

Probability Exercises

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Q2

	gw	¬gw
ps	28	2
¬ps	140	30

a)

$$28 + 2 + 140 + 30 = 200$$

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

$$P(gw \wedge ps) = \frac{28}{200} = 0.14$$

$$P(ps) = \frac{30}{200} = 0.15$$

$$P(gw|ps) = \frac{0.14}{0.15} = 0.93$$

The counts where Potter did not catch the Golden Snitch (ie the bottom row) are irrelevant to this calculation.

b)

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

$$P(ps \wedge gw) = 0.14$$

$$P(gw) = \frac{168}{200} = 0.84$$

$$P(ps|gw) = \frac{0.14}{0.84} = 0.01$$

The count where Gryffindor did not win (ie the right column) are not relevant to this calculation.

Q4

	noisy: +	noisy: -
cool: +	62	108
cool: -	38	292

$$62 + 108 + 38 + 292 = 500$$

$$p(cool : +) = \frac{170}{500} = 0.34$$

$$p(cool : + | noisy : +) = \frac{p(cool : + \wedge noisy : +)}{p(noisy : +)}$$

$$p(\text{cool} : + \wedge \text{noisy} : +) = \frac{62}{500} = 0.124$$

$$p(\text{noisy} : +) = \frac{100}{500} = 0.2$$

$$p(\text{cool} : + | \text{noisy} : +) = \frac{0.124}{0.2} = 0.62$$

$$0.34 \neq 0.62$$

cool: + is not independent of noisy: +.

Q5

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

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

$$p(\text{cool} : + | \text{open} : +) = \frac{54+36}{100} = 0.9$$

$$p(\text{cool} : + | \text{open} : +, \text{noisy} : +) = \frac{54}{60} = 0.9$$

cool: + is conditionally independent of noisy: + given open: +.

$$p(\text{cool} : + | \text{open} : -) = \frac{8+72}{400} = 0.2$$

$$p(\text{cool} : + | \text{open} : -, \text{noisy} : +) = \frac{8}{40} = 0.2$$

cool: + is conditionally independent of noisy: + given open: -.