

AZTERKETA 1

1. AKATS KOPURUEN BIDEKO KONTROLA

60

10m²-ko 50 lagun \rightarrow 100 akats

A) Akats kopuru totalen grafikoen limiteak

• $\lambda = \frac{100 \text{ akats}}{10 \cdot 50 \text{ lagun}} = 0,2 \text{ akats/m}^2$ **AKATS TASA**

• $W \rightarrow$ akats kopuru totala 10m² tan

KONSOLIDARIO PROPIETATEA $W \sim P(n\lambda) \rightarrow W \sim P(10 \cdot 0,2)$

Prinsipioz $\lambda > 2$ deretan ezin da

LTZ aplikatu, BAINA

\downarrow LTZ

$W \sim N(2\sqrt{2})$

$GL = n\lambda + 3\sqrt{n\lambda} = 2 + 3\sqrt{2} = 6,24$

$BL = n\lambda - 3\sqrt{n\lambda} = 2 - 3\sqrt{2} < 0 \rightarrow = 0$

B) $\lambda = 0,18 \text{ akats/m}^2$

\hookrightarrow Tasa hobea (akats gutxiago m²-ko)

Ekoizlearen ariskua $\rightarrow \alpha$?

$W \sim P(1,8)$ \rightarrow $W \sim N(1,8; \sqrt{1,8})$ (LTZ)

GOI LIMITEA

$\alpha = P(\text{KANPOAN OUDO EGONDA}) = P(W > 6,24) =$

$1 - P(W < 6,24) = 1 - F(3,3) = 1 - 0,9995 = 0,0005$

$\cdot 0,5$

2

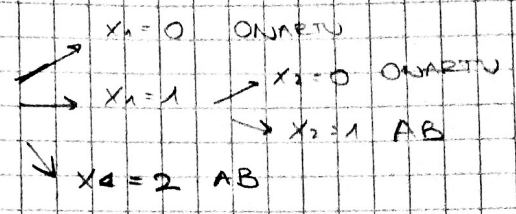
Plan bikaitze
N = 10.000
Kuskatzea 1

Zonortasun normala
AQL = % 0,65

A) Eroslearen oniskua (β) % 1 Akats tasa $\rightarrow p_0 = 0,01$

HIZKIA $\rightarrow j$

50	0	2
50	1	2



$$\beta = P(\text{ONARTU} | p = 0,01) = P(x_1 = 0) + [P(x_1 = 1) \cdot P(x_2 = 0)] =$$

$$= \binom{50}{0} \cdot 0,99^{50} \cdot 0,01^0 + \left[\binom{50}{1} \cdot 0,99^{49} \cdot 0,01^1 \cdot \binom{50}{0} \cdot 0,99^{50} \cdot 0,01^0 \right] =$$

$$= 0,6 + [0,3 \cdot 0,6] = 0,78$$

B) 100 sorta elaitzi \rightarrow Gehenera 20 batzertuak?

W \rightarrow batzertutako sorta kop. $\rightarrow W \sim b(n=100, p=\text{Prob(batzertu)})$

$$P(\text{batzertu}) = 1 - P(\text{onartu}) = 1 - 0,78 = 0,22$$

LTZ $\left\{ \begin{array}{l} npq > 5 \\ n > 30 \end{array} \right. \rightarrow W \sim N(22; 4,14)$

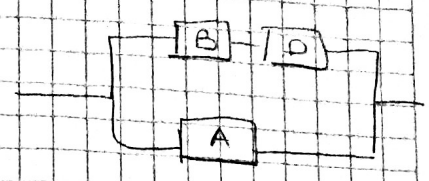
$W \sim b(100; 0,22)$

$$P(\text{Prob}(W \leq 20)) = \text{Prob}(Z \leq -0,48) = 1 - F(0,48) =$$

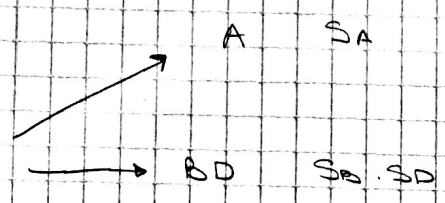
$$= 0,6844$$

3 FIDAGARRITASUNA

- A berria
- B 10h adina → ikuskatu ✓
- D 20h adina → Ez da ikuskatu



A) 100h → MTF Jusioa → 120h
 Espontzialak



Paraleloak direnez, posibilitate bakoitz lan egiteko modu sistematik funtzionaturiko du.

