1. Naloga

$P_{pop} = 1500$ mm/leto $\qquad 1km^2 = 10^3 m^2$

izhlapi 700 mm $\qquad 1500 - 700 = 800$ mm/leto

Površinski odtok površina

$$\varphi = \frac{\text{odtekla voda}}{\text{padla voda}} = \frac{800}{1500} = 0,53 = \underline{53\ \%}$$

2. Naloga

10, 15, 20, 30, 50, 55 m^3/s $\quad$ 2 letna povratna doba

Pearsonova III porazdelitev $\quad$ k.a. = 0,7

Kolikokrat v opazovalnem obdobju je bil tak pretok presežen?

$C_s = 0,7$

$T = 2$ leti

$p = \frac{1}{2} = 0,5$

$z = -0,116$

$$\left.\begin{matrix} 10 \\ 15 \\ 20 \\ 30 \\ 50 \\ 55 \end{matrix}\right\} ar = 30 \qquad \left.\begin{matrix} (10-30)^2 = 400 \\ (15-30)^2 = 225 \\ (20-30)^2 = 100 \\ (30-30)^2 = 0 \\ (50-30)^2 = 400 \\ (55-30)^2 = 625 \end{matrix}\right\} 1750$$

$$S_x = \sqrt{\frac{1750}{6}} = 17,08\ m^3/s$$

$Q_t = S_t + z(t) \cdot S_x$

$Q_t = 30 + (-0,116) \cdot 17,08$

$Q_t = 28,02\ m^3/s$

Pretok je bil presežen 3x.

V obdobju 36 let se je nek dogodek zgodil 4x.

$C_s = 0,3$

$T = \frac{36}{4} = 9$

$P(x) = \frac{1}{T} = \frac{1}{9} = 0,11$ ← verjetnost da se bo dogodek zgodil v katerem koli letu.

$p = \frac{1}{T}$ $\quad q = 1 - p$ $\quad p = 0,11$

$q = 1 - 0,11 = 0,89$

$$n = \left(\frac{(q-p)}{C_s\sqrt{pq}}\right)^2 = \left(\frac{0,89 - 0,11}{0,3\sqrt{0,11 \cdot 0,89}}\right)^2 = 69,1 \text{ let}$$

Povratna doba je 69 let.

Log Pearson III

$T = 25 \text{ let} \rightarrow P = \frac{1}{25} = 0,04 = 0,96$

Znani podatki

$C_s = 1,1$ $\quad$ $\cancel{z = 0,96}$ $\quad z = 2,066$

	Q	log			
1	13	1,1139	1,3095	$(1,1139 - 1,3095)^2 = 0,0383$	
2	17	1,2304		$(1,2304 - 1,3095)^2 = 0,0063$	
3	19	1,2788		$(1,2788 - 1,3095)^2 = 0,0009$	$S_x = \sqrt{\frac{0,1054}{5}}$
4	24	1,3802		$(1,3802 - 1,3095)^2 = 0,0049$	$S_x = 0,1452$
5	35	1,5441		$(1,5441 - 1,3095)^2 = 0,0550$	

$Q_t = S_T + z(t) \cdot S_x$

$Q_t = 1,3095 + 2,066 \cdot 0,1452$

$Q_t = 3,5207 \ m^3/s$

$Q = 10^{3.5207}$

$Q = 41,21 m^3$

$C_x = 2$. Podatki isti kot v prejšnji nalogi

$$C_s = \frac{n}{(n-1)(n-2)} \cdot \frac{\Sigma(x_i - \bar{x})^3}{S_x^3}$$

z $t = 0,96$

$$C_s = \frac{5}{4 \cdot 3} \cdot \frac{0,005272}{0,003235}$$

$$= 0,41\bar{6} \cdot 1,6297$$

$$= 0,6779$$

$cs = 0,7$

$Z = 1,967$

$$Q_{log}(t) = 1,3094 + 1,967 \cdot 0,1479$$

$$= 1,600$$

$$Q = 10^{1,600} = \underline{\underline{39,81\ m^3/s}}$$

BINOMSKA FUNKCIJA

$$P_n(x) = \binom{n}{x} \cdot p^x \cdot q^{n-x}$$

št. let

št. poskusov

verjetnost lahko se zgodi v katerem koli dnevu

$p = \frac{1}{T}$

$q = 1 - p$

Vsi poskusi: 54 let

$T = \frac{54}{3} = \underline{\underline{18\ let}}$

Uspeli poskusi: 3

Kolikšna je verjetnost da se v 54 letih zgodi 3x poplava?

