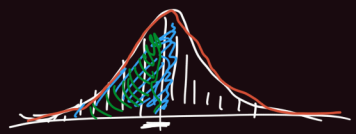
$X_i \sim \mathcal{U}(\{1, 2, \dots, 6\})$ $\mathbb{E}(X_i) = \frac{7}{2}$ $Var(X_i) = \mathbb{E}(X_i^2) - (\mathbb{E}(X_i))^2 = \frac{35}{12}$

$S_{24} = X_1 + \dots + X_{24}$ $\mathbb{E}(S_{24}) = 84$ $Var(S_{24}) = 70$

$S \sim \mathcal{N}(84, 70)$ $S \approx S_{24}$ en "loi"

$\mathbb{P}(S_{24} = 84) \simeq \mathbb{P}(S \in [84, 85[)$

pnorm(85) − pnorm(84)



rnorm
dnorm
p
q

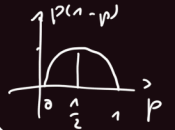
$Y = \begin{cases} S_{24} == 84 \rightsquigarrow 1 \\ \text{sinon} \rightsquigarrow 0 \end{cases}$

$N = 10000$

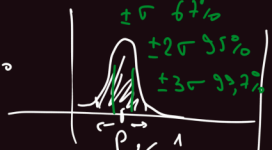
$\mathbb{E}(Y) = \mathbb{P}(S_{24} == 84) = p$

$Var(Y) = \mathbb{E}(Y^2) - \mathbb{E}(Y)^2$

$= p - p^2 = p(1-p)$



$S^Y_{10000} = \frac{Y_1 + \dots + Y_{10000}}{10\,000} \sim \mathcal{N}\left(p, \underbrace{p(1-p)/N}_{<\frac{1}{4}}\right)$



$\mathbb{P}\left(S^Y_N \in \left[p - \frac{2}{\sqrt{N}}, p + \frac{2}{\sqrt{N}}\right]\right) = 95\%$

$\mathbb{P}\left(p \in \left[S^Y_N - \frac{2}{\sqrt{N}}, S^Y_N + \frac{2}{\sqrt{N}}\right]\right) = 95\%$

X_i i.i.d

$S = X_1 + \dots + X_n \sim \mathcal{N}(N\mathbb{E}(X), Var(X)_{*n})$

$\frac{S}{N} \sim \mathcal{N}\left(\mathbb{E}(X), \frac{Var(X)}{N}\right)$

$0{,}04733 \qquad N = 100000$

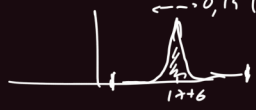
$1 \pm \frac{1}{\sqrt{10^5}} = 0{,}00316$

$X \sim \mathcal{U}[1774, 1778]$ $\mathbb{E}(X) = 1776$ $Var(X) = \frac{4}{3}$

$\frac{a+b}{2}$ $\frac{(b-a)^2}{12} = \frac{16}{12} = \frac{4}{3}$

$S_{18} = \frac{X_1 + \dots + X_{18}}{18} \sim \mathcal{N}\left(1776, \frac{4}{3 \times 18}\right)$

$\mathbb{P}(S_{18} \in [1775, 1777]) =$

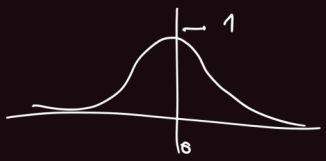


$pnorm(1777, \dots) - pnorm(1775, \dots)$

$$\mathbb{E}(X) = \int_a^b x \cdot \frac{1}{b-a}\, dx = \left[\frac{x^2}{2}\right]_a^b \cdot \frac{1}{b-a} = \frac{b^2 - a^2}{2(b-a)} = \frac{b+a}{2}$$

$$\mathbb{E}(X^2) = \int_a^b \frac{x^2}{b-a}\, dx = \left[\frac{x^3}{3}\right]_a^b \frac{1}{b-a} = \dots$$

$\sqrt{\frac{4}{3 \cdot 18}} = 0{,}272$



$\frac{1}{0{,}272}$

$-3{,}67$ $\qquad$ $3{,}67$

$\frac{1}{0{,}272} \mid \cdot$

$1 \qquad 1$

$X = \begin{cases} 2 & \text{avec proba } \frac{1}{4} \\ -1 & \text{——— } \frac{3}{4} \end{cases}$ $\quad \mathbb{E}(X) = -\frac{1}{4} \quad \mathbb{E}(X^2) = \frac{1}{4} \times 4 + \frac{3}{4} \times 1 = \frac{7}{4}$

$\mathrm{Var}(X) = \mathbb{E}(X^2) - \mathbb{E}(X)^2 = \frac{7}{4} - \frac{1}{16} = \frac{27}{16}$

$\mathbb{P}(S_{240} > 0) =$

$S_{240} \sim \mathcal{N}\left(-60, \frac{27 \times 240}{16}\right)$