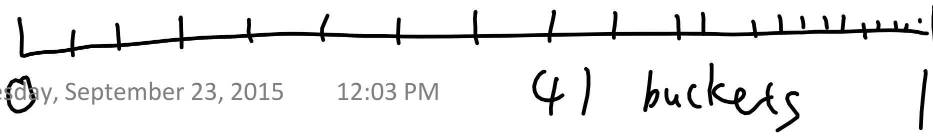
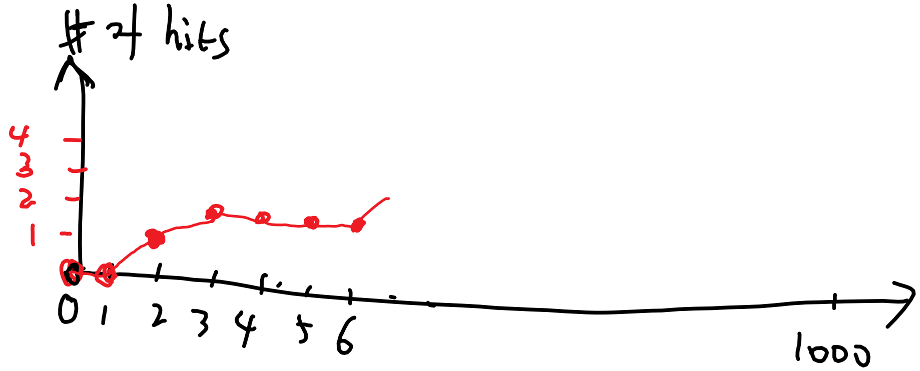


① generate 1 U

② find which bucket U falls in?

$i = 10 \rightarrow X = 9$

1000 times

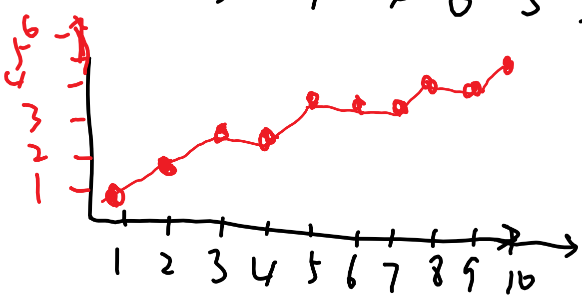


X=0, appear 2 times

X=1, appear 1 time

X=2, " 4 times

[1 3 4 4 6 5 3 2 5 4] ← 10 samples for dice rolling



sort [1 2 3 3 4 4 4 5 5 6]

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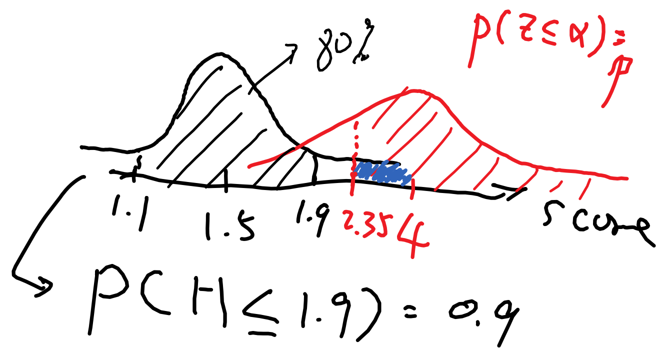
r.v. H: normal email score $H \sim N(1.5, \sigma^2)$

S: spam email score $S \sim N(4, 1^2)$



define r.v. $Z \sim N(0,1)$ $Z = \frac{H - 1.5}{\sigma}$

$P(H \le 1.9) = P\left(Z \le \frac{0.4}{\sigma}\right) = 0.9$ checking normal table, we know $\frac{0.4}{\sigma} = 1.3 \Rightarrow \sigma = 0.3$

Q1: find Threshold, T, $P(S \ge T) = 0.95$?

define r.v. $Z = \frac{S-4}{1}$ then $Z \sim N(0,1)$

$P(S \ge T) = P(Z \ge T - 4) = 0.95 \Rightarrow P(Z \le T-4) = 0.05$

look up normal table, we know $T - 4 = -1.65 \Rightarrow T = 2.35$

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Q_2 : $P(H \geq T)$? $T = 2.35$ $P(H \geq 2.35)$?

we know $H \sim N(1.5, 0.3^2)$

define r.v. $Z = \frac{H - 1.5}{0.3}$, then $Z \sim N(0,1)$

$P(H \geq 2.35) = P\left(Z \geq \frac{2.35 - 1.5}{0.3}\right) = P(Z \geq 2.8)$

$= 1 - P(Z < 2.8) = 1 - 0.9974 = 0.0026$

Binomial $\sim B(n=2000, p=0.001)$ Poisson $\lambda = np = 2$

Q_a : $P(X=3) = e^{-2} \cdot \frac{2^3}{3!}$ Q_b: $P(X>2) = 1 - P(X \leq 2)$

$$P(X = k) = e^{-\lambda} \frac{\lambda^k}{k!}$$

Q_3 $E[N] = \frac{1}{p} = 1000$

$Y = \max(X_1, X_2, \cdots, X_n)$

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$Z = \min(X_1, X_2, \cdots, X_n)$

$p(X \le t)$, $p(X > t)$

$p(Y \le t)$?

suppose exp. distr.

$p(X \le t) = 1 - e^{-\lambda t}$

$p(X > t) = e^{-\lambda t}$

$$p(Y \le t) = p(X_1 \le t, X_2 \le t, X_3 \le t, \cdots X_n \le t)$$

$$= p(X_1 \le t) \cdot p(X_2 \le t) \cdots\cdots p(X_n \le t) = [1 - e^{-\lambda t}]^n$$

$$p(Z \le t) = 1 - p(Z > t) = 1 - p(X_1 > t, X_2 > t, \cdots X_n > t)$$

$$= 1 - p(X_1 > t) \cdot p(X_2 > t) \cdots p(X_n > t)$$

$$= 1 - e^{-\lambda n t}$$

last 3 flips

$\{0\ 1, \underbrace{1}$

$\{1, \underbrace{0\ 1}$