$$P_{54}(3) = \binom{54}{3} \cdot 0,055^3 \cdot 0,945^{54-3} = 0,23 = \underline{\underline{23\%}}$$

$p = \frac{1}{18} = 0,055$

$q = 1 - 0,055 = 0,945$

Dogodek se ne zgodi v n zaporednih let

$$p(x) = 1 - P(x) = \left(1 - \frac{1}{18}\right)^{54} = 0,05$$

$$P(x) = \left(1 - \frac{1}{T}\right)^n$$

Dogodek se zgodi vsaj enkrat v n zaporednih let

$$p(x) = \left(1 - \left(1 - \frac{1}{T}\right)^n\right) =$$

$$p(x) = 1 - \left(1 - \frac{1}{18}\right)^{54} = \underline{\underline{0,95}}$$

$P(x) = \left(1 - \frac{1}{T}\right)^{n} = x$

ne poznamo

$T = \frac{-1}{\sqrt[n]{1-x} - 1}$

43 let
5 dogodkov

Verjetnost da se poplava zgodi vsaj 3x

največkrat 2 x

točno 5 krat

$T = \frac{43}{5} = 9 \text{ let}$

$p = \frac{1}{T} = \frac{1}{9} = 0{,}11$

$q = 1 - 0{,}11 = 0{,}89$

$P_n(x) = \binom{n}{x} p^x \cdot q^{n-x}$

$P_{43}(0) = \left(1 - \frac{1}{T}\right)^{n} = 0{,}00631 = 0{,}631\,\%$

$P_{43}(1) = \binom{43}{1} \cdot 0{,}11^1 \cdot 0{,}89^{42} = 0{,}03542$

$P_{43}(0) = \binom{43}{0} \cdot 0{,}11^0 \cdot 0{,}89^{43} = 0{,}00666 = 0{,}666\,\%$

$P_{43}(2) = \binom{43}{2} \cdot 0{,}11^2 \cdot 0{,}89^{41} = 0{,}0919$

$P_{43}(3) = \binom{43}{3} \cdot 0{,}11^3 \cdot 0{,}89^{40} = 0{,}1553$

Največ 2x

$P_0 + P_1 + P_2 = 0{,}00631 + 0{,}03542 + 0{,}0919 = 0{,}13363 = 13{,}36\,\%$

Vsaj 4x

$1 - P_0 - P_1 - P_2 - P_3 = 1 - 0{,}00631 - 0{,}03542 - 0{,}0919 - 0{,}1553 = 0{,}71107$

$= 71{,}11\,\%$

$$P\left(\frac{x_1}{x_2}\right) = \frac{P(x_1 \cap x_2)}{P(x_2)}$$

← verjetnost produkta neodvisnih dogodkov

← vrednost x_2

pogojna vrednost

$$P(x_1 \cup x_2) = P(x_1) + P(x_2) - P(x_1 \cap x_2)$$

$P(x_1) = 0{,}6$

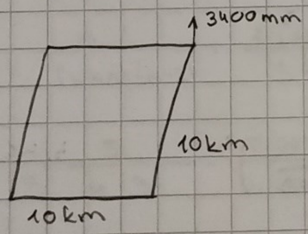
$P(x_2) = 0{,}3$

verjetnost vsote združljivih dogodkov

$$P(x_1 \cup x_2) = P(x_1) + P(x_2) - P(x_1) \cdot P(x_2)$$

$$= 0{,}6 + 0{,}3 - (0{,}6 \cdot 0{,}3) = \underline{\underline{0{,}72 = 72\%}}$$

Na povodje velikosti 100 km² pade povprečna letna količina padavin 3400 mm. Od tega jih izhlapi 1300 mm. Po poenostavljeni enačbi vodne bilance izračunajte površinski odtok s povodja v m². Kolikšen je koeficient odtoka?



$$\varphi = \frac{\text{odtekla voda}}{\text{padla voda}} = \frac{2100\text{ mm}}{3400\text{ mm}} = 0{,}6176 = \underline{62\%}$$

padle vode 3400 mm

izhlapele vode 1300 mm

odtekle vode 2100 mm

3400 mm = 0,0034 km

1300 mm = 0,0013 km

$100 \cdot 0{,}0034\text{ km} = 0{,}34\text{ m}^3$

$100 \cdot 0{,}0013\text{ km} = 0{,}13\text{ m}^3$

Za izmerjene pretoke 50, 100, 90, 120, 150, 180 m^3/s, izračunajte 5-letno povratno dobo po pearsonovi III porazdelitvi, če je koeficient asimetrije enak 0,7. Ne pozabite na enote! Kolikokrat v opazovalnem obdobju je bil tak pretok presežen?