$$S_{SMA} = S(A) + S(BD) - S(A, BD) = S_A + S_B S_D - S_A S_B S_D = S_A + (1 - S_A) S_B S_D = S_A + F_A S_B S_D$$

• MTF = 100 → $\lambda = 1/100$ → $S(t) = e^{-t/100}$
 $F(t) = 1 - e^{-t/100}$

(A) $S_A(120) = e^{-120/100} = 0,3$
 $F_A(120) = 1 - 0,3 = 0,7$

(B) $S_B(120) = S_B(10, 130) = \frac{S_B(130)}{S_B(10)} = \frac{e^{-130/100}}{e^{-10/100}} = 0,3$

↳ Espontzialak mantentzen ez direnez adinorik ez dute esan jenetan, eta eraitza berdinean berria jentzen.

(D) $S_D(120) \rightarrow S_D(120 + 20) = S_D(140) = e^{-1,4} = 0,25$

$S_{SMA} = 0,3 + (0,7 \cdot 0,3 \cdot 0,25) = 0,35$

B)

Hiru osagaien dentsitate funtzioa

Dentsitate funtzioa

$$f(x) = k$$

$$0 < x < 50$$

$F(30)$? (DESFI DAGARITASUNA)

↑
↓
tante konstante integratuko dugu

$$f(t) = \frac{1}{b-a} = \frac{1}{50-0} = \frac{1}{50}$$

INTEGRATUE

$$\hookrightarrow F(t) = \int f(t) dt = \int \frac{1}{50} dt = \frac{t}{50}$$

$$\textcircled{A} S_A(30) = 1 - \frac{30}{50} = 0,4 \quad \rightarrow F_A = 0,6$$

$$\textcircled{B} S_B = \frac{S_B(40)}{S_B(10)} = 0,25$$

$$\textcircled{D} S_D = 1 - \frac{50}{50} = 0$$

$$S_{SMA} = S_A + F_A S_B S_D = 0,4 + 0,6 \cdot 0,25 \cdot 0 = 0,4$$

$$F_{SMA} = 1 - S_{SMA} = 1 - 0,4 = 0,6 \quad \text{DESFI DAGARITASUNA}$$

AZTERKETA 2

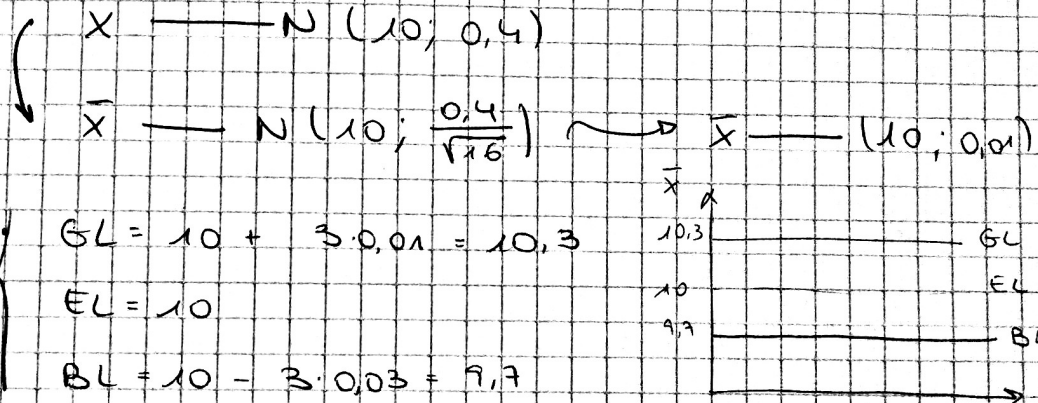
1) BETERORAK $\rightarrow 10^{11,5}$
 ZENTRATUA $GI = 1,25$

A) Kontrol grafikoa lineal? Lagin batzuetarako
 $n = 16$ 60 irizpidea

DESBIERATZEN
 \uparrow

$M_p = 10$ $GI = GI_p$

$GI = \frac{\text{Tolerantzia tartea}}{6\sigma_p} = 1,25 = \frac{11,5 - 8,5}{6\sigma_p}$ $\sigma_p = 0,4$



B) Bariantza bikoiztu $\rightarrow \sigma^2 = 2 \cdot 0,4^2 \rightarrow \sigma = 0,5657 = \sigma_p$

