Random variable

Random process ⟶ outcomes ⟶ numbers

$$X = \begin{cases} 1 \longrightarrow \text{head} \\ 0 \longrightarrow \text{tail} \end{cases}$$

↳ random variable

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Y = Sum of upward face after rolling 7 dice

$P(Y \leq 30) = P(\text{sum of} \ldots \text{is} \leq 30)$

X = number of cars pass in an hour

Ahmed —Pick→ 2 no. (0 ⟶ 9)

—pick→ one letter من 26

ticket matches 2 numbers and 1 letter ⟶ Price 10,405

~~tick~~ letter match and one or both don't match ⟶ loss

X = net profit from play — **04R**

$$E(X) = P(\text{big Price}) * (10405 - 5) + P(\text{small Price}) * (100 - .5)$$

$P(\text{big Price}) = \frac{1}{10} * \frac{1}{10} * \frac{1}{26}$ — احتمالية انه يكسب الكبيرة * نفسها

$P(\text{small Price}) = \frac{1}{26} - \frac{1}{2600}$ — احتمالية انه يكسب الصغيرة

$E(X)$ ↳ expected profit

$$+ P(\text{niether}) * (-5)$$

$P(\text{niether}) = 1 - P(\text{small}) - P(\text{grand})$ — او انه ملحابة من دل حاجة

10 trout 10 sunfish

- bet 1 → 3 fish → sunfish → 100$ (Paythin) ; otherwise 20$ (Pay you)
- bet 2 → at least 2 sunfish of next 3 fish → 50$; otherwise 25$

1. what is the Expected value of bet 1?

X = (what you profit from bet 1)

ttt
tts
tss
sss
sst
sts

$E(X) = P(3\text{ sunfish}) \cdot (-100) + (1 - P(3\text{ sunfish})) \cdot (20)$

$= 5$

$P(\text{getting one sunfish}) = \frac{10}{20} = \frac{1}{2}$

$P(3\text{ sunfish}) = \frac{1}{2} * \frac{1}{2} * \frac{1}{2}$

2. what is the Expected value of bet 2?

Y = what you profit of bet 2

$E(Y) = P(\text{at least 2 sunfish of 3}) \cdot (50) + (1 - P(\text{at least 2 sunfish of 3}))(-25) = 125$

✓ sss
✓ sst
✓ sts
✓ tss
× stt
× tst
× tts
× ttt

$\frac{4}{8}$

Prob (score) = 0.7

Prob (miss) = 0.3

P(Exactly 2 scores in 6 attempts) = $(0.7)^2 \cdot (0.3)^4 \cdot 15$

(2 scores, 4 misses, عدد مرات الحدوث)

0.3 0.3 0.3 0.3

S S M M M M

0.7 0.7

$_6C_2 = \frac{6!}{2!(6-2)!}$

M S M S M M

0.3 0.7 0.3 0.7 0.3 0.3

عدد مرات الحدوث نفسها = 15

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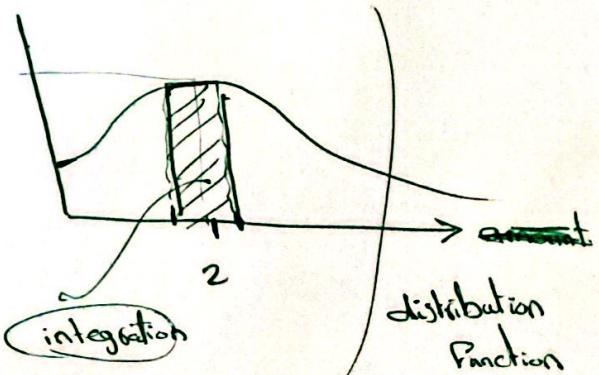
2 types of random variable

discrete
- → distinct - Separate values
- → Finite
- → Can not infinite
- → they do tend to be integers but not have to be integers

Continous
any value in interval
- → infinite
- → amount ✓



طب ازاى هنا هقول ان عايزة مثلاً exactly حاجة معينة

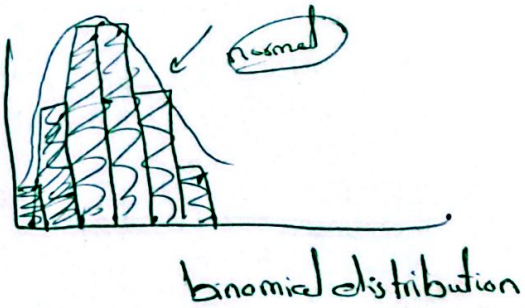
$$P(1.9 < Y < 2.1) \equiv P(|Y-2| < 0.1)$$

almost 2

Visualization of abinomial distribution

الاحتمالات → discrete ✓

على شكل Histogram



binomial distribution

term Life insurance and death prob ✓

X = number of success with pubability p after n trials

$E(X) = n.p$

X = number of basket I make after 10 shots

P = 48%

$E(X) = n.p =$

$$P(X=K) = \binom{n}{k} p^{k} (1-p)^{n-k}$$

Law of large numbers

X , $E(X)$

$\overline{X}_n = \frac{X_1 + X_2 + X_3 + \cdots}{n}$ sample mean

mean of n observation of our random variable

$\overline{X}_n \longrightarrow E(X)$ $\quad n \longrightarrow \infty$ large sample

$\overline{X}_n \longrightarrow \mu$