	Q		
1	50	$(50-115)^2 = 4225$	
2	100	$(100-115)^2 = 225$	
3	90	$(90-115)^2 = 625$	
4	120	$(120-115)^2 = 25$	
5	150	$(150-115)^2 = 1225$	
6	180	$(180-115)^2 = 4225$	

$S_t = 115$; vsota kvadratov $= 10550$

$$S_x = \sqrt{\frac{10550}{6}} = 41,93$$

$T = 5$ let

$C_s = 0,7$

$p = \frac{1}{5} = 0,2$

$z = -0,857$

$$Q_t = S_t + z(t) \cdot S_x$$

$$Q_t = 115 + (-0,857) \cdot 41,93$$

$$Q_t = 79,06 \ m^3/s$$

Pretok je presežen 5x.

V obdobju 60 let se je nek dogodek zgodil 6x.

$C_s = 0,3$

$T = \frac{60}{6} = 10$

$P_x = \frac{1}{T} = \frac{1}{10} = 0,1$

$q = 1 - p = 1 - 0,1 = 0,9$

$$n = \left(\frac{q-p}{cs\sqrt{p \cdot q}} \right)^2$$

$$n = \left(\frac{0,9 - 0,1}{0,3\sqrt{0,1 \cdot 0,9}} \right)^2$$

$$n = 79,01$$

Povratna doba je 79 let.

log Pearson III

$t = 30\,let$ $\quad C_s = 1{,}2$

$\frac{1}{30} = 0{,}033$

$F(x) = 0{,}96$

$z = 2{,}087$

	Q	log Q
1	15	1,176
2	19	1,279
3	21	1,322
4	25	1,398
5	29	1,462

$S_t = 1{,}3274$

$(1{,}176 - 1{,}327)^2 = 0{,}022801$

$(1{,}279 - 1{,}327)^2 = 0{,}002304$

$(1{,}322 - 1{,}327)^2 = 0{,}000025$

$(1{,}398 - 1{,}327)^2 = 0{,}005041$

$(1{,}462 - 1{,}327)^2 = 0{,}018225$

$\Sigma = 0{,}048396$

$$S_x = \sqrt{\frac{0{,}048396}{5}} = 0{,}09838$$

$$Q_{log}(t) = S_t + z(t) \cdot S_x)$$

$$= 1{,}3274 + (2{,}087) \cdot 0{,}09838$$

$$= 1{,}53272$$

$$Q(T) = 10^{1{,}53272} = 34{,}097\ m^3/s$$

Poišči C_s podatki so enaki kot v prejšni nalogi.

$$C_s = \frac{n}{(n-1)(n-2)} \cdot \frac{\Sigma (x_i - \bar{x})^3}{S x^3}$$

$$= \frac{5}{4 \cdot 3} \cdot \frac{-0{,}000731514}{0{,}000113351}$$

$$= -2{,}69$$

$(1{,}176 - 1{,}327)^3 = -0{,}00344$

$(1{,}279 - 1{,}327)^3 = -0{,}00011$

$(1{,}322 - 1{,}327)^3 = -0{,}000000125$

$(1{,}398 - 1{,}327)^3 = 0{,}000357911$

$(1{,}462 - 1{,}327)^3 = 0{,}0024603$

$S_x = 0{,}048396^3 = 0{,}000113351$

$$Q_{log}(t) = S_t + z(t) \cdot S_x$$

BINOMSKA FUNKCIJA

n= Vsi poskusi : 78 $T = \frac{78}{6} = 13$ let

x= Uspeli poskusi : 6 $P_{(A)} = \frac{1}{13} = 0{,}08$

$q = 1 - 0{,}077 = 0{,}92$

Kolikšna je verjetnost da se v 78 letih zgodi 6x poplava?

$$P_{78}(6) = \binom{78}{6} \cdot 0{,}08^{6} \cdot 0{,}92^{78-6} = 0{,}1663 = 16{,}63\ \%$$

