Lab 1 note (Thursday 9/10/20)

What is the probability of seeing a sum of 7 when rolling 2 fair dice?

$S = \{(1,1), (1,2), (1,3) \ldots\ldots (6,6)\}$

36 sample points

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

$|A| = 6 \quad |S| = 36$

$P(A) = \frac{6}{36} = \boxed{\frac{1}{6}}$

1st experiment

3, 2, 6, 8, 7 ← 4 rolls

2nd experiment

10, 11, 7 ← 2 rolls

⋮

100,000th exp. ← no. rolls

B

What is the probability of seeing sum of 7 after exactly 3 rolls?

1 roll : $\frac{1}{6} = 0.167$ → need 0 roll before it to see 7

2 rolls : $\frac{5}{6} \times \frac{1}{6} = 0.139$ → need 1 roll before it to see 7

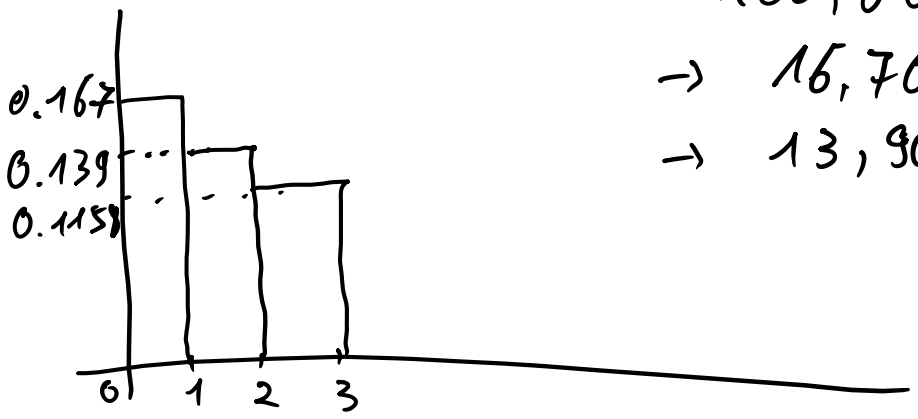
3 rolls : $\frac{5}{6} \times \frac{5}{6} \times \frac{1}{6} = 0.1158$

1st roll, 2nd roll, 3rd roll

5 6 8 ... (and) 5 6 8 ... (and) 7

⋮

n rolls :



100,000

→ 16,700 0 rolls

→ 13,900 1 roll

coin no. 1 2 3 ... 100

3) $a_1\ a_2\ a_3\ a_4 \ldots\ a_{100}$

$\downarrow\ \downarrow\ \downarrow\ \downarrow\ \qquad \downarrow$

$2 \times 2 \times 2 \times 2 \times \cdots \times 2$

Total posible outcomes: 2^{100}

Outcomes that has 35 heads:

$C(100, 35)$

Prob. of seeing 35 heads when tossing 100 coins: $\frac{C(100,35)}{2^{100}} = 8.63 \times 10^{-4}$

Method 2: binomial distribution

$$C(n, x) \times p^x \times q^{(n-x)}$$

n: 100
x: 35
p: $1/2$
q: $1/2$

$$\rightarrow C(100, 35) \times \left(\frac{1}{2}\right)^{35} \times \left(\frac{1}{2}\right)^{65}$$

$$= 8.63 \times 10^{-4}$$

random.randint(0, 1)

1st experiment:

0, 1, 0, 0, 1 1

$\downarrow\ \downarrow\ \downarrow\ \downarrow\ \qquad \downarrow$

coin1 coin2 3 4 ... 100

If you see 35 heads → count + 1

2nd experiment

0, 0, 1 1

count/ N (total experi -)

