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(1) • Binomal destribution - determines number of successes in fixed number of attempts. In each attempt has probabity of sucess (p), and probability of failure $(q = 1-p)$

example: coin flipped 7 times - what prob of of gaining 3 heads?

$n = 7 \quad p = \frac{3}{7} \quad k = 3$

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

• Geometric disteibution - deteemins number of attempts until first success obtained in this sequenee - each has p

x - number of attempts
p - prob of success

$$P(x=k) = (1-p)^{k-1} \cdot p$$

example: peeson rolls six-sided die until get a six, what is the prob that they need to roll the die 3 time?

$$P(x=3) = (1-\tfrac{1}{6})^{3} \cdot \tfrac{1}{6} \approx 0.1494$$

(2) Classical - $P(A) = \frac{\text{favorable results}}{\text{total amount of results}}$ => it's measure of likehood of eevent happening

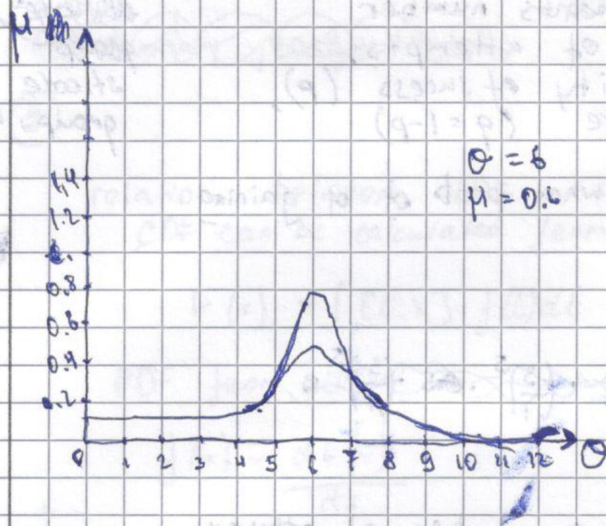
Requrements -
- the outcomes must be equally likely
- the outcomes must be countable

Statical - prob measure of the degree of expected event happening. stands on well-known data.

event A - $P(A) = \frac{p(A|D) \cdot p(A)}{p(D)}$

requrements - data knowledge about event
- requres model specification

③ Plot



Effects

④

CLT

let x_1, x_2, x_n be identicaly disteibuted, random vars
- their mea would be μ
- their variance θ^2

$n \to \infty$ - the desteibution of sample mean

$$\frac{(x_1 + x_2 + \dots + x_n)}{n} \sim N\left(\mu, \frac{\theta^2}{n}\right)$$

~~CLT - states that the sample mean~~

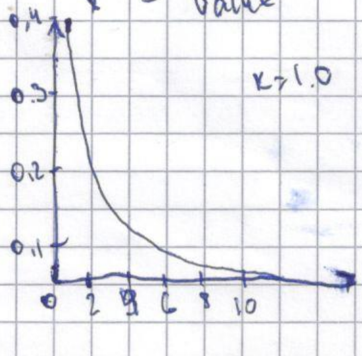
- CLT is fundamental result in probability theory
- CLT ~~oft~~ often used to approximate sample men, when it's size is large

⑤

gamma desteibution
- often used to model the amount of time untile a event happens

$$f(x) = \left(\frac{x^{(k-1)}}{\Gamma(k)}\right) \cdot e^{\frac{-x}{\theta}}$$

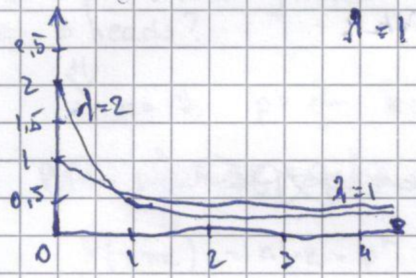
k - shape param
θ - scale param
Γ(k) - gamma function
x - value



exponential destribution
- time between events, used to estimate time until failure

$$f(x) = \lambda e^{-\lambda x}$$

x - time   λ - rate



⑥

Prior prob
- prob of event or hypotesis happening before new data obtained.