$\bar{X} \sim N(10; \frac{0,5657}{\sqrt{16}})$ $\bar{X} \sim N(10; 0,1414)$

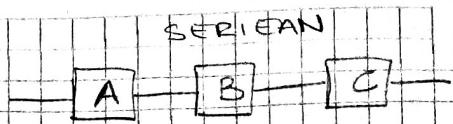
$\beta = P(\text{ONARTU gauzi esakoa}) = P(\bar{X} \text{ BARRUN}) = \text{Prob}(9,7 < \bar{X} < 10,3) =$
 $= F(2,12) - (1 - F(2,12)) = -1 + 2F(2,12) = 0,966$

C) Bariantza mantendu, m_p aldatu $\rightarrow M_p$
 Lagin bat lurretatik kanpo esakoa prob (gaitur) = 0,01 bada

$\bar{X} \sim N(m, 0,01)$

$\text{Prob}(\bar{x} > 10,3) = 0,01 \xrightarrow{\text{Tip. platu}} 10,27 = M_p$

2 FIDAGARRITASUNA



- (A) kemia $\lambda = 0,03$
- (B) adna 4h ~~ikusker~~ $\lambda_B = 0,03$
- (C) adna 5h ~~ikusker~~ \checkmark Borteko normala $M=10$ $V=3$

A) Misia \rightarrow 10h Fidagaritasuna?

$$S_{SMA}(10) = S_A \cdot S_B \cdot S_C \quad (\text{SERIEAN})$$

$$(A) S_A(10) = e^{-0,03 \cdot 10} = 0,741$$

$$(B) S_B(10+4) = e^{-0,03 \cdot 14} = 0,657$$

↳ (ikuskeratu gabel)

$$(C) S_C(15/5) = \frac{S(15)}{S(5)} = \frac{0,048}{0,952} = 0,05$$

$$\textcircled{*} S(15) = P(T_c > 15) = P\left(z > \frac{15-10}{3}\right) = P(z > 1,66) = 0,048$$

$$\textcircled{*} S(5) = P(T_c > 5) = P\left(z > \frac{5-10}{3}\right) = P(z > -1,66) = 0,952$$

HORTAZ

$$S_{SMA}(10) = 0,741 \cdot 0,657 \cdot 0,05 = 0,0243$$

B) B \rightarrow $\frac{5h}{}$ ordeakatu D fidagaritasuna (Misia 10h)
BERRIA

Berez deno kemia kalkulatu alako gure, baina seriean dardenera badakigu osagai guztiak lan egin behar dituela.

$$S_{SMA} = S_A \cdot S_B \cdot S_C \cdot S_D$$

$$S_B(5+4) = S_B(9) = e^{-0,03 \cdot 9} = 0,763$$

$$S_D(5) = e^{-0,03 \cdot 5} = 0,861$$

Beste biet
orde jartzen
dute

$$S_{SMA}(10) = 0,741 \cdot 0,763 \cdot 0,861 \cdot 0,05 = 0,02433$$

c) Paralel → des fidajrosuna ?

$$F_{\text{sm}}(10) = F_A(10) \cdot F_B(14) \cdot F_C(5,15) = \\ = (1 - 0,741) \cdot (1 - 0,657) \cdot (1 - 0,057) = 0,084$$

3

Loteji baxitak 2000 unitate dartei
1/2 abots maila (B)
AQL = 14

A) $n = 1000$ 10-eko lagreen abots bat → Baxtertu
Baxtertu → 1000 €
Espedizio kostua (sahatua) → 500 €

B) $n = 250$ plan bikariz
ikuskatua. Zonotasa NORMALA
Baxtertu → 250 €
Espedizio kostua → 150 €

A) Lotegen gteen kosturik baxuea ? baxterte-espeditio

A) $10 \mid 0 \mid 1$ $X \sim b(10; 0,02)$

• $P(\text{ONARTU}) = P(X=0) = 0,98^{10} = 0,81$

• $P(\text{BAXTERTU}) = 1 - P(\text{ONARTU}) = 1 - 0,81 = 0,19$

→ Baxterte & espeditio = $(0,81 \cdot 1000) - (0,19 \cdot 500) = 595$

B) $\begin{array}{c|c|c} 8 & 0 & 2 \\ \hline 3 & 1 & 2 \end{array}$ $X \sim b(8; 0,02)$

• $P(\text{ONARTU}) = P(X=0) + [P(X=1) \cdot P(X \neq 0)] = 0,85 + (0,14 \cdot 0,85) = 0,97$

• $P(\text{BAXTU}) = 1 - P(\text{ONARTU}) = 1 - 0,97 = 0,03$

→ Baxt - Oar = $(0,03 \cdot 250) - (0,97 \cdot 150) = 153$

B lotegiak espeditio kosturik baxuea