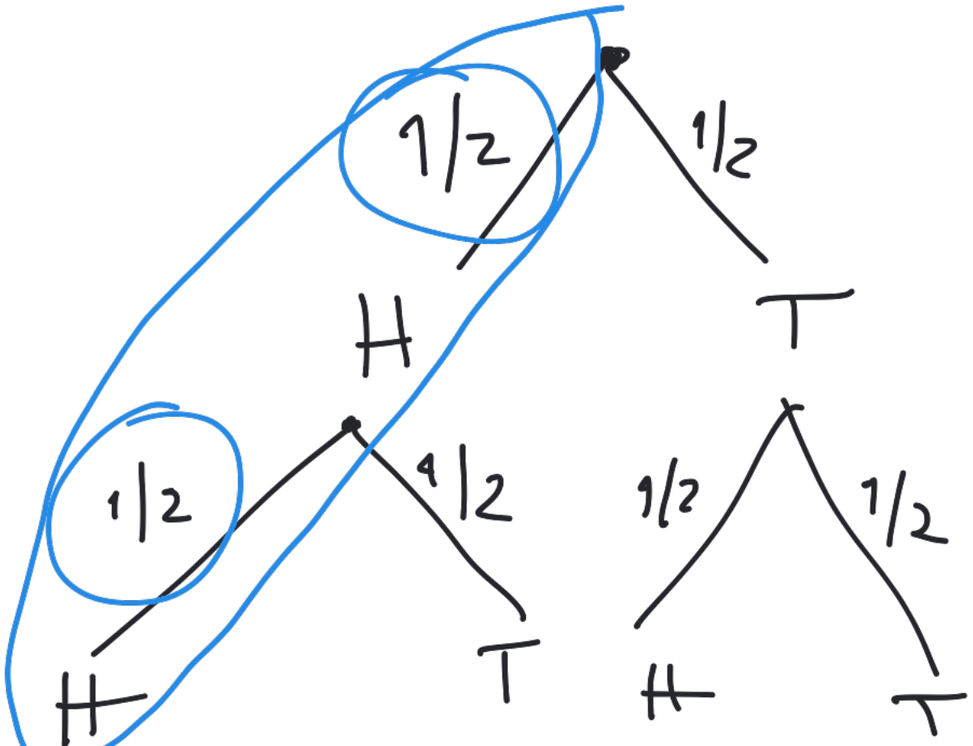
① Experiment: flip a fair coin twice




Is the exp. fair?

1st flip

YES!

