ESTATISTIKA AZTERKETAK

2014 UZTAILA
2013 UZTAILA (zuzendu gabe)
2014 URTARRILA
2015 URTARRILA
2015 EKAINA
2016 URTARRILA
2016 EKAINA
2017 EKAINA
2013 URTARRILA

2014 UZTAILA

ESTATISTIKA AZTERKETAK

$\boxed{1}$

0,07 FALTSUAK — 0,1 BENETAKOAK → BENETAKO BEZALA SAILKATUA

0,07 FALTSUAK — 0,9 FALTSUAK

0,93 BENETAKOAK — 0,98 BENETAKOAK

0,93 BENETAKOAK — 0,02 FALTSUAK → FALTSU BEZALA SAILKATUA

Ⓐ Ohartu da faltsu bezala sailkatzea eta benetan faltsua izatea

A) $P(\text{faltsuak}) = 0.07 \cdot 0.98 + 0.93 \cdot 0.2 = 0{,}0816 \rightarrow \%\ 8{,}16$

B) $P(\text{benetakoak} / \cancel{\text{benetako bezala sailkatu}}) = \dfrac{0.93 \cdot 0.98}{0.93 \cdot 0.98 + 0.1 \cdot 0.07} = 0{,}9924$

5 produktu hartu → 3 benetakoak ? $\quad X \longrightarrow b(5, 0.83)$

$\binom{5}{3} \cdot p^3 \cdot q^2 = \dfrac{5!}{3!(5-3)!} \cdot 0{,}9924^3 \cdot 0{,}0076^2 = 0{,}00056$

C) $n = 1000$

$p(100 < \text{faltsuak})$ $\quad p(\text{faltsu sailkatu}) = 0{,}0816$

n handia denez <u>LTZ</u> Binomialetik normalera

$nq = 1000 \cdot 0{,}9184 = 918{,}4 > 5$ ✓ $\quad \mu_x = 81{,}6$

$np = 1000 \cdot 0{,}0816 = 81{,}6 > 5$ ✓ $\quad \sigma = \sqrt{npq} = 8{,}656$

$X \longrightarrow N(161{,}6\ ,\ 11{,}639)$

$p(100 < \text{faltsuak}) = 1 - p(100 > \text{faltsuak})$

$Z = \dfrac{X - \mu}{\sigma} = \dfrac{100 - 81{,}6}{8{,}656} = 2{,}18$

$= 1 - F(2{,}18) = 1 - 0{,}9854 = 0{,}0168$

$\boxed{2}$ INDEPENDENTEAK

Puntu. $f(x) = \begin{cases} K_1 X & 500 \le x \le 1000 \\ 0 & \text{BESTELA} \end{cases}$

Tomatea $f(y) = \begin{cases} K_2 & 500 \le y \le 2000 \\ 0 & \text{BESTELA} \end{cases}$

A) K_1 ? K_2 ?

- $F(x) = \int_{-\infty}^{\infty} f(x)\,dx = 1 = \int_{500}^{1000} K_1 x\,dx = K_1 \dfrac{x^2}{2}\Big]_{500}^{1000} = K_1\, 375000 = 1$; $K_1 = \dfrac{1}{375000}$

- $F(y) = \int_{-\infty}^{\infty} f(y)\,dy = 1 = \int_{500}^{2000} K_2\,dy = K_2\, y\Big]_{500}^{2000} = K_2\, 1500 = 1$; $K_2 = \dfrac{1}{1500}$

B) Independienteak direna

↳ $f(x,y) = f(x)\, f(y) = \frac{1}{37500} \cdot \frac{1}{1500}$

↳ Kobariantza $= Cov_{xy} = 0$

C) Patatak $\longrightarrow$ Salmenta $= 2€/kg$

$\longrightarrow$ Kostua $= 0,8€/kg$

Tomateak $\longrightarrow$ Salmenta $= 3,5€/kg$

$\longrightarrow$ Kostua $= 2,2€/kg$

Urte batean batezbesteko irabazia

Kostu finkoak 1200 €

$\text{Irabaziak} = (2-0,8)x + (3,5-2,2)y - 1200$

$EI = 1.2\, Ex + 1,3\, Ey - 1200$

$Ex = \int_{-\infty}^{\infty} x f(x)\, dx = \int_{500}^{1000} x \cdot \frac{1}{37500}\, dx = \frac{1}{37500}\left[\frac{x^2}{2}\right]_{500}^{1000} = 1 = 750$

$Ey = \int_{-\infty}^{\infty} y f(y)\, dx = \frac{1}{1500} \cdot \frac{y^2}{2}\Big]_{500}^{2000} = 1 = 1250$

Tartearen erdiko puntua

$EI = 1,2 \cdot 750 + 1,3 \cdot 1250 - 1200 = 1325$

$\boxed{3}$

$X \longrightarrow N(100, 1)$

$98 - 102$ ✓

$n = 20$

Akastun $1 \longrightarrow$ baztertu

A) Sorta 1 baztertu $\longrightarrow$ Akats bat gutxienez

$p(\text{baztertu}) = 1 - p(98 < x < 102) = 1 - F(-2 < x < 2) =$

$1 - [F(2) - F(-2)] = 1 - [F(2) - (1 - F(2))] =$

$1 - F(2) + 1 - F(2) = 2 - 2F(2) = 0,0456$

TIPIFIKATU

$x = 98 \quad t = \frac{98-100}{1} = -2$

$x = 102 \quad t = \frac{102-100}{1} = 2$

$P(X \geq 1) = 1 - P(X=0) = 1 - \binom{20}{0} \cdot 0,046^0 \cdot 0,9544^{20} = 0,6068$

↓

Sorta baztertu

B) Aurreko atalean kontuan hartuta

$P(\text{sorta onartu}) = 1 - 0,6068 = 0,3931$

$0,3931^3 = 0,0607 \longrightarrow$ 3 sorta onartu

C) Urtero 120 sorta $\longrightarrow$ 60 onartu

$X \longrightarrow b(120,\ 0,3931)$ $\quad n = 120$, $p = 0,3931$

$np = 120 \cdot 0,3931 = 47,172 \geq 5$ $\quad \sqrt{npq} = 5,35$

$nq = 120 \cdot 0,6068 = 72,816 \geq 5$

BINOMIALETIK NORMALERA

$X \longrightarrow N(47,172,\ 5,35)$

$P(X \geq 60) = 1 - P(X < 60) = 1 - F\left(\dfrac{60 - 47,172}{5,35}\right) = 1 - F(2,39) =$

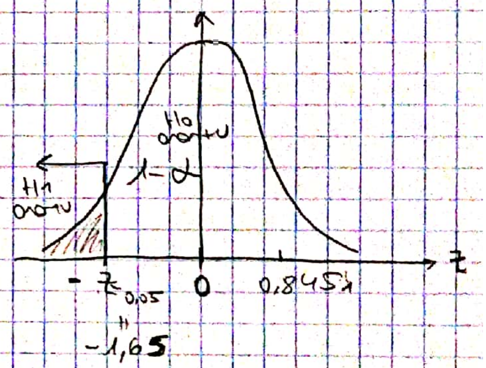
$1 - 0,9916 = 0,0084$

$\boxed{4}$

Akats kopurua $\longrightarrow$ λ akats/km

(Akatsak < 7)

$\alpha = \%5$ $\quad$ • 150 akats 20km-tan



$H_0:\ \lambda \geq 7$

$H_1:\ \lambda < 7$

$W \longrightarrow P(\lambda_W = 7 \cdot 20 = 140) \xrightarrow[\lambda \geq 5]{LT7} W \longrightarrow N(140,\ 11,8322)$

$z = \dfrac{W - 140}{11,8322} \longrightarrow z = \dfrac{150 - 140}{11,8322} = 0,8451$

$-z_{0,05} = -1,65$

Hau kontuan edukita, H0 onartuko dugu. Hortaz, makina berriarekin geratuko gara, makina zaharrak ez baitu zirtaten 7 baino txikiagoko tasarik.

%95eko konfiantzarekin onartuko dugu makina zaharreko sistemak gutxienez akatsen 7ko tasa dago duela.

2015 UZTAILA

1

$n = 90$

40 ipar-amerikarrak $\longrightarrow$ % 40 elebidunak

30 erresiarrak $\longrightarrow$ % 60 elebidunak

20 alemaniarrak $\longrightarrow$ % 80 alemaniarra

A) elebiduna izateko prob?

