Odds

March 11/2020

One application of probability commonly used in sports (and gambling) is odds. They are typically expressed in terms of the odds in favour of an event, and the odds against the event. Odds are written as fractions, or ratios, of whole numbers (no decimals).

Odds in favour of A are P(A) : P(A') or $\frac{P(A)}{P(A')}$

Odds against A are P(A') : P(A)

Ex. A team is given a 75% probability of winning the playoffs. What are the odds for/against winning?

A = winning

$P(A) = 0.75$

$P(A') = 0.25$

odds in favour (winning) $\frac{0.75}{0.25} = \frac{3}{1} = 3:1$

odds against $\frac{0.25}{0.75} = \frac{1}{3} = 1:3$

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Ex. The odds of a team winning their next game is set at 3:2. What is the probability they will lose?

odds of winning $\frac{3}{2}$

odds of losing $\frac{2}{3}$ → lose 2 out of 2+3 games

$P(\text{lose}) = \frac{2}{5} = 0.4$

In general, given the odds in favour of A: $\frac{h}{k}$

The probability of A is: $P(A) = \frac{h}{h+k}$

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Assigned Work:

p.318 # 1-6, (9) 12-14
6 12, 14

6. odds for B = $\frac{5}{4}$

$P(B) = \frac{5}{9}$ $P(E) = \frac{4}{9}$

how can E win?

① E E E (3 games) $P(EEE) = \left(\frac{4}{9}\right)\left(\frac{4}{9}\right)\left(\frac{4}{9}\right)$

② 4 games

_ _ _ E

2E, 1B

$P\left(\begin{matrix}\text{4 games,}\\ \text{E wins 3}\end{matrix}\right) = \frac{3!}{2!} \times \left(\frac{4}{9}\right)^3 \times \frac{5}{9}$

③ _ _ _ _ E

2E, 2B

$P\left(\begin{matrix}\text{5 games,}\\ \text{E wins 3}\end{matrix}\right) = \frac{4!}{2!2!} \times \left(\frac{4}{9}\right)^3 \times \left(\frac{5}{9}\right)^2$

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9. odds for TO: $\frac{1}{5}$ odds for M: $\frac{2}{13}$

$P(T) = \frac{1}{6}$ $P(M) = \frac{2}{15}$

if 6 stanley cups played, T wins 1

if 15 S.C. played, M wins 2

$P(T) = \frac{5}{30}$ $P(M) = \frac{4}{30}$

$P(T \text{ or } M) = \frac{9}{30}$ odds: $\frac{P(A)}{P(A')}$

odds for (T or M) $= \frac{9}{21}$

$= \frac{3}{7}$

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12. $P(R \text{ with } L) = 0.3$

$P(R \text{ with } C) = 0.4 = \frac{4}{10}$

$P(R \text{ with } B) = 0.5 = \frac{5}{10}$

$P(R|L) = 0.3 = \frac{3}{10}$

(a) odds of $R|L = \frac{3}{7}$

(b) odds of $R|C = \frac{4}{6} = \frac{2}{3}$

(c) odds of $R|B = \frac{5}{5} = \frac{1}{1}$

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14. 2 of 3 or 3 of 7 to win — 4 Q's 90% correct; 2 Q's only 50% correct

① best case

$P = {}_4C_3 \times {}_2C_0 \times (0.9) \times (0.9) \times (1.0)$

↑ 3 of 4 "easy" Q's — ↑ can answer last a right or wrong

② worst case

${}_2C_2 \times {}_4C_1 \times$ [C C W ; 0.5 × 0.5 × 1.0] +

[C W C ; 0.5 × 0.5 × 0.9] or [W C C ; 0.5 × 0.5 × 0.9] +

③ ${}_2C_1 \times {}_4C_2 \times$ [C C D/C ; 0.5 × 0.9 × 1.0] or [C W C ; 0.5 × 0.1 × 0.9] or [W C C ; 0.5 × 0.9 × 0.9]

$\frac{① + ② + ③}{{}_6C_3}$

${}_6C_3$ = total # of ways to get questions

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