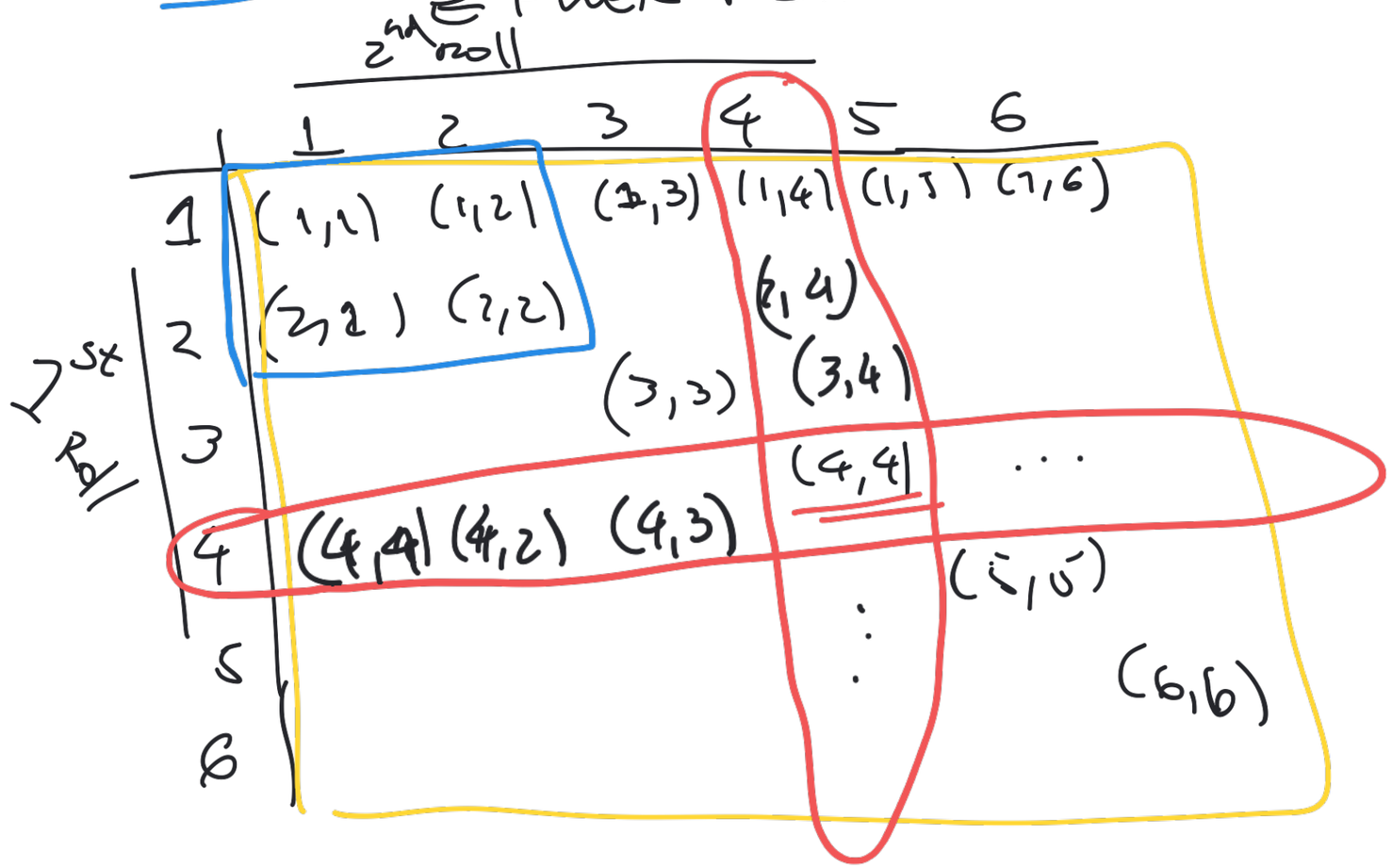
2nd flip

$$\Omega = \{(H,H),(H,T),(T,H),(T,T)\}$$

$$P((H,H)) = \frac{1}{2}\times\frac{1}{2} = \frac{1}{4} = P((H,T)) = P((T,H)) = P((T,T))$$

② Exp.: roll a 6-sided die 2 times

$E \equiv$ observing either 1 or 2 on either roll




$$P(E) = \frac{|E|}{|\Omega|} = \frac{4}{36}$$

$$\Omega = \{(1,1),(1,2),(1,3),\ldots,(6,6)\},\ |\Omega| = 36$$

$$E = \{(1,1),(1,2),(2,1),(2,2)\},\ |E| = 4$$

③ Exp.: Roll 6-sided fair die twice

$\Omega = \{(1,1),(1,2),\ldots,(6,6)\}$, $|\Omega| = 36$

$E \equiv$ at least one roll is 4

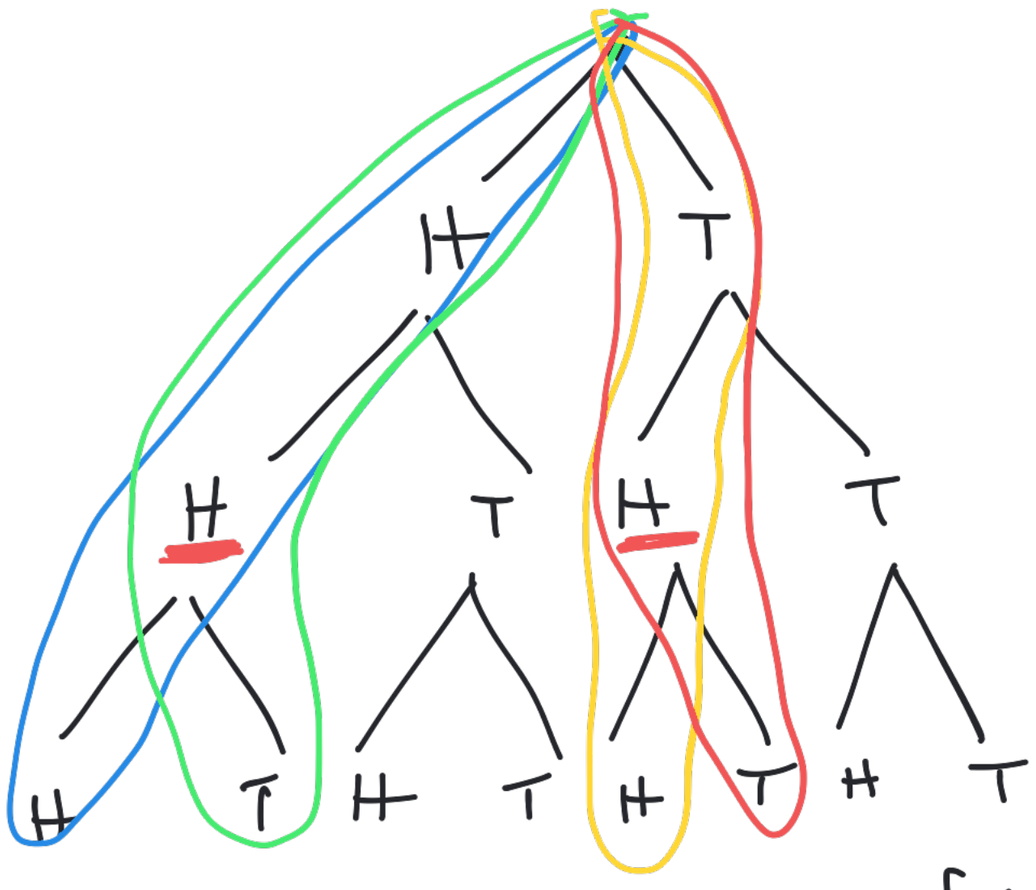
$E = \{(1,4),(2,4),(3,4),(4,4),(5,4),(6,4),$
$(4,1),(4,2),(4,3),(4,5),(4,6)\}$

$|E| = 11$

$$P(E) = \frac{11}{36}$$

④ Exp.: flip a fair coin 3 times

E = observing heads in 2nd flip




1st flip

2nd flip

3rd flip

$P(E) = \frac{4}{8}$

$|\Omega| = 8$

$E = \{(HHH), (HHT), (THH), (THT)\}$

⑤ Exp: flip coin 3 times

Sub-Exp. : # of heads in experiments

$|\Omega| = 8$ , $\Omega = \{(AAA), (HHT), (HTH), (HTT), (THA), (TAT), (TTT), (TTH)\}$

$S = \{0, 1, 2, 3\}$

↑ sample space for sub-experiment

E = it came up heads 2 times

$E = \{(HHT), (HTH), (THH)\}$

$P(E) = \frac{3}{|\Omega|} = \frac{3}{8}$

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$P(0 \text{ Heads}) = \frac{1}{8}$

$P(1 \text{ Heads}) = \frac{3}{8}$

$P(2 \text{ heads}) = \frac{3}{8}$

$P(3 \text{ heads}) = \frac{1}{8}$

Sub-exp is not fair