$\frac{40}{90} = 0,44 \rightarrow$ ipar amerikarra izateko prob.

$\frac{30}{90} = 0,33 \longrightarrow$ errusiarra izateko prob.

$\frac{20}{90} = 0,22 \longrightarrow$ alemaniarra izateko prob.

$P(\text{elebiduna}) = 0,44 \cdot 0,4 + 0,33 \cdot 0,6 + 0,22 \cdot 0,8 = 0,5517$

B) elebiduna dela jakinik $\longrightarrow$ errusiarra izateko prob?

$P\left(E/\text{elebi}\right) = \frac{P(E \cap \text{ele})}{P(\text{ele})} = \frac{0,198}{0,5517} = 0,35$

C) 3 hautatzailea $\longrightarrow$ 3-rak ezberdinak?

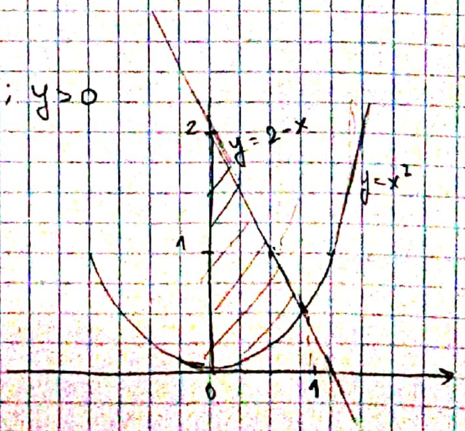
I A E
I E A
E A I   6 EDO $\longrightarrow$ $3! = 3 \cdot 2 \cdot 1 = 6$ (ordenazio kopurua)
E I A
A E I
A I E $\downarrow$ ordenazio bakoitzeko probabilitatea

$P(\text{3-rak ezberdinak}) = \overset{I}{\frac{40}{90}} \cdot \overset{E}{\frac{30}{89}} \cdot \overset{A}{\frac{20}{88}} = 0,034$

6 ORDENAZIO $\longrightarrow 6 \cdot 0,034 = 0,204$

2

$$f(x,y) = \begin{cases} kx & y < x^2;\ y < 2-x \quad x > 0;\ y > 0 \\ 0 & \text{BESTELA} \end{cases}$$



$\left.\begin{array}{l} y = 2-x \\ y = x^2 \end{array}\right\}\ 2 - x = x^2;\ x^2 + x - 2 = 0$

$x = \frac{-1 \pm \sqrt{1^2 - 4 \cdot 1 \cdot (-2)}}{2 \cdot 1} = \frac{-1 \pm 3}{2} \begin{array}{l} \nearrow x = 1 \\ \searrow x = -2 \end{array}$

$F(x,y) = \int_{-\infty}^{y}\int_{-\infty}^{x} kx\, dx\, dy = \int_0^1 \int_{x^2}^{2-x} kx\, dy\, dx = \int_0^1 kx\ \left[(2-x) - x^2\right] dx =$

$k\left[\int_0^1 2x\, dx - \int_0^1 x^2 dx - \int_0^1 x^3 dx\right] = k\left[\frac{2}{2} - \frac{1}{3} - \frac{1}{4}\right] = k\left[\frac{12}{12} - \frac{4}{12} - \frac{3}{12}\right] = k\frac{5}{12} = 1;\ \boxed{k = \frac{12}{5}}$

B) $P(X > 1/2)$?

$$P(X > 1/2) = 1 - P(X < 1/2) = 1 - F(1/2) = 1 - 0{,}3 = \boxed{0{,}6}$$

$$x = 1/2 \to F(x) = \int_{-\infty}^{\infty} f(x,y)dx \; ; \; F(1/2) = \int_0^{1/2} \frac{12}{5} x \, dx = \frac{12}{5} \left.\frac{x^2}{2}\right]_0^{1/2} = \frac{12}{5} \cdot \frac{1/4}{2} = 0{,}3$$

c) $\cdot$ $f(x) = \int_{-\infty}^{\infty} f(x,y)\, dy = \int_{x^2}^{2-x} \frac{12}{5} x \, dy = \frac{12}{5} x (2 - x - x^2) =$

$$\frac{24}{5}x - \frac{12}{5}x^2 - \frac{12}{5}x^3$$

$\cdot$ $f(y) = \int_{-\infty}^{\infty} f(x,y) dx = \int_0^1 \frac{12}{5} x \, dx = \frac{12}{5}\left[\frac{x^2}{2}\right]_0^1 = \frac{12}{10}$

d) $F(x) = \int_{-\infty}^{\infty} f(x,y) dx =$

$F(y) = \int_{-\infty}^{\infty} f(x,y) dy =$

e) $F(x,y) = \int_{-\infty}^{y} \int_{-\infty}^{x} f(x,y)\, dx\, dy = \int_0^1 \int_{x^2}^{2-x} \frac{12}{5} x \, dy\, dx = \int_0^1 \frac{12}{5} x (2 - x - x^2) dx =$

$\frac{12}{5}\left[\int_0^1 2x\, dx - \int_0^1 x^2 dx - \int_0^1 x^3 dx\right] = \frac{12}{5} \cdot \frac{5}{12} = 1$ MASA OSOA

3

100h $\to$ HUTS

$\lambda = 8$ (batezbestekoa)

A) 100 $P(1 \le x \le 2)$ NON: x: huts egiten duten osagaiak

$$P(1 \le x \le 2) = P(1) + P(2) = \frac{e^{-8} \cdot 8}{1} + \frac{e^{-8} \cdot 8^2}{2} = 0{,}0134$$

B) 300 ordutan 28 osagaik huts egin (gutxienez)

100 orduko Poisson-en banaketa emanda dugunez, 300 ordurako egokitu dugu

$\lambda = 24 > 5$ BALDINTZA

$$X \longrightarrow P(24) \xrightarrow{LLZ} X \longrightarrow N(24, 2\sqrt{6})$$

$$P(X \ge 28) = 1 - P(X < 28) = 1 - F\left(\frac{28 - 24}{2\sqrt{6}}\right) = 1 - F(0{,}8165) =$$

$1 - 0{,}7939 = \boxed{0{,}2061}$

$\boxed{4}$

%90 ⟶ 2014 krisiaren azken urtea

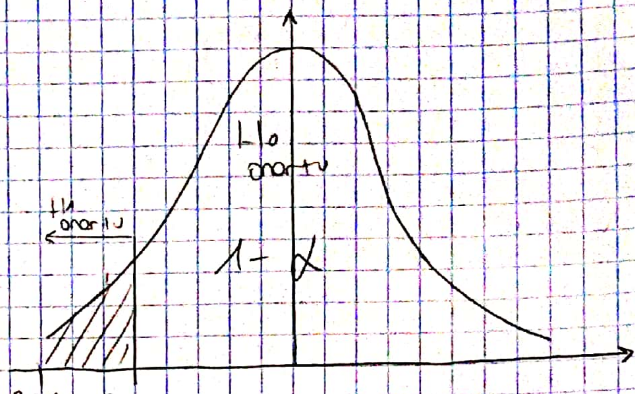
80 autendari ⟶ 66-k berdina pentsatu

$\alpha = \%5$

A)

H_0: %90 = 2014 azken urtea

H_1: %90 > Ez azken urtea



$$f = \frac{66}{80} = 0,825$$

$$z = \frac{f-p}{\sqrt{\frac{f(1-f)}{n}}} = \frac{0,825-0,9}{\sqrt{\frac{0,9\cdot(1-0,9)}{80}}} = -2,236$$

Hau ikusita, ezin dugu ikerketak dioena baieztatu

B) Zenbat x?

f gure ezezaguna

$$z = -1,65 < \frac{f-0,9}{\sqrt{\frac{0,9\cdot(1-0,9)}{80}}} \; ; \; -1,65\cdot\sqrt{\frac{0,9\cdot 0,1}{80}} < f-0,9 \; ;$$

$$f > -1,65\cdot\sqrt{\frac{0,9\cdot 0,1}{80}} + 0,9 \; ; \; f > 0,8446$$

$$0,8446 < f = \frac{x}{80} \; ; \; x > 80\cdot 0,8446 \; ; \; x > 67,57 \downarrow \; x > 68$$

Hipotesia baieztatu ahal izateko, 68 erantzun positibo beharko genituzke gutxienez.