Da se dogodek zgodi vsaj enkrat v n-zaporednih let.

$$P(x) = 1(1 - \frac{1}{T})^{n} = 1(1 - \frac{1}{13})^{78} = 0{,}002$$

Dogodek se zgodi vsaj enkrat v n-zaporednih let.

$$P(x) = 1-(1- \frac{1}{T})^{n} = 1-(1- \frac{1}{13})^{78} = 0{,}998$$

n 63 let

x 5 dogodkov

$$P_n(x) = \binom{n}{x} \cdot p^{n} \cdot q^{n-x}$$

Verjetnost da se poplava zgodi vsaj 3x

največ 2x

vsaj 4x

$T = \frac{63}{5} = 13$ let

$P = \frac{1}{T} = \frac{1}{13} = 0{,}08$

$q = 1 - 0{,}08 = 0{,}92$

$$P_{63}(0) = (1 - \frac{1}{T})^{n} = (1 - \frac{1}{13})^{63} = 0{,}00646 = 0{,}646\%$$

$$P_{63}(1) = \binom{63}{1} \cdot 0{,}08^{1} \cdot 0{,}92^{62} = 0{,}02866$$

$$P_{63}(0) = \binom{63}{0} \cdot 0{,}08^{0} \cdot 0{,}92^{63} = 0{,}00523$$

$$P_{63}(2) = \binom{63}{2} \cdot 0{,}08^{2} \cdot 0{,}92^{61} = 0{,}07726$$

$$P_{63}(3) = \binom{63}{3} \cdot 0{,}08^{3} \cdot 0{,}92^{60} = 0{,}13599$$

Največ 2x

$$P_0 + P_1 + P_2 = 0{,}00646 + 0{,}02866 + 0{,}07726 = 0{,}11238 = 11{,}24\%$$

Vsaj 4x

$$1 - P_0 - P_1 - P_2 - P_3 = 1 - 0{,}00646 - 0{,}02866 - 0{,}07726 - 0{,}13599$$

$$= 0{,}75163 = 75{,}16\ \%$$

→ Zaščita pred 2-letno povratno dobo

→ odstranitev po 3letih

$p = \frac{1}{T} = \frac{1}{2} = 0,5$

$q = 1 - 0,5 = 0,5$

Poplava se ne zgodi

$(1 - \frac{1}{T})^n = (1 - \frac{1}{2})^3 = 0,125 = \underline{\underline{12,5\%}}$

Poplava se zgodi 2x

$P_n(x) = \binom{n}{x} p^x \cdot q^{n-x}$

$P_2(3) = \binom{3}{2} = \cdot 0,5^2 \cdot 0,5^1 = 0,375 = \underline{\underline{37,5\%}}$

$P_0(3) = \binom{3}{0} = 0,5^0 \cdot 0,5^3 = 0,125 = \underline{\underline{12,5\%}}$

$1 - (1 - \frac{1}{2})^3 = 0,875 = \underline{\underline{87,5\%}}$

Povratna doba 10 let

Obdobje: 40 let

$p = \frac{1}{10} = 0,1$

$q = 1 - 0,1 = 0,9$

Take vode nebo

$P = (1 - \frac{1}{T})^n = (1 - \frac{1}{10})^{40} = 0,0148 = \underline{\underline{1,48\%}}$

Taka voda bo 3x

$P_n(x) = \binom{n}{x} p^x - q^{n-x}$

$P_{40}(3) = \binom{40}{3} \cdot 0,1^3 - 0,9^{40-3} = 0,2003 = \underline{\underline{20,03\%}}$

Možnost da se taka voda zgodi 3x je 20,03%.

GUMBEL

Q 100 let $z = 3,137$

1 175
2 182
3 203
4 167
5 194
6 210

$\overline{x} = 188,5$

$(175 - 188,5)^2 = 182,25$
$(182 - 188,5)^2 = 42,25$
$(203 - 188,5)^2 = 210,25$
$(167 - 188,5)^2 = 462,25$
$(194 - 188,5)^2 = 30,25$
$(210 - 188,5)^2 = 462,25$

