

Математика

Датум 17

N1, 17

$$n = 25$$

2, 4, 5, 6, 5, 9, 5, 2, 5, 4, 5, 6, 5, 9, 2, 4, 5, 6, 9, 5, 6, 9, 5, 6, 5

1) Бир. рг

2, 2, 2, 4, 4, 4, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 6, 6, 6, 6, 6, 9, 9, 9, 9

2) Частот. рг.

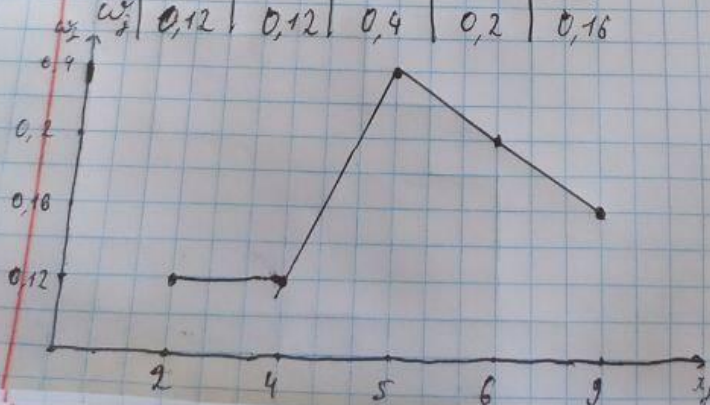
x_j	2	4	5	6	9
n_j	3	3	10	5	4

$$n = \sum_{j=1}^5 n_j = 3 + 3 + 10 + 5 + 4 = 25$$

3) Нормал. закон

$$w_j = \frac{n_j}{n}$$

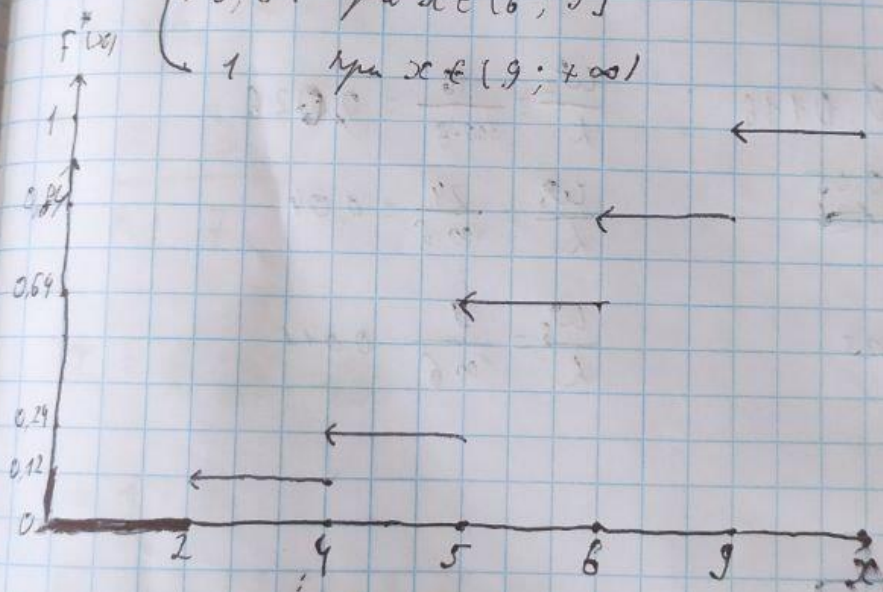
x_j	2	4	5	6	9
w_j	0,12	0,12	0,4	0,2	0,16



$$4) F^+(x) = \sum_{x_j \leq x} \frac{\lambda_j}{\lambda}$$



$$F^+(x) = \begin{cases} 0, & \text{при } x \in (-\infty; 2] \\ 0,12 & \text{при } x \in (2; 4] \\ 0,24 & \text{при } x \in (4; 5] \\ 0,64 & \text{при } x \in (5; 6] \\ 0,84 & \text{при } x \in (6; 9] \\ 1 & \text{при } x \in (9; +\infty) \end{cases}$$