2014 URTARRILA

1

$m = 6$ $\qquad X \longrightarrow N(6, 0{,}5)$

$\sigma = 0{,}5$

A) $p(x<5) = F\left(\frac{5-6}{0{,}5}\right) = F(-2) = 1 - F(2) = 1 - 0{,}9772 = 0{,}0228$

B) $n = 10$

bat ere ez konkretuo ?

$p(0) = \binom{10}{0} \cdot 0{,}0228^{0} \cdot 0{,}9772^{10} = 0{,}7940$

$\downarrow$ 1

c) Y pisua gramotan

$y = 2x$ $\qquad$ Sorta bakoitzak 5 pieza

Sorta baten pisua < 50 ?

$Y \longrightarrow N(12, 1)$

5 PIEZA

$m_Y = m_1 + m_2 + m_3 + m_4 + m_5 = 5 \cdot m = 60$

$\sigma_y = \sqrt{\sigma_1^2 + \sigma_2^2 + \sigma_3^2 + \sigma_4^2 + \sigma_5^2} = \sqrt{5}$

$p(y<50) = F\left(\frac{50-60}{\sqrt{5}}\right) = F(-4{,}47) = 0$

d) m ? Akastun proportioa %1

$p(x<5) = 0{,}01 = F\left(\frac{5-m}{0{,}5}\right) \rightsquigarrow \frac{5-m}{0{,}5} = -2{,}3$;

$m = -[(-2{,}3) \cdot 0{,}5 - 5]$; $\boxed{m = 6{,}15}$

2

$1 \longrightarrow 3/5$

$2 \longrightarrow 1/2$

$3 \longrightarrow 1/4$

A) p(txoria zauritute)?

$p(\text{txoria zauritute}) = 1 - p(\text{txoria bizirik}) = 1 - \left(\frac{2}{5} \cdot \frac{1}{2} \cdot \frac{3}{4}\right) =$

$1 - 0{,}15 = 0{,}85$

B) 1 2 3 ordenatio kop.?

$p(\text{3-rek eman}) = \frac{3}{5} \cdot \frac{1}{2} \cdot \frac{1}{4} = 0{,}075$

$p\left(\text{3-rek eman}/\text{zauritute}\right) = \frac{0{,}075}{0{,}85} = 0{,}0882$

3

$n = 5$

$\bar{x} = 15{,}6$

$s^2 = 1{,}44 \longrightarrow s = 1{,}2$

%95 eko konfiantza tartea

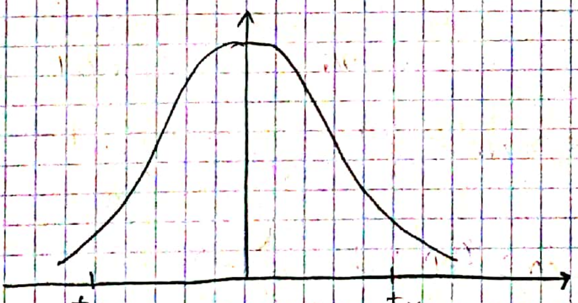
$\downarrow$

$\alpha = \%5$

$0{,}025$

$\alpha/2 = \%2{,}5 \rightsquigarrow 0{,}975$

$p(a < m < b)$?



$X \longrightarrow t(4)$ %5 KASUA

$t = \frac{\bar{x} - m}{s/\sqrt{n}}$

$-t_{\alpha/2} = -2{,}776$ $\qquad$ $t_{\alpha/2} = 2{,}776$

$\text{Prob}\left(-2{,}776 < \frac{\bar{x} - m}{s/\sqrt{n}} < 2{,}776\right) = 0{,}95$;

$\text{Prob}\left(-2{,}776 \cdot \frac{s}{\sqrt{n}} - \bar{x} < -m < 2{,}776 \cdot \frac{s}{\sqrt{n}} - \bar{x}\right) = 0{,}95$;

$\text{Prob}\left(2{,}776 \cdot \frac{1{,}2}{\sqrt{4}} + 15{,}6 > m > -2{,}776 \cdot \frac{1{,}2}{\sqrt{4}} + 15{,}6\right) = 0{,}95$;

$\left[\text{Prob}(13{,}93 < m < 17{,}268) = 0{,}95\right]$

$\boxed{4}$

$\lambda = 15 \longrightarrow$ moto istripuak /hileko $\qquad X — P(15)$

$\lambda = 10 \longrightarrow$ istripuak /hileko $\qquad Y — P(10)$

A) P(moto istripurik ez) ?

$$X — P(15) \xrightarrow[LTZ]{\lambda > 5} X — N(15, 3{,}87)$$

$$P(\text{moto istripurik ez}) = F\left(\frac{0-15}{3{,}87}\right) = F(-3{,}87) \approx 0$$

B) $W = X + Y$

$$\lambda = 15+10 = 25 > 5 \xrightarrow{LTZ} W — N(25, 5)$$

$$P(\text{istripu} \geq 1) = 1 - P(\text{istripurik ez}) = 1 - F\left(\frac{0-25}{5}\right) = 1 - \underbrace{F(-5)}_{\approx 0} = 1$$

C) P(istripu > 20) ?

$$P(\text{istripu} > 20) = 1 - P(\text{istripu} < 20) = 1 - F\left(\frac{20-25}{5}\right) = 1 - F(-1) =$$

$$1 - (1 - F(1)) = F(1) = 0{,}8413$$

2015 URTARRILA

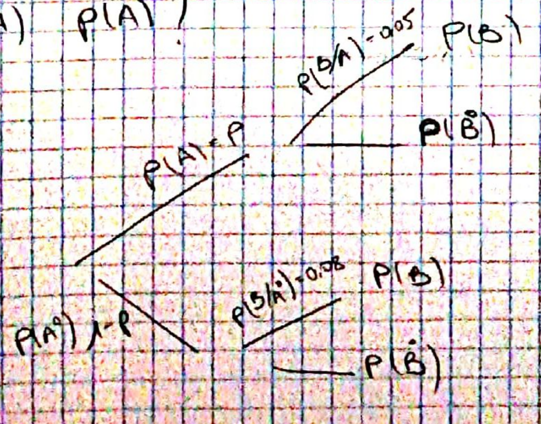
$\boxed{1}$

$P(B) = 0{,}06$

$P(B/A) = 0{,}05$

$P(B/A^c) = 0{,}08$

A) $P(A)$?



$$P(B) = p \cdot 0{,}05 + (1-p) \cdot 0{,}08 = 0{,}06$$

$$p\,0{,}05 - p\,0{,}08 + 0{,}08 = 0{,}06; \quad \boxed{p = 0{,}66}$$

B) A eta B independienteak?

Independienteak badira $P(B/A) = P(B)$

$\hookrightarrow P(B/A) = \dfrac{\overbrace{P(A)\ P(B)}^{P(A\cap B)}}{P(B)}$

Ez denez betetzen, ez dira independienteak izango.

C) A eta $\mathring{A}$ gertakariak independienteak?

A eta $\mathring{A}$ ez dira independienteak izan, elkarren esgozinak baitira.

$P(A\cap A^{\circ}) = 0$

A A°

$\boxed{2}$

$$f(x) = \begin{cases} a+bx^2 & 0<x<1 \\ 0 & \text{BESTELA} \end{cases}$$

A) a eta b?

$$F(x) = \int_{-\infty}^{\infty} f(x)\,dx = \int_0^1 a+bx^2\,dx = \int_0^1 a\,dx + \int_0^1 bx^2\,dx = a + b\frac{x^3}{3}\Big]_0^1;$$

$$\boxed{a+\frac{b}{3}=1}$$

$$Ex = 0{,}25 = \int_{-\infty}^{\infty} x f(x)\,dx = \int_0^1 x\cdot(a+bx^2)\,dx = \int_0^1 x a\,dx + \int_0^1 bx^3\,dx =$$

$$a\frac{x^2}{2}\Big]_0^1 + b\frac{x^4}{4}\Big]_0^1 = \boxed{\frac{a}{2}+\frac{b}{4}=0{,}25}$$

$$a = 1-\frac{b}{3} \rightsquigarrow \frac{1-b/3}{2}+\frac{b}{4}=0{,}25;\quad \frac{2-2b/3}{4}+\frac{b}{4}=0{,}25;$$

$$\frac{2+b/3}{4}=0{,}25;\quad 2+\frac{b}{3}=1;\quad \frac{b}{3}=-1;\ \boxed{b=-3}$$

$$a = 1-\frac{-3}{3} = 1+1;\ \boxed{a=2}$$

B) $P(0{,}2<x)$?

$$F(0{,}2) = \int_0^{0{,}2} 2-3x^2\,dx = \int_0^{0{,}2} 2\,dx - 3\int_0^{0{,}2} x^2\,dx = (2\cdot 0{,}2) - 3\cdot\left[\frac{x^3}{3}\right]_0^{0{,}2} =$$

$$0{,}4 - 0{,}08 = \boxed{0{,}392}$$

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3

$\lambda = 0{,}1$

$n = 120$

$p(100 < x)$ Akats gabekoak?