$\sum = 1389,5$

$S_x = \sqrt{\frac{1389,5}{6}} = 15,22$

$Q(t) = S_t + z(t) \cdot S_x$

$Q(t) = 188,5 + 3,137 \cdot 15,22$

$Q(t) = 236,25 \ m^3/s$

$R = 10\%$

$n = 5$ let

Kakšno povratno dobo mora uporabiti konstruktor avtoceste za kritični podvoz, če je pripravljen sprejeti le 10% tveganje poplavljanja v naslednjih 5 letih?

$$R = 1-\left(1-\frac{1}{T}\right)^n$$

$$\left(1-\frac{1}{T}\right)^n = R-1 /^n$$

$$\left(1-\frac{1}{T}\right) = \sqrt[n]{R-1}$$

$$\frac{1}{T} = \sqrt[n]{1-R} - 1$$

$$\frac{1}{T} = \sqrt[5]{1-10\%} - 1 = 0{,}02085$$

$$T = 0{,}02085^{-1}$$

$$T = 47{,}96 = \underline{\underline{48 \text{ let}}}$$

Pogojna verjetnost $P(E/F)$ izpada elektrike pri poplavi je 0,7, pogojna verjetnost $P(F/E)$ pojava poplave pri izpadu elektrike pa je 0,3. Določi verjetnosti $P(E)$ in $P(F)$, če je produkt verjetnosti $P(E\cap F)$ enak 0,2.

$P(E/F) = 0{,}7$

$P(F/E) = 0{,}3$

$P(E\cap F) = 0{,}2$

$P(E) = ?$

$P(F) = ?$

$$P(F) = \frac{P(E\cap F)}{P(E/F)} = \frac{0{,}2}{0{,}7} = \underline{\underline{0{,}2857}}$$

$$P(E) = \frac{P(E\cap F)}{P(F/E)} = \frac{0{,}2}{0{,}3} = 0{,}666 = \underline{\underline{0{,}67}}$$

V poplavnem območju je zgrajen protipoplavni zid za zaščito tamkajšnjih hiš. Zid je zgrajen za zaščito pred pretoki vode s/z 7-letno ~~dobo~~ povratno dobo. Zid bodo odstranili po 5 letih, potem ko bodo vse hiše preselili. Določi verjetnost, da:

a) zid ne bo prelit med selitvijo

b) zid bo prelit vsaj enkrat preden se vsi preselijo;

c) zid bo prelit 2x preden se vsi preselijo

a) $T = 7$ let $\qquad P(P) = \frac{1}{T} = \frac{1}{7} = 0{,}1428 = \underline{0{,}14}$

$n = 5$ let $\qquad P(\bar{P}) = 1 - P(P) = 1 - 0{,}14 = \underline{0{,}86}$

$$P(A) = P(\bar{P}) \cdot P_2(\bar{P}) \ldots P_n = \left(1 - \frac{1}{T}\right)^n = \left(1 - \frac{1}{7}\right)^5 = \underline{0{,}4627}$$

b) $P(B) = P - P(A) = 1 - P(A) = 1 - 0{,}4627 = \underline{0{,}5373}$

c) x 2
n 5 $\qquad P_5(2) = \binom{5}{2} \cdot 0{,}14^2 \cdot 0{,}86^{5-2} = \underline{0{,}1247}$

Kakšna je verjetnost, da se visoka voda s/z 5-letno povratno dobo, ne pojavi v obdobju 15 let? Kakšna je verjetnost, da se tako visoka vode pojavijo 5-krat v istem obdobju? Kolikokrat se bo tako visoka voda v tem obdobju pojavila ~~najverjetnje~~ najverjetnejše?

$T = 5$ let $\qquad p = \frac{1}{T} = \frac{1}{5} = 0{,}2$

$n = 15$ let $\qquad q = 1 - 0{,}2 = 0{,}8$

$x = 5$ krat $\qquad P_{15}(5) = \binom{15}{5} \cdot 0{,}2^5 \cdot 0{,}8^{15-5} = \underline{0{,}1032}$

$$P(A) = \left(1 - \frac{1}{T}\right)^n = \left(1 - \frac{1}{5}\right)^{15} = \underline{0{,}0352}$$

