Simplifying Regret


INDIA
सत्यमेव जयते
2011

दस रुपये
₹
10
TEN RUPEES

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₹
10
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₹
10
TEN RUPEES

INDIA
सत्यमेव जयते
2011

1
RUPEE
1996

INDIA
सत्यमेव जयते

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10
नये पैसे
1957

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10
नये पैसे
1957

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No. of times tossed

$$N_1 = 5$$

$$N_2 = 3$$

$$N_3 = 5$$

$$10 \times p_1 = \textbf{Rs } 9$$

Mean reward upon head

Loss w.r.t. best coin

(Red in this case)


Rs 0


Rs 8


Rs 6

Total expected reward $= 9 \times N_1 + 1 \times N_2 + 3 \times N_3$

Total expected regret $= 0 \times N_1 + 8 \times N_2 + 6 \times N_3$

$$10 \times p_2 = \textbf{Rs } 1$$

$$10 \times p_3 = \textbf{Rs } 3$$

Regret is suffered only for pulling the sub-optimal arms

(blue and magenta in this case)

Simplifying Regret

Mean reward upon head	Loss w.r.t. best coin (Red in this case)	No. of times tossed
$10 \times p_1 = \text{Rs } 9$	Rs 0	$N_1 = 5$
$10 \times p_2 = \text{Rs } 1$	Rs 8	$N_2 = 3$
$10 \times p_3 = \text{Rs } 3$	Rs 6	$N_3 = 5$

Total expected reward $= 9 \times N_1 + 1 \times N_2 + 3 \times N_3$

Total expected regret $= 0 \times N_1 + 8 \times N_2 + 6 \times N_3$

Regret is suffered only for pulling the sub-optimal arms

(blue and magenta in this case)

Simplifying Regret

	Mean reward upon head	Loss w.r.t. best coin (Red in this case)	No. of times tossed
Coin 1	μ_1	0	$N_1(T)$
Coin 2	μ_2	$\mu_1 - \mu_2 = \Delta_2$	$N_2(T)$
⋮	⋮	⋮	⋮
Coin K	μ_K	$\mu_1 - \mu_K = \Delta_K$	$N_K(T)$

Total expected reward $= \mu_1 \times \mathbb{E}[N_1(T)] + \mu_2 \times \mathbb{E}[N_2(T)] + \cdots + \mu_K \times \mathbb{E}[N_K(T)]$

Total expected regret $= 0 \times \mathbb{E}[N_1(T)] + \Delta_2 \times \mathbb{E}[N_2(T)] + \cdots + \Delta_K \times \mathbb{E}[N_K(T)]$