Probability Distribution:

26 October 2022 09:23

Distributions

$S = \{HHH, HHT, HTH, THH, TTT, TTH, THT, HTT\}$

X = head

probability distribution function $P(x)$

X	P(x)
0	1/8
1	3/8
2	3/8
3	1/8
	1

$P(x=0) = 1/8$

$P(x=1) = 3/8$

$P(x=2) = 3/8$

$P(x \le 2) = F(x)$ ← Cummulative distribution function

X	P(x)	F(x)
0	1/8	1/8
1	3/8	4/8
2	3/8	7/8
3	1/8	8/8 = 1

$P(x \le 2) = 7/8$

$= P(x=1) + P(x=2) + P(x=0)$

$P(x>1) =$

$P(x>1) + P(x \le 1) = 1$

$P(x>1) = 1 - P(x \le 1)$

$= 1 - F(x)$

mean $= \sum x\, P(x)$

$= 0 \times 1/8 + 1 \times 3/8 + 2 \times 3/8 + 3 \times 1/8$

$P(x<3) = P(x \le 2)$

$= 0 + 3/8 + 6/8 + 3/8 = 12/8 = 1.5$

	x	Sum	probabilities	cummulative_probs
0	2	1	0.028	0.028
1	3	2	0.056	0.084
2	4	3	0.083	0.167
3	5	4	0.111	0.278
4	6	5	0.139	0.417
5	7	6	0.167	0.584
6	8	5	0.139	0.723
7	9	4	0.111	0.834
8	10	3	0.083	0.917
9	11	2	0.056	0.973
10	12	1	0.028	1.001

$P(x \le 3) = F(3) = 0.084$

$P(x \le 10) = F(10) = 0.917$

$P(x<9) = P(x \le 8) = F(8) = 0.723$

$P(x>10) = 1 - P(x \le 10)$

$= 1 - F(10) = 1 - 0.917$

Mean $= \sum x \cdot P(x)$

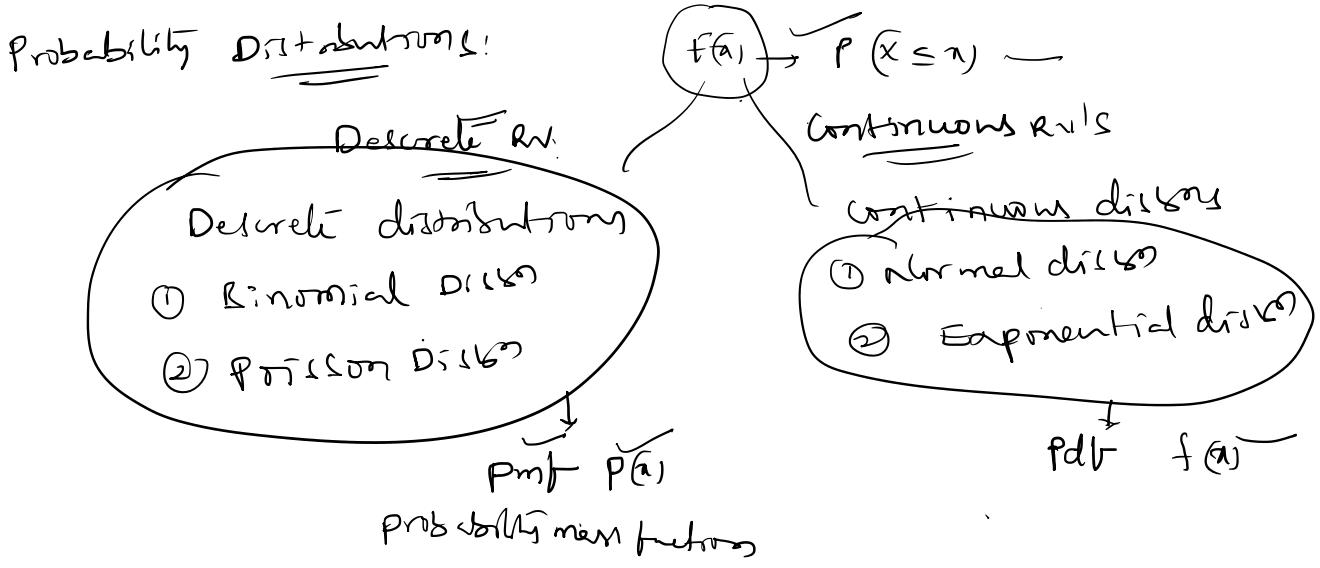
Variance $= \sum x^2 \cdot P(x) - (\text{mean})^2$

A local club plans to invest $10000 to host a baseball game. They expect to sell tickets worth $15000 . But if it rains on the day of game, they won't sell any tickets and the club will lose all the money invested. If the weather forecast for the day of game is 20% possibility of rain, is this a good investment?

X	P(x)
	0.8

mean $= \sum x \cdot P(x)$

A company makes electronic gadgets. One out of every 50 gadgets is faulty, but the company doesn't know which ones are faulty until a buyer complains. Suppose the company makes a $3 profit on the sale of any working gadget, but suffers a loss of $80 for every faulty gadget because they have to repair the unit. Check whether the company can expect a profit in the long term.



Binomial Distribution:

① we have 'n' independent trails

② each trail having same outcomes

n — trails

x — success

p — P(success)

q — P(failure)

$$P(x) = {}^{n}C_{x} \cdot p^{x} \cdot q^{n-x}$$

10 times tossing a coin

$$P(2) = {}^{10}C_{2} \cdot \left(\tfrac{1}{2}\right)^{10} \cdot \left(\tfrac{1}{2}\right)^{10-2} = \square$$

2 tossing

3 — dice $6^3 = 216$

{HH HT TT TH}

$P(2\text{ heads}) = \frac{1}{4}$

2 throwing dice.

An agent sells life insurance policies to five equally aged, healthy people. According to recent data, the probability of a person living in these conditions for 30 years or more is 2/3. Calculate the probability that after 30 years:

1. All five people are still living.
2. At least three people are still living.
3. Exactly two people are still living.

① $n = 5$, $P(\text{living}) = \frac{2}{3}$, $P(\text{die}) = 1 - \frac{2}{3} = \frac{1}{3}$

$P(5 \text{ living}) = {}^{n}C_{x} \, p^{x} \, q^{n-x} = {}^{5}C_{5} \cdot \left(\frac{2}{3}\right)^{5} \cdot \left(\frac{1}{3}\right)^{5-5}$

$= 1 \cdot \left(\frac{2}{3}\right)^{5} \cdot 1 = \left(\frac{2}{3}\right)^{5}$

② $P(x \geq 3) =$

③ $P(x = 2) =$