$$P(B) = 1 - P(A) = 1 - 0{,}0352 = \underline{0{,}9648}$$

$R = 10\%$

$n = 35$ let

$T = ?$

$$R = 1\left(1 - \frac{1}{T}\right)^n$$

$$\left(1 - \frac{1}{T}\right)^n = R - 1$$

$$1 - \frac{1}{T} = \sqrt[n]{R - 1}$$

$$\frac{1}{T} = \sqrt[n]{R - 1} - 1$$

$$\frac{1}{T} = \sqrt[35]{1 - 10\%} - 1$$

$$T = 0{,}0030^{-1}$$

$$T = 332{,}69$$

$$\underline{T = 333 \text{ let}}$$

$P(E/F) = 0{,}7$

$P(F/E) = 0{,}3$

$P(E \cap F) = 0{,}15$

$P(E) = ?$

$P(F) = ?$

$$P(x_1/x_2) = \frac{P(x_1 \cap x_2)}{P(x_2)}$$

$$P(F) = \frac{0{,}15}{0{,}7} = \underline{0{,}2143}$$

$$P(E) = \frac{0{,}15}{0{,}3} = \underline{\underline{0{,}5}}$$

$T = 7\,let$

$n = 6\,let$

$x = 2$

$$P = \left(1 - \frac{1}{7}\right)^n = \left(1 - \frac{1}{7}\right)^6 = \underline{\underline{0{,}39657}}$$

$$P = 1 - P(A) = 1 - 0{,}39657 = \underline{\underline{0{,}60343}}$$

$$P = \left(1 - \frac{1}{7}\right)^n = \left(1 - \frac{1}{7}\right)^6 = 0{,}397$$

$$q = 1 - 0{,}397 = 0{,}603$$

$$P_7(6) = \binom{7}{6} \cdot 0{,}397^6 \cdot 0{,}603^{7-6} = \underline{\underline{0{,}0165}}$$

$T = 5\,let$

$n = 2\,leti$

$x = 1$

$$P = \left(1 - \frac{1}{5}\right)^2 = 0{,}64$$

$$q = 1 - 0{,}64 = 0{,}36$$

$$P = \left(1 - \frac{1}{5}\right)^2 = 0{,}64 = 64\,\%$$

$$P_2(1) = \binom{2}{1} \cdot \left(\frac{1}{5}\right)^1 \cdot \left(1 - \frac{1}{5}\right)^1 = \underline{\underline{0{,}32}}$$

Da se padavine ~~[illegible]~~ pojavijo jutri

$$p = \frac{10}{31} = 0{,}32258 = 32{,}25\,\%$$

Da se padavine ne pojavijo jutri

$$q = 1 - p = 1 - \frac{10}{31} = 0{,}6774 = 67{,}74\,\%$$

Da se pojavijo 3x v naslednjih 10 dneh

$$P_{10}(3) = \binom{10}{3} \cdot \left(\frac{10}{31}\right)^3 \cdot \left(1 - \frac{10}{31}\right)^{10-3} = 0{,}2636 = 26{,}36\,\%$$

Vsaj 1x v naslednjih 10ih dneh

$$P_{10}(1) = \binom{10}{1} \cdot \left(\frac{10}{31}\right)^1 \cdot \left(1 - \frac{10}{31}\right)^{10-1} = 0{,}09691 = 9{,}69\,\%$$

Metoda Sevruka:

N = 7 dni

$S_p = 0$

$k_p = 1,044$

$P_M = 82,4 mm$

Veter = 1,8 m/s

$$\frac{2,0-2,5}{1,05-1,035} = \frac{2,0-1,8}{1,05-x} = \frac{0,5}{0,015} \times \frac{0,2}{1,05-x}$$

$$0,2 \cdot 0,015 = 0,5 \cdot (1,05-x)$$

$$0,003 = 0,5 \cdot (1,05-x)$$

$$\frac{0,003}{0,5} = 1,05-x$$

$$1,05-0,006 = x$$

$$\underline{x = 1,044}$$

$$P_k = k_p \cdot \left[P_M + 0,15 \cdot N \cdot \left(2 - \frac{S_p}{100}\right)\right]$$

$$P_k = 1,044 \cdot \left[82,4 + 0,15 \cdot 7 \cdot \left(2 - \frac{0}{100}\right)\right]$$

