sprint 3 – deliverables
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① the newton-pepys problem

$P(X \geq 1 \text{ 6 in 6 rolls}) = 1 - P(B)^6$ ← total probability

$\boxed{P(X \geq 1 \text{ 6 in 6 rolls}) = .665102023319 6159}$

A - getting a six
B - getting anything else
P(A) - 1/6
P(B) - 5/6

$P(X \geq 2 \text{ 6 in 12 rolls}) = 1 - P(X=0) + P(X=1)$
$= 1 - P(B)^{12} + \binom{12}{1} * P(B)^{11} * P(A)^1$

$\boxed{P(X \geq 2 \text{ 6 in 12 rolls}) = .6186673737}$

$P(X \geq 3 \text{ 6 in 18 rolls}) = 1 - P(X=0) + P(X=1) + P(X=2)$
$= 1 - P(B)^{18} + \binom{18}{1} * P(B)^{17} * P(A)^1 + \binom{18}{2} * P(B)^{16} * P(A)^2$

$\boxed{P(X \geq 3 \text{ 6 in 18 rolls}) = .5973456859}$

(*) The proposition with the greatest chance of success is the first: getting at least one 6 in 6 rolls

② geometric urn

$E[X] = 1/p = 20$ ← expected number of draws to draw first red ball

total number of balls - 100

$E[X] = 1/20 = \text{redBalls}/100$
$100 * (1/20) = (\text{redBalls}/100) * 100$
$5 = \text{redBalls}$
$\text{blackBalls} = \text{totalBalls} - \text{redBalls}$
$\text{blackBalls} = 95$

$\boxed{\begin{array}{l}\text{estimated number of red balls} = 5 \\ \text{estimated number of black balls} = 95\end{array}}$

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③ dragon dice

$P(0) = P(B)^3$
$P(1) = \binom{3}{1} * P(B)^2 * P(A)^1$
$P(2) = \binom{3}{2} * P(B)^1 * P(A)^2$
$P(3) = P(A)^3$
↑ number of die that match hermione's pick

A - match		-1	amount for no match
B - no match		1	amount for one match
P(A) - 1/6		2	amount for two matches
P(B) - 5/6		3	amount for three matches

$P(0) = .5787037037$
$P(1) = .3472222222$
$P(2) = .0694444444$
$P(3) = .0046296296$

$E[X] = (-1)(P(0)) + (1)(P(1)) + (2)(P(2)) + (3)(P(3))$
↑ expected outcome (amount won) for playing dragon dice

$E[X] = -.0787037039$