N2.17

$a_{i-1} - a_i$	0-6	6-12	12-18	18-24	24-30	30-36
n_i	7	16	30	24	14	9

$$n = 100$$

$$b = h = 6$$

$$\frac{w_i}{h} = \frac{n_i}{nh}$$

$$\frac{w_1}{h} = \frac{7}{100 \cdot 6} = 0,0116$$

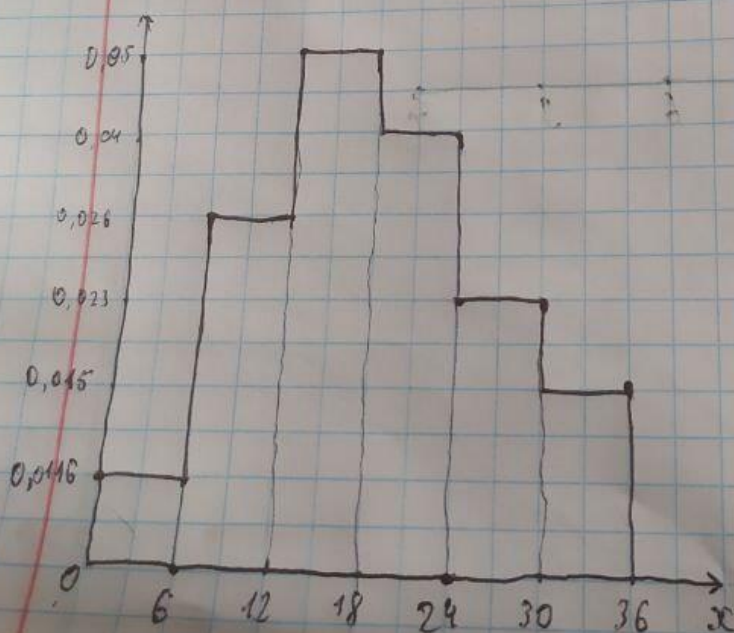
$$\frac{w_2}{h} = \frac{16}{100 \cdot 6} = 0,026$$

$$\frac{w_3}{h} = \frac{30}{100 \cdot 6} = 0,05$$

$$\frac{w_4}{h} = \frac{24}{100 \cdot 6} = 0,04$$

$$\frac{w_5}{h} = \frac{14}{100 \cdot 6} = 0,023$$

$$\frac{w_6}{h} = \frac{9}{100 \cdot 6} = 0,015$$



$$1) \bar{x} = \frac{1}{n} \sum_{i=1}^5 x_i \cdot h_i = \frac{1}{25} (2 \cdot 3 + 4 \cdot 3 + 5 \cdot 10 + 6 \cdot 5 + 9 \cdot 4) = \frac{137}{5} = 27.4$$

$$s^2 = \frac{1}{n} \sum_{i=1}^5 x_i^2 \cdot h_i - (\bar{x})^2 = \frac{1}{25} (2^2 \cdot 3 + 4^2 \cdot 3 + 5^2 \cdot 10 + 6^2 \cdot 5 + 9^2 \cdot 4) -$$

$$27.4^2 = \frac{1}{25} (12 + 48 + 250 + 180 + 324) - 27.4^2 = 3.8304$$

$$s = \sqrt{s^2} = \sqrt{3.8304} \approx 1.96$$

2) x_i	3	9	15	21	27	33
h_i	7	16	30	24	14	9

$$\bar{x} = \frac{1}{100} (3 \cdot 7 + 9 \cdot 16 + 15 \cdot 30 + 21 \cdot 24 + 27 \cdot 14 + 33 \cdot 9) =$$

$$= 17.94$$

$$s^2 = \frac{1}{100} (3^2 \cdot 7 + 9^2 \cdot 16 + 15^2 \cdot 30 + 21^2 \cdot 24 + 27^2 \cdot 14 + 33^2 \cdot 9) - 17.94^2 =$$

$$= 65.1564$$

N 4.17

$$G = 5$$

$$\bar{x} = 19,2$$

$$n = 49$$

$$\gamma = 0,95$$

$$a = ?$$

Решение

$$\bar{x} - \frac{t_{\gamma} G}{\sqrt{n}} < a < \bar{x} + \frac{t_{\gamma} G}{\sqrt{n}}$$