$$\underline{P_k = 88,218 \text{ mm}}$$

$$\frac{P_k - P_M}{P_M} = \frac{88,218 - 82,4}{82,4} = \underline{7,06\%}$$

Metoda Dahlströma

$$P_k = (1 + k_v) \cdot P_M + N \cdot \Delta P_1 + \sum_{i=1}^{N} \Delta P_2$$

$$P_k = (1+0,02) \cdot 82,4 mm + 7 dni \cdot 0,1 + 4,452 = 89,1$$

$$\Delta P_2 = N \cdot E_d = 7 \cdot 0,636 = 4,452$$

$$E_d = 0,035 \cdot T + 0,125 = 0,035 \cdot 14,6°C + 0,125 = 0,636$$

$$\frac{89,1 - 82,4}{82,4} = \underline{8,25\%}$$

Metoda Sevruka

N = 18 dni

$S_p = 0$

$P_M = 131,6 mm$

Veter = 1,96 m/s

$k_p = 1,0488$

$$k_p = \frac{2,0-1,5}{1,05-1,035} = \frac{2,0-1,96}{1,05-x} = \frac{0,5}{0,015} \times \frac{0,04}{1,05-x}$$

$$0,5 \cdot (1,05-x) = 0,015 \cdot 0,04$$

$$0,5 \cdot (1,05-x) = 0,0006$$

$$1,05-x = 0,0012$$

$$x = 1,05 \cdot 0,0012 = 1,0488$$

$$P_k = k_p \cdot \left[P_M + 0,15 \cdot N \cdot \left(2 - \frac{S_p}{100}\right)\right]$$

$$P_k = 1,048 \cdot \left[131,6 + 0,15 \cdot 18 \cdot \left(2 - \frac{0}{100}\right)\right]$$

$$P_k = 143,576 \text{ mm}$$

$$\frac{P_k - P_M}{P_M} = \frac{143,576 - 131,6}{131,6} = \underline{9,1\%}$$

Metoda Sevruka

$P_M = 175 mm$

$N = 19$ dni

$V_p = 100\%$

$S_p = 0\%$

$k_p = 1{,}022$

Veter $= 0{,}9\ m/s$

$$k_p = \frac{1{,}0 - 0{,}5}{1{,}025 - 1{,}01} = \frac{1{,}0 - 0{,}9}{1{,}025 - x} = \frac{0{,}5}{0{,}015} = \frac{0{,}1}{1{,}025 - x}$$

$$0{,}5 \cdot (1{,}025 - x) = 0{,}1 \cdot 0{,}015$$

$$1{,}025 - x = \frac{0{,}0015}{0{,}5}$$

$$x = 1{,}025 - 0{,}003$$

$$x = 1{,}022$$

$$P_k = k_p \left[P_M + 0{,}15 \cdot N \cdot \left(2 - \frac{S_p}{100}\right)\right]$$

$$P_k = 1{,}022 \left[175 + 0{,}15 \cdot 19 \cdot \left(2 - \frac{0}{100}\right)\right]$$

$$\underline{P_k = 184{,}68\ mm}$$

$$\frac{184{,}68 - 175}{175} = 0{,}0553 = \underline{5{,}53\%}$$

GUMBEL

$T = 5$ let

Q

	Q	
1	150	$(150-150)^2 = 0$
2	110	$(110-150)^2 = 1600$
3	180	$(180-150)^2 = 900$
4	100	$(100-150)^2 = 2500$
5	200	$(200-150)^2 = 2500$
6	160	$(160-150)^2 = 100$
7	250	$(250-150)^2 = 10000$
8	100	$(100-150)^2 = 2500$
9	80	$(80-150)^2 = 4900$
10	170	$(170-150)^2 = 400$

$\bar{Q} = 150$

$S_x = \sqrt{\frac{25400}{10}}$

$S_x = 50{,}4 \ m^3/s$

$Q(t) = St + z(t) \cdot S_x$

$Q(t) = 150 + 0{,}719 \cdot 50{,}4$

$Q(t) = 186{,}24 \ m^3/s$

Pearson III

$C_s = 0{,}7$

$T = 2$ leti

$P = \frac{1}{2} = 0{,}5$

$z = -0{,}116$

$Q(t) = St + z(t) \cdot S_x$

$Q(t) = 150 + (-0{,}116) \cdot 50{,}4$

$Q(t) = 144{,}154 \ m^3/s$

log Pearson III

Q log

	Q log	$(x - St)^2$
1	2,17609	0,000633
2	2,04139	0,012000
3	2,25527	0,010885
4	2,00000	0,022782
5	2,30102	0,022525
6	2,20412	0,002828
7	2,39794	0,061010
8	2,0	0,022782
9	1,90309	0,061428
10	2,23045	0,006322

$\bar{x} = 2{,}150937$

$S_x = \sqrt{\frac{0{,}223195}{10}} = 0{,}149397$

$Q(t) = St + Z(t) \cdot S_x$

$Q(t) = 2{,}150937 - 0{,}116 \cdot 0{,}149397$

$Q(t) = 2{,}133607$

$Q(t) = 10^{2{,}133607} = 136{,}02 \ m^3/s$

VAJA 13.