$p(\text{Akatsik gabeko pieza}) = \dfrac{e^{-0{,}1} \cdot 0{,}1^0}{0!} = 0{,}904$

BINOMIALA plazatzen $\longrightarrow$ $X \longrightarrow b(120, 0{,}904)$

BINOMIALETIK NORMALERA $\xrightarrow{LTZ}$ $np \geq 5 \to 108{,}58$

$nq \geq 5 \to 11{,}52$

$X \longrightarrow N(108{,}58\ ,\ 3{,}228)$

$p(100 < x) = 1 - p(100 \geq x) = 1 - F\left(\dfrac{100 - 108{,}58}{3{,}228}\right) = 1 - F(-2{,}65) =$
$F(2{,}65) = \boxed{0{,}996}$

4

Torlojuak $X \longrightarrow N(15, 4)$

Azkoinak $Y \longrightarrow N(10, 3)$

$X + Y = W$

A) Torlojuen eta azkoinen pisuak independienteak

$\to$ LEVI

$\mu_W = \mu_x + \mu_y = \boxed{25}$

$\sigma_W^2 = 4^2 + 3^2 = 25$; $\boxed{\sigma_W = 5}$

$W \longrightarrow N(25, 5)$

$p(22 > W) = F\left(\dfrac{22 - 25}{5}\right) = F(-0{,}6) = 1 - F(0{,}6) =$
$1 - 0{,}7257 = \boxed{0{,}2743}$

B) $\rho = 0{,}8$

$\rho = \dfrac{Cov_{xy}}{\sigma_x \sigma_y}$; $Cov_{xy} = \rho\, \sigma_x \sigma_y = 0{,}8 \cdot 4 \cdot 3 = 9{,}6$

$\mu_W = \mu_x + \mu_y = 25$

$\sigma_W^2 = 4^2 + 3^2 + 2 \cdot 9{,}6 = 60{,}2 \longrightarrow \boxed{\sigma_W = 7{,}75}$

$p(22 > W) = F\left(\dfrac{22 - 25}{7{,}75}\right) = F(-0{,}387) = 1 - F(0{,}387)$

$1 - 0{,}6517 = 0{,}3483$

6

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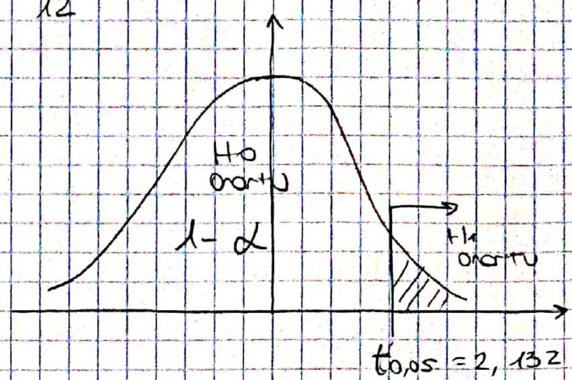
5

$n=5 \rightarrow 10 \quad 9 \quad 9 \quad 10 \quad 12$



$H_0: 9=m$

$H_1: 9<m$

$\alpha = \%5$

$$\bar{x} = \frac{10+9+9+10+12}{5} = 10$$

$$S^2 = \frac{(10-10)^2+(9-10)^2+(9-10)^2+(10-10)^2+(12-10)^2}{4} = \frac{1+1+4}{4} = \frac{6}{4} = \frac{3}{2}$$

$$S = \sqrt{3/2} = 1,22$$

1.5 KASUA

$X \longrightarrow t(4)$

$$t = \frac{\bar{x}-m}{S/\sqrt{n}} = 2,132$$

$$t = \frac{10-9}{1,22/\sqrt{4}} = 1,639$$ $\longrightarrow$ Hortaz, %95eko konfiantzarekin onar dezakegu batazbestekoa gehienez 9 izango dela

2015 EKAINA

1

$P(x<9) = 0,9772$

$P(x>3) = 0,8413$

$X<3 \rightarrow$ Intentsitate baxua

$3<x<9 \rightarrow$ " ertaina

$x>9 \rightarrow$ " handia

A) $P(x<3)$? $P(3<x<9)$? $P(x>9)$?

$P(x<3) = 1-P(x>3) = 1-0,8413 = 0,1587$

$P(3<x<9) = F(9)-F(3) = P(x<9)-P(x<3) = 0,9772-0,1587 =$
$= 0,8185$

$P(x>9) = 1-P(x<9) = 1-0,9772 = 0,0228$

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B) $P(x>5)$?

Horretarako, m eta σ kalkulatu behar ditugu

↓ TIPIFIKATU

- $z = \dfrac{3-m}{\sigma}$ ⊕ $P(x<3) = 0,15 \rightsquigarrow z = -1,04$

$3 - m = -1,04\sigma$; $\left[m = 3 + 1,04\sigma\right]$

- $z = \dfrac{9-m}{\sigma}$ ⊕ $P(x<9) = 0,9772 \rightsquigarrow z = 2$

$9 - m = 2\sigma$ ↳ ORDEZKATUZ $9 - 3 - 1,04\sigma = 2\sigma$; $6 = 3,04\sigma$; $\boxed{\sigma = 1,97}$

$m = 3 + (1,04 \cdot 1,97) = 5,052$

$X \longrightarrow N(5,052,\ 1,97)$

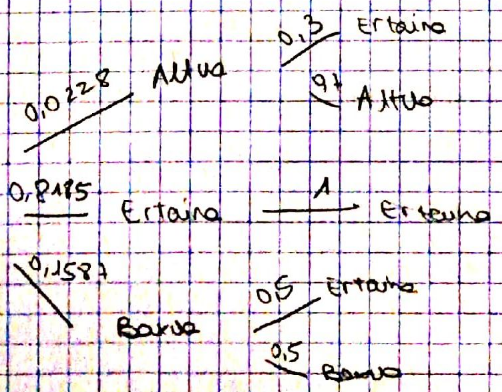
$P(x>5) = 1 - P(x<5) = 1 - F\left(\dfrac{5-5,05}{1,97}\right) = 1 - F(-0,026) = F(0,026)$
$= 0,512$

C) 20 seinale → $n = 20$ $p(x<3) = 0,1597$

$Y \longrightarrow b(20,\ 0,1597)$

$P(Y \leq 1) = P(0) + P(1) = \binom{20}{0} \cdot 0,1597^0 \cdot 0,8403^{20} + \binom{20}{1} \cdot 0,1597^1 \cdot 0,8403^{19} =$
$= 0,0308 + \dfrac{20!}{1! \cdot (20-1)!} \cdot 0,1597 \cdot 0,8403^{19} = 0,148$

$\boxed{2}$



A) P(ertaina kontrolaren ostean) $= 0,8185 + (0,0228 \cdot 0,3) + (0,1587 \cdot 0,5) =$
$= 0,90469$

P(Ez ertainak kontrolaren aurretik) $= (0,0228 \cdot 0,3) + (0,1587 \cdot 0,5) =$
$= 0,08619$

$P\left(\dfrac{\text{Ez ertaina aurretik}}{\text{ertainak kontrolaren ostean}}\right) = \dfrac{0,08619}{0,90469} = 0,095$

7

B)

A E B

p(altua) = 0,0228 · 0,7 = 0,01596

p(ertaina) = 0,90469

p(baxua) = 0,1587 · 0,5 = 0,07935

p(dena erbesdinak) = 0,01596 · 0,90469 · 0,07935 = 0,00114

6 ordenazio posible $\longrightarrow$ 3! = 6

0,00114 · 6 = 0,00687

$\boxed{3}$

/40 muga

A)

$n = 14$

$\bar{x} = 43,2$

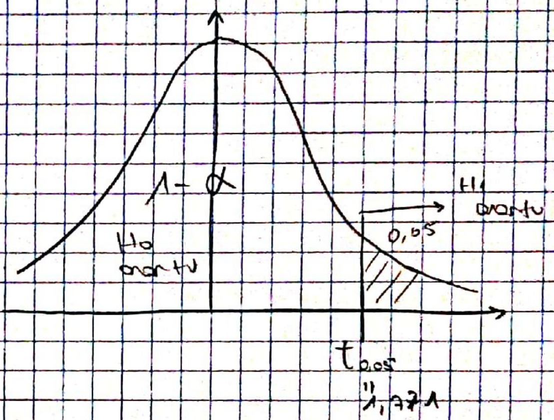
$S = 5,8$

$\alpha = /5$

$H_0: M = 40$

$H_1: M > 40$

$$t = \frac{43,2 - 40}{5,8/\sqrt{14}} = 2,064$$



X —— $t(13)$

Horrela, hipotesia baztertuko dugu.