$$t_{\gamma}: \Phi(t_{\gamma}) = \frac{\gamma}{2}; \quad \Phi(t_{\gamma}) = \frac{0,95}{2} = 0,475 \rightarrow t_{\gamma} = 1,96$$

$$19,2 - \frac{1,96 \cdot 5}{7} < a < 19,2 + \frac{1,96 \cdot 5}{7}$$

$$17,8 < a < 20,6$$

$$\text{Ответ: } a \in (17,8; 20,6)$$

N 5.17

$$S = 5$$

$$a = ?$$

$$\bar{x} = 19,2$$

$$n = 16$$

$$\gamma = 0,95$$

$$\bar{x} - t \frac{S}{\sqrt{n}} < a < \bar{x} + t \frac{S}{\sqrt{n}}$$

$$t = t(x; n)$$

$$t = t(0,95; 16) = 2,13$$

$$19,2 - 2,31 \cdot \frac{5}{4} < a < 19,2 + 2,31 \cdot \frac{5}{4}$$

$$16,3125 < a < 22,0875$$

Выводы: $a \in (16,3125; 22,0875)$

$$N 6,17$$

$$S = 0,8$$

$$B = ?$$

$$n = 30$$

$$x = 0,99$$

Известно

$$S(1-q) < B < S(1+q), q < 1$$

$$0 < B < S(1+q), q \geq 1$$

$$q = q(x, n) = 0,43 < 1$$

$$0,8(1 - 0,43) < B < 0,8(1 + 0,43)$$

$$0,456 < B < 1,144$$

Выводы: $B \in (0,456; 1,144)$

N7.17

$(x_i, y_i): (1; 2,5), (3; 4,8), (5; 5,9), (7; 4,9), (9; 6,5)$

Таблица

i	x_i	y_i	x_i^2	$x_i y_i$	y_i^2
1	1	2,5	1	2,5	6,25
2	3	4,8	9	14,4	23,04
3	5	5,9	25	29,5	34,81
4	7	4,9	49	34,3	24,01
5	9	6,5	81	58,5	42,25
Σ	25	24,6	165	139,2	130,36

$$a, b \begin{cases} a \sum_{i=1}^n x_i^2 + b \sum_{i=1}^n x_i = \sum_{i=1}^n x_i y_i \\ a \sum_{i=1}^n x_i + b n = \sum_{i=1}^n y_i \end{cases}$$

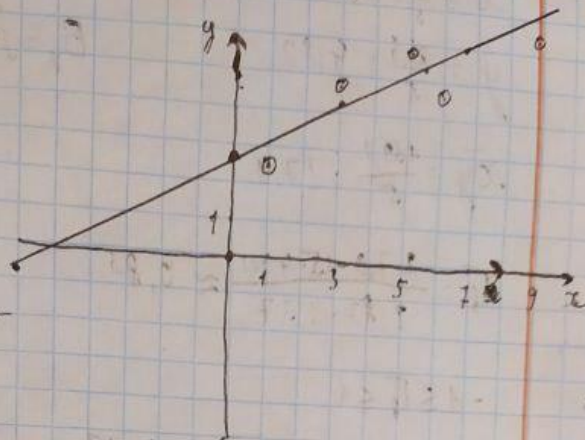
$$a, b \begin{cases} 165a + 25b = 139,2 \\ 25a + 5b = 24,6 \end{cases}$$

$$a, b \begin{cases} 165a + 25b = 139,2 \\ a = 0,984 - \frac{1}{5}b \end{cases}$$

$$\begin{cases} 10,5(0,984 - \frac{1}{5}b) + 2,5b = 139,2 \\ a = 0,984 - \frac{1}{5}b \end{cases}$$

$$\begin{cases} b = 2,895 \\ a = 0,405 \end{cases}$$

$$y = 0,405x + 2,895$$



x	y
0	2,895
3	4,11

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$$r = \frac{\bar{x}\bar{y} - \bar{x} \cdot \bar{y}}{s_x \cdot s_y}$$

$$\bar{x} = \frac{1}{n} \sum_{i=1}^n x_i; \quad \bar{y} = \frac{1}{n} \sum_{i=1}^n y_i$$