Površina porečja: $3{,}11\ km^2$

najdaljša vodna pot: $3{,}01\ km = 3010\ m$

h max : 1100 m

h min : 429

dh : 671 m

tan kota: $0{,}2229$ $\frac{dh}{pot} = \frac{671}{3010}$

kot: atan $0{,}2229 = 12{,}5658$

Povprečen padec: $(kot / 45) \cdot 100 = (12{,}5658/45) \cdot 100 = 27{,}92\ \%$

Raba tal: Gozd 96% k: 0,48

pašniki 4% k: 0,49

Povratna doba: 50 let

$$C = 0{,}96 \cdot 0{,}48 + 0{,}04 \cdot 0{,}49 = 0{,}48$$

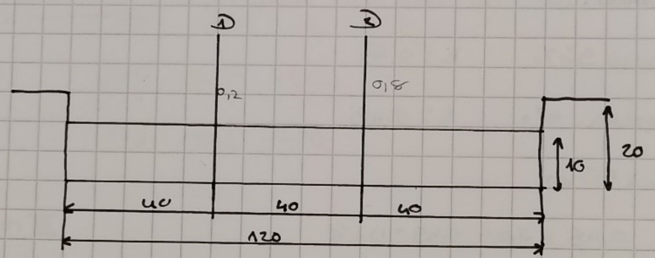
$$T_c = \frac{1{,}8 \cdot (1{,}1 - 0{,}48) \cdot (3010/0{,}3048)^{0{,}5}}{27{,}92^{(1/3)}} = 36{,}56\ min$$

$C = 0{,}48$ $Q_{max} = 0{,}278 \cdot C \cdot i \cdot A$

$i = 76\ min/h$ $Q_{max} = 0{,}278 \cdot 0{,}48 \cdot 76 \cdot 3{,}11$

$A = 3{,}11\ km^2$ $Q_{max} = 31{,}54\ m^3/s$

Na vodotoku Glinščica so bile s hidrometričnim krilom opravljene meritve hitrosti vode na dveh vertikalah. Prečni prerez vodotoka je prikazan na sliki (kote v cm.). Za obe vertikali sa že izračunana delna pretoka q_1 in q_2 (tabela). S pomočjo grafoanalitične metode izračunajte pretok vodotoka. Prikazana naj bo grafična in analitična rešitev. Ne pozabite na opremo osi grafa in enote!



$q_1 = 0{,}2$

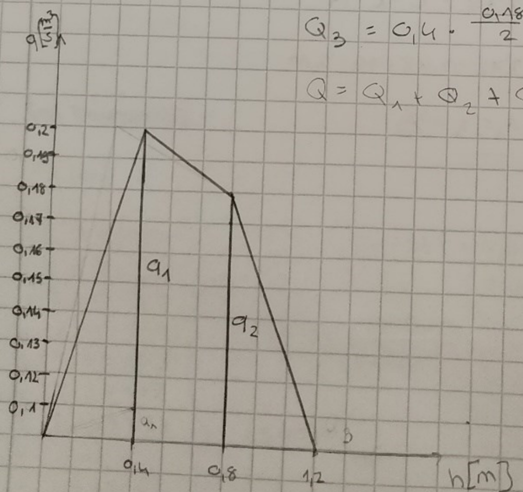
$q_2 = 0{,}18$

$$Q_1 = 0{,}4 \cdot \frac{0{,}2}{2} = \underline{\underline{0{,}04 \ m^3/s}}$$

$$Q_2 = 0{,}4 \cdot \frac{0{,}2+0{,}18}{2} = \underline{\underline{0{,}076 \ m^3/s}}$$

$$Q_3 = 0{,}4 \cdot \frac{0{,}18}{2} = \underline{\underline{0{,}036 \ m^3/s}}$$

$$Q = Q_1 + Q_2 + Q_3 = 0{,}152 \ m^3/s$$



$V = l \cdot P$

V = volumen odtoka s povodja [km³]

l = povprečne padavine vseh postaj iz mm v km

P = površina celotnega povodja