIVERS UNIVERSITY

COMP 3710 - 3
Applied Artificial Intelligence (3,1,0)
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Seminar/Lab 11.

Uncertainty in Environments

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2.

        P (a) = 0.04

        P (b) = 0.05

        P (a | b) = 0.6

        P (a | ¬b) = 1 / 95

P (a ∧ b) = p (a | b) * p (b) = 0.6 * 0.05 = 0.03

P (b | a) = p (b∧a) / p (a) = 0.03 / 0.04 = 0.75

P (¬b | a) = 1- P (b | a) = 0.25

3.

	toothache		¬ toothache	
	catch	¬ catch	catch	¬ catch
cavity	.108	.012	.072	.008
¬ cavity	.016	.064	.144	.576

$P(toothache \,|\, cavity \lor \neg catch)$

= P (toothache ∧ (cavity ∨ ~ catch)) / p (cavity ∨ ~ catch)

= (0.108 + 0.012 + 0.064) / (0.108 + 0.012 + 0.072 + 0.008 + 0.576)

= 0.184 / 0.84

= 0.219

4.

$P\,(\text{cavity}) = 0.2$

$P\,(\text{catch} \mid \text{cavity}) = 0.9$

$P\,(\text{catch} \mid \sim\text{cavity}) = 0.2$

$P\,(\text{toothache} \mid \text{cavity}) = 0.6$

$P\,(\text{toothache} \mid \sim\text{cavity}) = 0.1$

a. $P(\text{toothache}) = P(\text{toothache} \wedge \text{cavity}) + P(\text{toothache} \wedge \sim\text{cavity})$
$= P\,(\text{toothache} \mid \text{cavity}) * P\,(\text{cavity}) + P\,(\text{toothache} \mid \sim\text{cavity}) * P\,(\sim\text{cavity})$
$= 0.6 * 0.2 + 0.1 *(1 - 0.2)$
$= 0.2$

b. $P(\text{catch}) = P\,(\text{catch} \wedge \text{cavity}) + P\,(\text{catch} \wedge \sim\text{cavity})$
$= P\,(\text{catch} \mid \text{cavity}) * P\,(\text{cavity}) + P\,(\text{catch} \mid \sim\text{cavity}) * P\,(\sim\text{cavity})$
$= 0.9 * 0.2 + 0.2 * (1 - 0.2)$
$= 0.34$

c. $P(\text{cavity} \mid \text{toothache}) = P(\text{cavity} \wedge \text{toothache}) / P(\text{toothache})$
$= P\,(\text{toothache} \mid \text{cavity}) * P\,(\text{cavity}) / P\,(\text{toothache})$
$= 0.6 * 0.2 / 0.2$
$= 0.6$

d. $P(\text{cavity} \mid \text{catch}) = P(\text{cavity} \wedge \text{catch}) / P(\text{catch})$
$= P\,(\text{catch} \mid \text{cavity}) * P\,(\text{cavity}) / P\,(\text{catch})$
$= 0.9 * 0.2 / 0.34$
$= 0.529$

5.

+: positive result;

-: negative result;

D: disease;

$P(+|D) = 0.99$

$P(-|\sim D) = 0.99$

$P(D) = 0.0001$

$P(+) = P(+ \wedge D) + P(+ \wedge \sim D)$

$\quad = [P(+|D) * P(D)] + [P(\sim D) - P(- \wedge \sim D)]$

$\quad = [0.99 * 0.0001] + [(1- 0.0001) - P(-|\sim D) * P(\sim D)]$

$\quad = 0.000099 + [0.9999 - 0.99 * 0.9999]$

$\quad = 0.000099 + 0.009999$

$\quad = 0.010098$

$P(D|+) = P(+|D) * P(D) / P(+)$

$\quad = 0.99 * 0.0001 / 0.010098$

$\quad = 0.0098$