$$s_x = \sqrt{\frac{1}{n} \sum_{i=1}^n x_i^2 - (\bar{x})^2}; \quad s_y = \sqrt{\frac{1}{n} \sum_{i=1}^n y_i^2 - (\bar{y})^2}$$

$$\bar{x}\bar{y} = \frac{1}{n} \sum_{i=1}^n x_i \cdot y_i$$

7.17

$$n = 5; \quad \sum_{i=1}^5 x_i = 25; \quad \sum_{i=1}^5 y_i = 24,6; \quad \sum_{i=1}^5 x_i^2 = 105; \quad \sum_{i=1}^5 x_i y_i = 139,2; \quad \sum_{i=1}^5 y_i^2 = 130,36$$

$$\bar{x} = \frac{25}{5} = 5$$

$$\bar{y} = \frac{24,6}{5} = 4,92$$

$$\bar{xy} = \frac{139,2}{5} = 27,9$$

$$r = \frac{27,9 - 5 \cdot 4,92}{2,83 \cdot 1,37} \approx 0,85$$

$$-1 \leq r \leq 1$$

N 9.17

$$\alpha = 0,01$$

$a_{i-1} - a_i$	2,0-3,5	3,5-5,0	5,0-6,5	6,5-8,0	8,0-9,5	9,5-11,0	11,0-12,5
n_i	5	16	21	42	32	8	6

$$x_i = \frac{a_{i-1} + a_i}{2}$$

x_i	2,75	4,25	5,75	7,25	8,75	10,25	11,75
n_i	5	16	21	42	32	8	6

$$n = 130$$

$$\bar{x} = \frac{1}{n} \sum x_i n_i = \frac{1}{130} (2,75 \cdot 5 + 4,25 \cdot 16 + 5,75 \cdot 21 + 7,25 \cdot 42 +$$

$$8,75 \cdot 32 + 10,25 \cdot 8 + 11,75 \cdot 6) = \frac{1879}{130} \approx 14,45$$

$$s^2 = \frac{1}{n} \sum x_i^2 \cdot h_i - (\bar{x})^2 = \frac{1}{150} (2,75^2 \cdot 5 + 4,25^2 \cdot 15 + 5,75^2 \cdot 21 +$$

$$+ 7,25^2 \cdot 42 + 8,75^2 \cdot 32 + 10,25^2 \cdot 8 + 11,75^2 \cdot 6) - 7,23^2 \approx 4,25$$

$$s = 2,06$$

$$(a_{i-1}, a_i] \rightarrow (z_{i-1}, z_i]$$

$$Z = \frac{x - \bar{x}}{s} \quad z_i = \frac{x_i - \bar{x}}{s}$$

i	z_{i-1}	z_i	$\Phi(z_{i-1})$	$\Phi(z_i)$	p_i	$n_i = n \cdot p_i$
1	$-\infty$	-1,81	0,5	0,4649	0,035	4,5
2	-1,81	-1,08	0,4649	0,3599	0,105	15,65
3	-1,08	-0,35	0,3599	0,1368	0,2231	29,007
4	-0,35	0,37	0,1368	0,1443	0,2811	36,543
5	0,37	1,1	0,1443	0,3643	0,2205	28,6
6	1,1	1,83	0,3643	0,4664	0,1021	13,273
7	1,83	2,56	0,4664	0,4948	0,0284	3,692

$$\chi^2 = \sum \frac{(n_i - \hat{n}_i)^2}{\hat{n}_i}$$

i	n_i	$\hat{n}_i - n_i$	$(\hat{n}_i - n_i)^2$	$\frac{(\hat{n}_i - n_i)^2}{\hat{n}_i}$
1	5	0,5	0,25	0,05
2	16	2,35	5,5225	0,4046
3	21	-8,003	64,048	2,2083
4	42	5,457	29,7789	0,8149
5	32	3,4	11,56	0,4042
6	8	-5,273	27,8045	2,0948
7	6	2,308	5,3269	1,4428

$$\chi^2 = \sum \frac{(n_i - \hat{n}_i)^2}{\hat{n}_i} = 7,4196$$

$$L = 0,01; \quad \chi^2_{\alpha} = (0,01; 4) = 13,3$$

$$\chi^2 = 7,4196 < 13,3 = \chi^2_{\alpha}$$