B) $\bar{x}$? $\longrightarrow$ Ho ONARTU

$$1,771 = t_{0,05} > \frac{\bar{x} - 40}{5,8/\sqrt{14}} \qquad \bar{x} < 42,74$$ izan beharko litzateke hipotesia onartu ahal izateko.

$\boxed{4}$

X: A produktuaren erreklamazio kopurua

Y: B produktuaren erreklamazio kopurua

$$f(x) = \begin{cases} K/x & 3 < x < 8 \\ 0 & bestela \end{cases} \qquad Y \text{ —— } N(3,5\ ,\ 0,75)$$

A) K? $f(y)$?

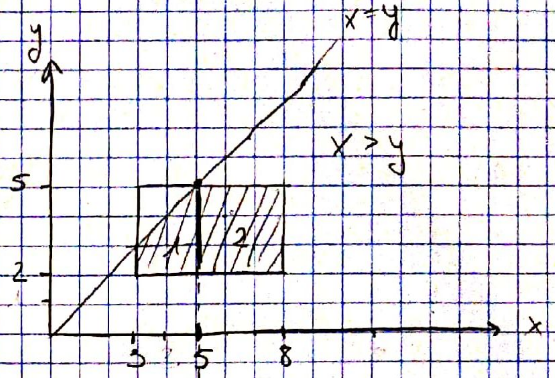
$$F(x) = \int_{-\infty}^{\infty} f(x)\,dx = \int_{3}^{8} \frac{K}{x}\,dx = K \ln(x)\Big]_3^8 = K\,0,981 = 1; \boxed{K = 1,0195}$$

• $m = \frac{a+b}{2} = 3,5$; $\underline{a = 7-b}$ $\xrightarrow{\text{Ebazketa}}$ $a = 2$, $b = 5$

$\sigma^2 = \frac{(b-a)^2}{12} = 0,75^2$

$f(y) = \frac{1}{b-a} = K = \frac{1}{3}$

B $P(X>Y)$?



0,5/0 INDEPENDIENTEAK DIRENEZ

$f(x)\cdot f(y) = f(x,y)$

$\frac{1,0195}{x}\cdot\frac{1}{3} = f(x,y)$; $f(x,y) = \frac{0,339}{x}$

2 ZATITAN BANATU BEHARRA

$P(X>Y) = 1 - P(X<Y)$

$F(x,y) = \int_3^5\int_x^5 \frac{0,339}{x}\,dy\,dx = \int_3^5 \frac{0,339}{x}(5-x)\,dx = \int_3^5 \frac{1,695}{x}\,dx - \int_3^5 0,339\,dx =$

$= 0,866 - 0,678 = 0,188$

• $P(X>Y) = 1 - P(X<Y) = 1 - 0,188 = \boxed{0,812}$

2016 URTARRILA

$\boxed{1}$

$m = 10$

$\sigma = 2$ Banaketa normala X: tenperatura $X \longrightarrow N(10,2)$

A) $P(X<8)$?

$P(X<8) = F\left(\frac{8-10}{2}\right) = F(-1) = 1 - F(1) = 1 - 0,8413 = 0,1587$

B) Urtarrilak 31 egun

$P(X>12)$?

$P(X>12) = 1 - P(X<12) = 1 - F\left(\frac{12-10}{2}\right) = 1 - F(1) = 1 - 0,8413 =$
$0,1587$

$M = n\cdot p = 31\cdot 0,1587 = 4,91$ ⇝ 5 egunetan tenperatura 12 gradu baino altuagoa izatea espero da.

$0{,}1587 \rightarrow X < 8 \longrightarrow p(\text{euria}) = 0{,}9$

$0{,}1587 \quad X > 12 \longrightarrow p(\text{euria}) = 0{,}6$

$0{,}6826 \quad 8 < X < 12 \longrightarrow p(\text{euria}) = 0{,}7$

$P(8 < X < 12) = P(X < 12) - P(8 > X) = 0{,}8413 - 0{,}1587 = 0{,}6826$

c) p(euria egin)?

$$p(\text{euria}) = (0{,}1587 \cdot 0{,}9) + (0{,}1587 \cdot 0{,}6) + (0{,}6826 \cdot 0{,}7) = \underline{0{,}7158}$$

D) $$P\left(\frac{X<8}{\text{euririk ez}}\right) = \frac{0{,}1587 \cdot 0{,}1}{1 - 0{,}7158} = 0{,}0558$$

$\boxed{2}$

$$\lambda = 2 \text{ istripu} / 10 \text{ buelta} \xrightarrow[\text{istripu / buelta bakoitzeko}]{\text{Poisson}} \underline{\lambda = 0{,}2}$$

$X \longrightarrow P(0{,}2)$

A) Buelta batean istripurik ez?

POISSON

$$p(0) = \frac{e^{-0{,}2} \cdot 0{,}2^{0}}{0!} = 0{,}818$$

B) 80 buelta $\quad P(12 < X)$?

Buelta batek Poisson-en banaketa jarraitzen badu, 80 bueltek ere jarraituko dute.

$\lambda = 0{,}2 \cdot 80 = 16 \geq 5$ ✓ $\quad$ TLT $\quad$ Banaketa Normala

$$X \longrightarrow P(16) \longrightarrow X \longrightarrow N(16, 4)$$

$$P(12 < X) = F\left(\frac{12-16}{4}\right) = F(-1) = 1 - F(1) = 1 - 0{,}8413 =$$
$$= 0{,}1587$$

$\boxed{3}$

$n = 400$ ontzi

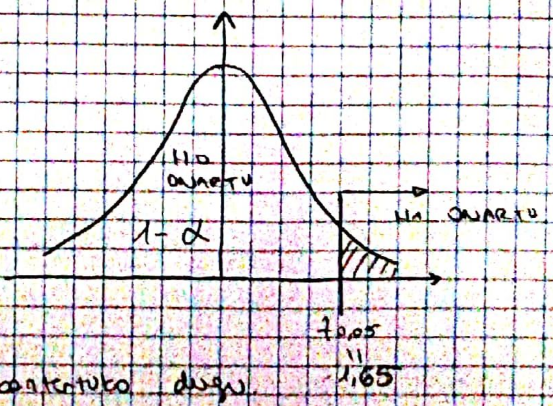
8 kutsatuta $\longrightarrow$ 3. KASUA $\longrightarrow f = \frac{8}{400} = 0{,}02$

A) $\alpha = \%5$

$H_0: p = \%1$

$H_1: p > \%1$

$$z = \frac{0{,}02 - 0{,}01}{\sqrt{\frac{0{,}01 \cdot 0{,}99}{400}}} = 2{,}01$$



HORTAZ, hipotesia baztertuko dugu.