Posterior prob
- prob of event or hypotesis after new data is obtained.

Bayesrule

$$P(H|D) = P(D|H) \cdot \frac{P(H)}{P(D)}$$

P(H|D) - posterior prob (with new data)
P(D|H) - likehood
P(H) - prior prob (initial data)
P(D) - marginal prob (inspecting data regardless of event)

⑦

For large sample is constructed using CLT

the confidence interval for μ is:
1) - calc $\bar{x}$ - sample mean, s - standart deviation
2) - calc SE - standart error of $\bar{x}$
3) - calc z' - critical value

$$z' = \Phi^{-1}\left(1 - \frac{a}{2}\right)$$ Φ - cumulative distribution

4) construct confidence interval

$$\bar{x} \pm (z' \cdot SE)$$

width of interval depends:
- sample size (n) - size increases → width of interval decreasos
- (a) - confidence level - (a) higher → interval become wider

~~Prediction~~

~~4) Summary, large samples~~

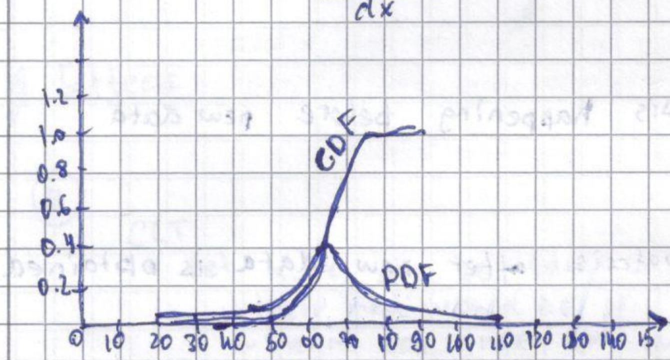
8

relation between CDF and PDF
CDF can be calculated from PDF with:

$$F(x) = \int [0, x] f(t) dt$$

PDF from CDF:

$$f(x) = \frac{dF(x)}{dx}$$



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random event
- situation or result ~~of unpredictable~~ which cannot be predicted
- may not happened at all
- result not determined by anything

example: rolling die, drawing card from deck, flipping coin

Random variable:
- math interpretation of random event
- it's a function which assigns value to each possible outcome of event

example: result of flipping coin can be represented as x, x=0 - coin lands on heads, x=1 - coin lands on tails

differences
- event is uncertain situation, variable is math interpretation of that outcome

continue on ~~next~~ additional pages...

(10) Inconsistent events - cannot occur at one moment => if one event occur, the other cannot

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$A: P(A) = 0.5$
$B: P(B) = 0.3$

$P(A \cap B) = 0$

Independed: can occur at one moment and are independed

$A: P(A) = 0.4$
$B: P(B) = 0.2$

$P(A \cap B) = P(A) \cdot P(B) = 0.08$

difference
- incosistent - cannot happen simultaneosly,
- independed - can happen simultaneosly

(11)

1) determine H0 - null hypothesis
H1 - alternative hypothesis

2) choose significance levea (α)

~~collect data~~ 3) calc test statistic

t-test example

$$t = \frac{(\bar{x}_1 - \bar{x}_2)}{s / \sqrt{n}}$$

4) determine critical interval - range of values where we reject H0

(12)

formulation:

$x_1, x_2 \ldots x_n$ - sequence of random vars
determine mean and variance are equal to λ
Let $S = x_1 + x_2 + \ldots x_n$ be sum of the first n vars

theorem states that $\lim_{(n \to \infty)} P(S \leq k) = P(\text{Poisson}(\lambda) \leq k)$

~~P(Poisson (λ) ≤ k) = prob that poissond varz with λ param~~

Proof:

~~step~~ - 1) S - characteristic