4) 4 Ones
4 Twos
4 Threes
⋮
4 kings

- cards poker draw

different kinds
(1, 2, 3 . . . , 13)

$$\underbrace{C(13,1) \times C(4,4)}_{\text{4 cards}} \quad \underbrace{C(48,2)}_{\text{2 cards}}$$

$$C(52,6)$$

$$= 0.0007.$$

$$\frac{C(13,1) \times C(4,4) \times C(48,1)}{C(52,5)}$$

5-card poker draw

$\{1,2,3,4\} \rightarrow \{$ Diamond Ax, Club Ax ... $\}$

$\{5,6,7,8\} \rightarrow \{$ Diamond two, Club two ... $\}$

$\{49,50,51,52\} \rightarrow \{$ Diamond king, club king ... $\}$

Creating a set of 6 random number in $[1,52]$

1, 5, 10, 12, 17, 18

↓

if in same kind -> count + 1

count / N

2) Toss a die 100 time:

No. 1 will occur: 10 times

2 " : 15 "

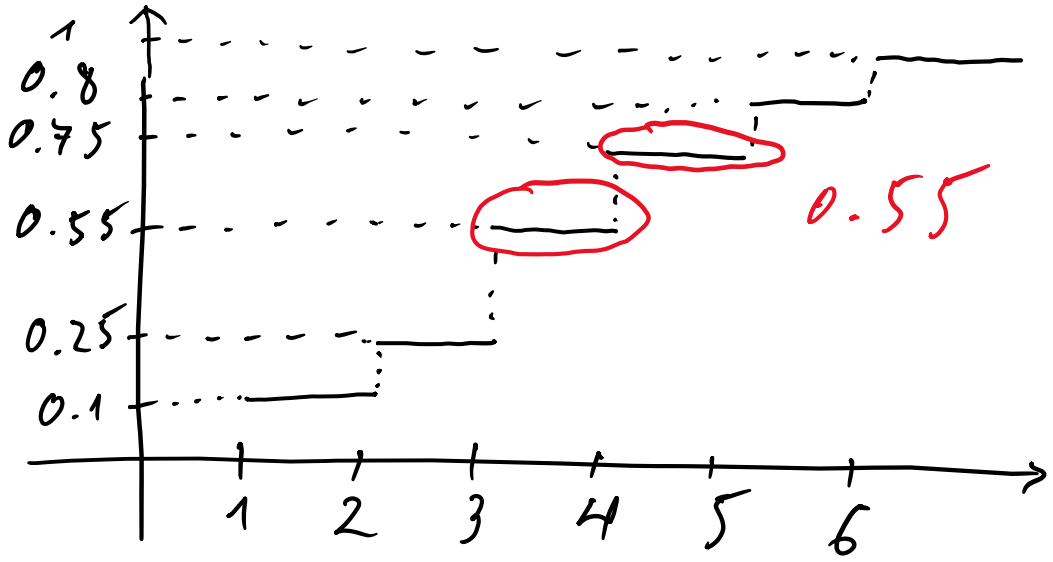
3 " : 30 "

4 " : 25 "

5 " : 5 "

6 " : 15 "

x	1	2	3	4	5	6
$f(x)$	0.1	0.15	0.3	0.25	0.05	0.15
$F(x)$	0.1	0.25	0.55	0.75	0.8	1



$r = 0.58$

$0.55 < r < 0.8$

3 4 4

Toss the die 10,000.

Using r : a random no. btw 0 & 1 to represent the no. of the die (1, 2, 3, 4, 5, 6)

1	2	3	4	5	6

$F = [0.1 \quad 0.25 \quad 0.55 \quad 0.8 \quad 0.85 \quad 1]$

$F = [0 \quad 0.1 \quad 0.25 \quad 0.55 \quad 0.8 \quad 0.85 \quad 1]$

1st toss

$r = 0.23$

$0.05 \in [0, 0.1)$

$\Rightarrow 1$

Check which range r is falling in

$[0.1, 0.25)$ or $[0.25, 0.55)$

.... $[0.85, 1)$

r is in $[0.1, 0.25)$

1 (2)

$\Rightarrow$ r represent no. 2.

$\Rightarrow$ the no. occuring on the 1st toss is (2).

$S = (10000, 1)$

$S[0] = 2$

2nd toss :

$r = 0.57$

$S[1] = 4$

check the range

$[0.55, 0.8]$

$\geq$ (4)

$\Rightarrow r$ represent no. (4).

⋮

10000th toss.

$S[9999] = 5$

$[x, y)$

(5)