B) $\alpha = \% 10 \longrightarrow z_{0,05} = 1,65$

$$p\left(-z_{\alpha/2} < \frac{\hat{f}-p}{\sqrt{\frac{\hat{f}(1-\hat{f})}{n}}} < z_{\alpha/2}\right) = p\left(-1,65 \cdot \sqrt{\frac{0,02 \cdot 0,98}{400}} + 0,02 < p < 1,65 \sqrt{\frac{0,02 \cdot 0,98}{400}} + 0,02\right) = 0,9$$

$\boxed{4}$

$$F(x) = \begin{cases} 1 - \frac{9}{x^2} & x > 3 \\ 0 & x < 3 \end{cases}$$

A)

$$f(x) = \frac{dF(x)}{dx} = -\frac{18}{x^3}$$

Independienteak direnez $\longrightarrow f(x_1, x_2) = f(x_1) \cdot f(x_2) = \frac{18}{x^3} \cdot \frac{18}{x^3}$

B) $p(x_1 > 5)$

$$p(x > 5) = 1 - p(x < 5) = 1 - F(5) = 0,36$$

$$p(x_1\text{-ek eta } x_2\text{-k iraun}) = 0,36^2 = 0,1296$$

C) $p(1\text{ek gutxienez iraun}) = 1 - p(\text{batek ere ez irau}) =$

$$1 - \text{Prob}(x_1 < 5 \cap x_2 < 5) = 1 - \underbrace{F(5) \cdot F(5)}_{\text{Independienteak direlako}} = 1 - (0,64 \cdot 0,64) = 0,5904$$

2016 EKAINA

$\boxed{1}$

6 bolo → 3 positibo, 3 negatibo

2 bolo atera

A) P(Biderketa ⊕)? ⟶ PP edo NN

$P(PP) = \frac{3}{6} \cdot \frac{2}{5} = \frac{1}{5}$

$P(NN) = \frac{3}{6} \cdot \frac{2}{5} = \frac{1}{5}$

$P(\text{Biderketa } \oplus) = \frac{1}{5} + \frac{1}{5} = 0,4$

B) $P(\text{bidekoera} \ominus) = 1 - P(\text{bidekoera} \oplus) = 0,6$

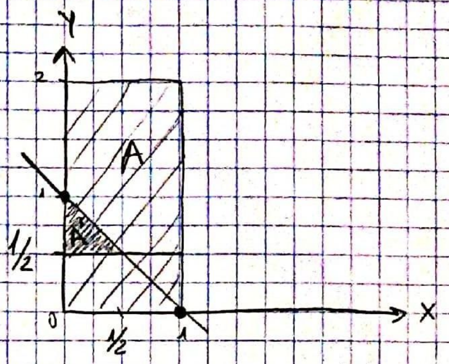
$$P\left(\text{2 bola negatibo} / \ominus\right) = \frac{\frac{3}{6} \cdot \frac{3}{5}}{0,6} = 0,5$$

$\boxed{2}$

$0 \leq x \leq 1$

$0 \leq y \leq 2$

Independienteak



$x < 1 - y$

A) $E(xy)$?

$$f(x,y) = \frac{1}{2}$$

- $f(x) = \int_{-\infty}^{\infty} f(x,y)\,dy = \int_0^2 \frac{1}{2}\,dy = \frac{1}{2} \cdot 2 = 1$
- $f(y) = \int_{-\infty}^{\infty} f(x,y)\,dx = \int_0^1 \frac{1}{2}\,dx = \frac{1}{2}$

$\rightarrow E_x = \int_{-\infty}^{\infty} x \cdot 1\,dx = \int_0^1 x\,dx = \left.\frac{x^2}{2}\right]_0^1 = \frac{1}{2}$

$\rightarrow E_y = \int_{-\infty}^{\infty} y \cdot \frac{1}{2}\,dy = \frac{1}{2}\int_0^2 y\,dy = \frac{1}{2} \cdot \left.\frac{y^2}{2}\right]_0^2 = \frac{1}{2} \cdot \frac{4}{2} = 1 = m_y$

$\hookrightarrow \left[E_{xy} = E_x \cdot E_y = \frac{1}{2} \cdot 1 = \frac{1}{2}\right]$

Independienteak direlako

B) $X+Y$ $\quad P\left(x+y<1 / y>1/2\right)$?

$A \rightarrow 1 \cdot \frac{3}{2} = \frac{3}{2} \longrightarrow \text{Prob}(y > 1/2) = \frac{1}{2} \cdot \frac{3}{2} = \frac{3}{4}$

$A' \rightarrow 1/2 \cdot 1/2 \cdot 1/2 = \frac{1}{8} \rightarrow \text{Prob}((x+y<1) \cap (y>1/2)) = \frac{1}{2} \cdot \frac{1}{8} = \frac{1}{16}$

- $P\left(x+y<1 / y>1/2\right) = \frac{1/16}{3/4} = \frac{4}{3 \cdot 16} = \boxed{0,083}$

C) $\rho = 0,8 \longrightarrow \text{cov}$?

Uniformeak direnez $\begin{cases} \sigma_x^2 = \frac{(1-0)^2}{12} = \frac{1}{12} \\ \sigma_y^2 = \frac{(2-0)^2}{12} = \frac{4}{12} = \frac{1}{3} \end{cases}$

$$\rho = \frac{\text{Cov}_{xy}}{\sigma_x \cdot \sigma_y} \; ; \; \left[\text{Cov}_{xy} = \rho\,\sigma_x \cdot \sigma_y = 0,8 \cdot \sqrt{1/12} \cdot \sqrt{1/3} = 0,133\right]$$

3

$\mu = 100$ Banaketa normala $X \longrightarrow N(100, 1)$

$\sigma = 1$

96 - 103 ONA

$n = 25 \longrightarrow$ Akastun bat $\longrightarrow$ Baztertu

A) $p(\text{ogi txarra}) = 1 - p(\text{akatsik ez}) = 1 - p(96 < x < 103)$

Tipifikatu

$$z = \frac{96-100}{1} = -4$$

$$z = \frac{103-100}{1} = 3$$

ERRAZAGO

$\hookrightarrow P(X<96) + P(X>103) =$

$F(-4) + 1 - F(3) = 1 - F(3)$

$$1 - p(96 < x < 103) = 1 - [F(3) - F(-4)] = 1 - [F(3) - (1 - F(4))] =$$

$$1 - F(3) + 1 - F(4) = 1 - F(3) = 1 - 0{,}9987 = 0{,}0013$$

BINOMIALA $\longrightarrow$ $X \longrightarrow b(25, 0{,}0013)$

$P(\text{sorta baztertu}) = 1 - P(\text{akatsik ez}) = 1 - \binom{25}{0} 0{,}0013^0 \cdot 0{,}9987^{25}$

$= 0{,}0319$

B) $p(3 \text{ sorta onartu})$?

$P(3 \text{ sorta onartu}) = 0{,}9987^3 = 0{,}\boxed{9961}$

C) 200 txanda

190 onartu

Binomialetik normalera $\xrightarrow{LTZ}$ $Y \longrightarrow N(199{,}74, 0{,}509)$

$np = 200 \cdot 0{,}9987 = 199{,}74 \geq 5$

$nq = 200 \cdot 0{,}0013$

$$P(Y>190) = 1 - P(Y<190) = 1 - F\left(\frac{190 - 199{,}74}{0{,}509}\right) = 1 - F$$

10

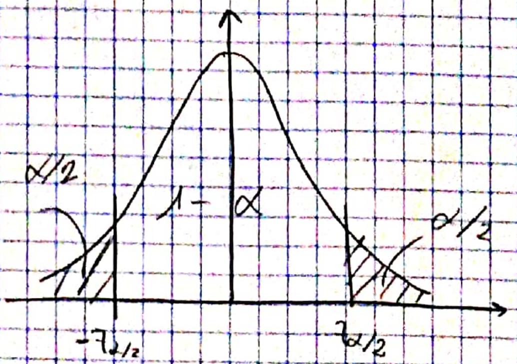
4

$\sigma = 0{,}25$

$n = 8$

$H_0: m = 5$

$H_1: m \neq 5$



A)

$\alpha = \alpha/2 + \alpha/2$

$\alpha = P(x < 4{,}85) + P(x > 5{,}15) =$

$F\left(\frac{4{,}85-5}{0{,}25/\sqrt{8}}\right) + 1 - F\left(\frac{5{,}15-5}{0{,}25/\sqrt{8}}\right) =$

$X \longrightarrow (m, \sigma/\sqrt{n})$

$X \longrightarrow (m, 0{,}25/\sqrt{8})$

$F(-1{,}69) + 1 - F(1{,}69) =$

$[4{,}85 \, , 5{,}15]$

$1 - F(1{,}69) + 1 - F(1{,}69) = 0{,}08$

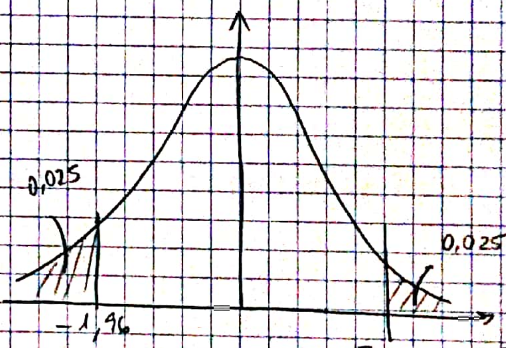
$\to \alpha = \%8$

B)

$\alpha = \%5 \to 0{,}05$

$\bar{x} = 5{,}08$ Erabakia?

