

$P_i = (R, \text{lon}_i, \pi/2 - \text{lat}_i)$ spherical coords

$P_i = (R \sin(\text{colat}_i) \cos(\text{lon}_i), R \sin(\text{colat}_i) \sin(\text{lon}_i), R \cos(\text{colat}_i))$
rectangular coords

$$\vec{a} \cdot \vec{b} = |a| |b| \cos(\alpha)$$

$$\begin{aligned} \cos(\alpha) &= \cos(\text{lat}_1) \cos(\text{lon}_1) \cdot \cos(\text{lat}_2) \cos(\text{lon}_2) \\ &+ \cos(\text{lat}_1) \sin(\text{lon}_1) \cos(\text{lat}_2) \sin(\text{lon}_2) \\ &+ \sin(\text{lat}_1) \sin(\text{lat}_2) \end{aligned}$$

$$= \cos(\text{lat}_1) \cos(\text{lat}_2) (\cos(\text{lon}_1) \cos(\text{lon}_2) + \sin(\text{lon}_1) \sin(\text{lon}_2))$$

$$+ \sin(\text{lat}_1) \sin(\text{lat}_2)$$

$$= \cos(\text{lat}_1) \cos(\text{lat}_2) \cos(\text{lon}_1 - \text{lon}_2) + \sin(\text{lat}_1) \sin(\text{lat}_2)$$

$$= \cos^{-1} [\cos(\text{lat}_1) \cos(\text{lat}_2) \cos(\text{lon}_1 - \text{lon}_2) + \sin(\text{lat}_1) \sin(\text{lat}_2)]$$

d = great circle distance between points

$$= R \alpha$$

losing bet
(1-l)
rowth per bet is G , where
 $G = \lim_{N \rightarrow \infty} \frac{1}{N} \ln(V_N/V_0)$
after N wins and L losses
 $V_N = V_0 (1+l)^W (1-l)^L$

How Things

Mathematical

Work

In limit, $\frac{W}{N} \rightarrow p$ and $\frac{L}{N} \rightarrow 1-p$
 $G = p \ln(1+l) + (1-p) \ln(1-l)$

Find l which maximizes G . Call it l_{opt}
 $\frac{dG}{dl} \Big|_{l=l_{opt}} = 0 = \frac{p}{1+l_{opt}} - \frac{1-p}{1-l_{opt}} \Rightarrow \frac{p}{1+l_{opt}} = \frac{1-p}{1-l_{opt}}$

$$l_{opt} = \frac{p(b+1)-1}{b} = \frac{pb-q}{b} \text{ where } q = pb(1-l_{opt})$$

or
if odds are b to 1, this means

$$l_{opt} = \frac{p - p_{track}}{1 - p_{track}}$$

term