$z = \frac{5{,}08-5}{0{,}25/\sqrt{8}} = 0{,}905$



$z_{0,025} = 1{,}96$

$1 - 0{,}025 = 0{,}975$

%95 eko konfiantzarekin baieztatu dezakegu batezbesteko tentsioa 5V dela.

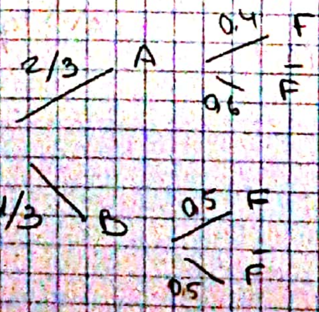
2017 EKAINA

1

2/3 A motako 20 kotxe → %40 familientzat

1/3 B motako 10 kotxe → %50 familientzat

A) A motakoa eta familiarena independienteak dira?



Independienteak badira

$P(F/A) = \frac{P(A \cap F)}{P(A)}$; $P(A \cap F) = P(F/A) \, P(A)$

$P(A \cap F) = 0{,}178$

$P(F) = \frac{2}{3} \cdot 0{,}4 + \frac{1}{3} \cdot 0{,}5 = 0{,}433$

$P(A \cap F) = P(A) \cdot P(F) = \frac{2}{3} \cdot 0{,}433 = 0{,}2\overline{8}$

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HORTAZ, A eta familiako ez dira independienteak izango

B) p(biak berdinak)?

$A_j A_j \longrightarrow p(A_j A_j) = \left(\frac{2}{3}\cdot 0{,}4\right)^2 = 0{,}071$

$B_j B_j \longrightarrow p(B_j B_j) = \left(\frac{1}{3}\cdot 0{,}5\right)^2 = 0{,}027$

$A\bar{j}\, A\bar{j} \longrightarrow p(A\bar{j} A\bar{j}) = \left(\frac{2}{3}\cdot 0{,}6\right)^2 = 0{,}16$

$B\bar{j}\, B\bar{j} \longrightarrow p(B\bar{j} B\bar{j}) = \left(\frac{1}{3}\cdot 0{,}5\right)^2 = 0{,}027$

p(biak berdinak) = 0,285

$\boxed{2}$

$$F(x) = \begin{cases} kx^2 & 0 < x < 20 \\ 0 & x < 0 \\ 1 & x > 20 \end{cases}$$

A) $p\left(x<15 / 10\text{zona}\right)$?

$$f(x) = \frac{dF(x)}{dx} = 2kx$$

$$\cdot\ F(x) = \int_{-\infty}^{\infty} f(x)\,dx = \int_0^{20} 2kx\,dx = 2k\left.\frac{x^2}{2}\right]_0^{20} = 400k = 1;\quad k = \frac{1}{400}$$

$$p(x>10) = 1 - F(10) = 1 - \left(\frac{1}{400}\cdot 10^2\right) = 1 - \frac{1}{4} = 0{,}75$$

$$\cdot\ F(x) = \int_{10}^{15} 2\frac{1}{400}x\,dx = \frac{1}{200}\left[\frac{x^2}{2}\right]_{10}^{15} = 0{,}3125$$

$$p\left(x<15 / x_{,}\right) = \frac{0{,}3125}{0{,}75} = 0{,}416$$

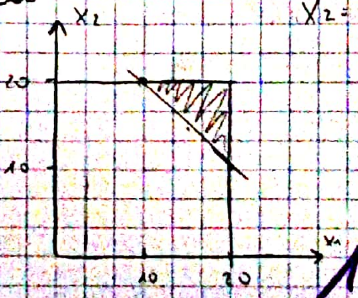
B) Independienteak

$p(x_1 + x_2 > 30)$?

Independienteak direnez $\longrightarrow f(x_1,x_2) = f(x_1)\cdot f(x_2) = \frac{1}{200}x_1 \cdot \frac{1}{200}x_2$

$$f(x_1,x_2) = \frac{x_1 \cdot x_2}{40000}$$

$X_2 = 30 - X_1$



$$\int_{10}^{20}\int_{30-x_1}^{20} \frac{x_1 x_2}{40000}\,dx_2\,dx_1 =$$

$$\int_{10}^{20} \frac{x_1}{40000}\left[\frac{x_2^2}{2}\right]_{30-x_1}^{20} dx_1 = \int_{10}^{20}\frac{x_1}{40000}\cdot\left[\frac{-500 + x_1^2 + 60x_1}{2}\right]dx_1$$

$$\frac{1}{2}\cdot\frac{1}{40000}\left(\int_{10}^{20} -500x_1\,dx_1 + \int_{10}^{20} x_1^3\,dx_1 + \int_{10}^{20} 60x_1^2\,dx_1\right) =$$

$$\frac{1}{80000}\left(-500\left[\frac{x^2}{2}\right]_{10}^{20} - \left[\frac{x^4}{4}\right]_{10}^{20} + 60\left[\frac{x^3}{3}\right]_{10}^{20}\right) = \frac{1}{80000}\left(-75000 - 37500 + 140000\right) =$$

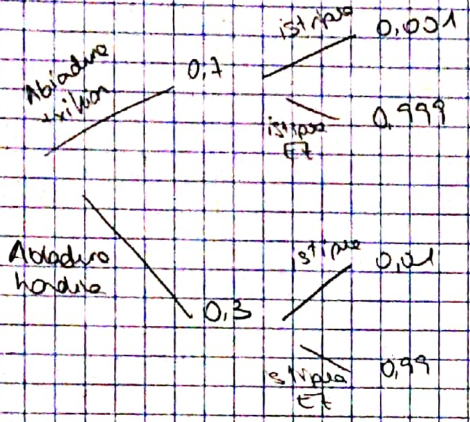
$$= \frac{27500}{80000} = 0,34375$$

2013 URTARRILA

$\boxed{1}$

p(istripua) = 0,001 Abiadura txikian

p(istripua) = 0,01 Abiadura altuan (/30)



A) p(istripua)?

p(istripua) = (0,7 · 0,001) + (0,3 · 0,01) = 0,0037

B) $p\left(\text{modu altuan}/\text{istripurik ez}\right)$?

p(istipurik ez) = (0,7 · 0,999) + (0,3 · 0,99) = 0,9963 = 1 − 0,0037

$$p\left(\text{modu altuan}/\text{istipurik ez}\right) = \frac{0,3 \cdot 0,99}{0,9963} = 0,298$$

C) 10 gidari ⟶ p(X < 3)? X: istripuak

BINOMIALA ⟶ X — b(10, 0,0037)

$$p(3 > X) = p(0) + p(1) + p(2) =$$

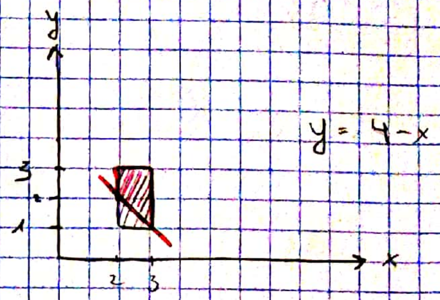
$$\binom{10}{0} 0,9963^{10} + \binom{10}{1} 0,9963^{9} \cdot 0,0037^{1} + \binom{10}{2} 0,9963^{8} \cdot 0,0037^{2} =$$

$$= 0,999$$

$\boxed{2}$

X eta Y INDEPENDIENTEAK

X → Banaketa uniformea $[2,3]$



Y → $f(y) = \begin{cases} ky & 1<y<3 \\ 0 & \text{BESTELA} \end{cases}$

A) $f(x,y)$?

• $f(x) = \frac{1}{b-a} = \frac{1}{3-2} = 1 \quad 2<x<3$ • $f(y) = \frac{1}{4}y \quad 1<y<3$

• $F(y) = \int_{-\infty}^{\infty} f(y)\,dy = \int_1^3 ky\,dy = k\left[\frac{y^2}{2}\right]_1^3 = k\left(\frac{9}{2}-\frac{1}{2}\right) = 4k = 1; \boxed{k = \frac{1}{4}}$

Independienteak direnez → $\boxed{f(x,y) = f(x)\cdot f(y) = 1\cdot\frac{1}{4}y = \frac{1}{4}y}$

B) $F(x,y)$?

$$F(x,y) = \int_1^y\int_2^x \frac{1}{4}y\,dx\,dy = \int_1^y \frac{1}{4}y(x-2)\,dy = \int_1^y \frac{1}{4}yx\,dy - \int_1^y \frac{2}{4}y =$$

$$\frac{1}{4}x\left[\frac{y^2}{2}\right]_1^y - \left(\frac{2}{4}\left[\frac{y^2}{2}\right]_1^y\right) = \frac{1}{4}\left(\frac{y^2}{2}-\frac{1}{2}\right) - \frac{2}{4}\cdot\left(\frac{y^2}{2}-\frac{1}{2}\right) = -\frac{1}{4}\left(\frac{y^2-1}{2}\right)$$

C) Dentsitate funtzioak A) atalean kalkulatuta.

ZUZENDU BEHARREA

x eta y-rekiko mugatu behar dago $F(x,y)$

$$F(x) = \int_2^3 1\,dx = 1$$

$$F(y) = \int_1^3 1\,dy = 2$$

D) $p(X+Y>4)$?

$$F(x,y) = \int_2^3\int_{4-x}^3 1\,dy\,dx = \int_2^3 [3-(4-x)]\,dx = \int_2^3 (-1+x)\,dx =$$

$$= -\int_2^3 1\,dx + \int_2^3 x\,dx = -1 + \left[\frac{x^2}{2}\right]_2^3 = -1 + \left(\frac{9}{2}-\frac{4}{2}\right) =$$

$$= -\frac{2}{2} + \frac{5}{2} = \frac{3}{2}$$

$\boxed{3}$

$$f(x) = \begin{cases} 0{,}5\,(2-x) & 0 < x < 2 \\ 0 & \text{BESTELA} \end{cases}$$

→ Egun bakoitzean registratzen den kafe kopurua

A) Egun batetik bestera salduatakoa INDEPENDIENTEA

$n = 250$

$p(X > 150)$?

$$E_x = \int_{-\infty}^{\infty} x\, f(x)\, dx = \int_0^2 x \cdot [0{,}5\,(2-x)]\, dx =$$

$$\int_0^2 (x - 0{,}5x^2)\, dx = \int_0^2 x\, dx - \int_0^2 0{,}5x^2\, dx = \left.\frac{x^2}{2}\right]_0^2 - 0{,}5\left[\frac{x^3}{3}\right]_0^2 =$$

$$\frac{4}{2} - \left(0{,}5 \cdot \frac{8}{3}\right) = \frac{4}{2} - \frac{4}{3} = \frac{12}{6} - \frac{8}{6} = \frac{4}{6} = \frac{2}{3}$$

Independienteak direnez

$m = E_x \cdot 250 = \frac{2}{3} \cdot 250 = 166{,}6$

$\sigma_1^2 = E(x^2) - m_x^2$

$$E(x^2) = \int_{-\infty}^{\infty} x^2 f(x)\, dx = \int_0^2 x^2 (1 - 0{,}5x)\, dx = \int_0^2 x^2 dx - \int_0^2 0{,}5x^3 dx =$$

$$= \left.\frac{x^3}{3}\right]_0^2 - 0{,}5 \left.\frac{x^4}{2}\right]_0^2 = \frac{8}{3} - 0{,}5\,\frac{16}{2} = \frac{8}{3} - 4 = -\frac{4}{3}$$

ZUZENDU BEHAR DA

$$\sigma_1^2 = \frac{5}{3} - \left(\frac{4}{3}\right)^2 = 1{,}22 \longrightarrow \sigma_1 = 1{,}105$$

$\sigma^2 = 1^2\sigma_1^2 + 1^2\sigma_2^2 \ldots = 250 \cdot \sigma_1^2 \quad , \sigma = \sqrt{250} \cdot 1{,}105;$

$\sigma = 17{,}4801$

$X \longrightarrow N(166{,}6\ ,\ 17{,}4801)$

$p(X > 150) = 1 - p(X < 150) = 1 - F(-0{,}949) =$

$$z = \frac{150 - 166{,}6}{17{,}4801} = -0{,}949$$

$\boxed{F(0{,}949) = 0{,}8264}$

$\boxed{4}$

$m = 0{,}02$

$\sigma = 0{,}01$

NORMALA $\rightsquigarrow$ $X \longrightarrow N(0{,}02,\ 0{,}01)$

ONTZAT $p \longrightarrow [0{,}009 - 0{,}031]$

A) $p(\text{soko oker})$?

$p(\text{soko oker}) = 1 - p(\text{soko ondo}) = 1 - p(0{,}009 < x < 0{,}031) =$

$1 - \left(P(X < 0{,}009) + \underbrace{P(x > 0{,}031)}_{1 - P(X < 0{,}031)} \right) = \cancel{1} - P(X < 0{,}009) - \cancel{1} + P(X < 0{,}031) =$

$- F(-1{,}1) + F(1{,}1) =$

$-1 + F(1{,}1) + F(1{,}1) = -1 + (2 \cdot 0{,}8665)$

$= 0{,}733$

TIPIFIKATU

$z = \dfrac{0{,}009 - 0{,}02}{0{,}01} = -1{,}1$

$z = \dfrac{0{,}031 - 0{,}02}{0{,}01} = 1{,}1$

B) $n = 20$

$p(x > 2)$?

BINOMIALA $\longrightarrow$ $X \longrightarrow b(20,\ 0{,}733)$

$p(x > 2) = 1 - p(x < 2) = 1 - p(0) - p(1) - p(2)$

- $p(0) = \binom{20}{0} \cdot 0{,}733^{0} \cdot 0{,}267^{20} = 3{,}39 \cdot 10^{-12}$
- $p(1) = \binom{20}{1} \cdot 0{,}733^{1} \cdot 0{,}267^{19} = 1{,}8614 \cdot 10^{-10}$
- $p(2) = \binom{20}{2} \cdot 0{,}733^{2} \cdot 0{,}267^{18} = 4{,}85 \cdot 10^{-9}$

$p(x > 2) = 1 - 3{,}39 \cdot 10^{-12} - 1{,}8614 \cdot 10^{-10} - 4{,}85 \cdot 10^{-9} = 0{,}999$

C) $\alpha = \%5$

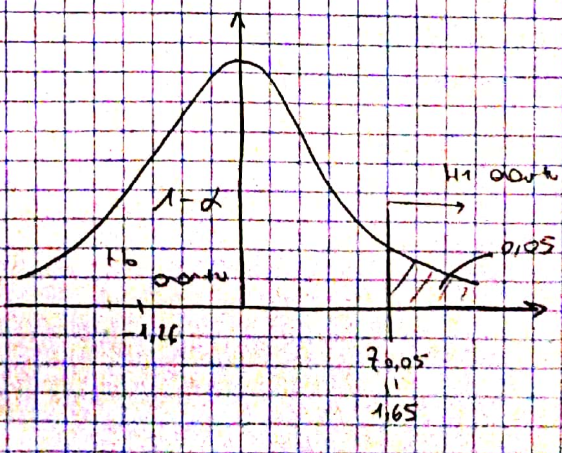
$n = 40$

$\bar{x} = 0{,}018$

$\sigma = 0{,}01$

$H_0: m = 0{,}02$

$H_1: m > 0{,}02$



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ESTATISTIKOA $\longrightarrow$ 1. kasua

$$z = \frac{0{,}018 - 0{,}02}{0{,}01 / \sqrt{40}} = -1{,}26$$

· % 95 eko konfiantzarekin baieztatu dezakegu batazbestekoa jaitsiko dela

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