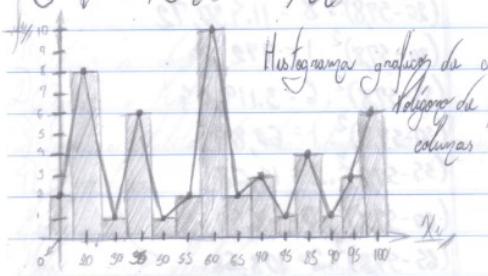
1 / 1

Histograma e polígono de frequências



Histograma gráficos de colunas geradas.
Polígono de frequência é um ponto no meio das colunas no qual será ligado por retas

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Aula Coluna 1

0-3 3-2
1-6 4-4
2-5

x_i	f_i	F_i	f_r	F_r	$x_i \cdot f_i$	$(x_i - \bar{x})^2 \cdot f_i$
0	3	3	15%	15%	0	$(0-1,9)^2 \cdot 3 = 10,83$
1	6	9	30%	45%	6	$(1-1,9)^2 \cdot 6 = 4,86$
2	5	14	25%	70%	10	$(2-1,9)^2 \cdot 5 = 0,05$
3	2	16	10%	80%	6	$(3-1,9)^2 \cdot 2 = 2,42$
4	4	20	20%	100%	16	$(4-1,9)^2 \cdot 4 = 17,64$
↓	↓		↓		↓	↓
$\sum x_i$	$\sum f_i = 20$		$\sum f_r = 100\%$		$\sum (x_i \cdot f_i) = 38$	$\sum (x_i - \bar{x})^2 \cdot f_i = 35,8$

Desvio Padrão
$S_x = \sqrt{\text{VARIÂNCIA}}$
$S_x = 1,37$

$\bar{x} = 38/20 \rightarrow \bar{x} = 1,9$

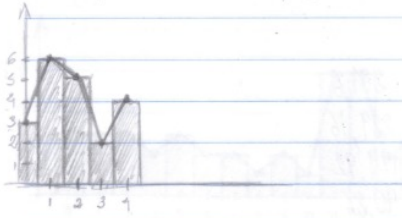
$M_o = 1$

$Md = x_{10} + x_{11} / 2 \rightarrow Md = 2+2/2 \rightarrow Md = 4/2 \rightarrow Md = 2$

Variância Amostral
$S_x^2 = \sum (x_i - \bar{x})^2 \cdot f_i / N-1 \quad S_x^2 = 1,88$

1 / 1

Histograma e polígono de frequência



Ava Coluna 2

x_i	f_i	F_i	f_R	F_R	$x_i \cdot f_i$	$(x_i - \bar{X})^2 \cdot f_i$
160	20	20	25%	25%	3.200	$(160-161,66)^2 \cdot 20 = 55,11$
161	17	37	21,25%	46,25%	2.737	$(160-161,66)^2 \cdot 17 = 7,91$
162	19	56	23,75%	70%	3.078	$(162-161,66)^2 \cdot 19 = 2,2$
163	18	74	22,50%	92,5%	2.934	$(163-161,66)^2 \cdot 18 = 32,32$
164	6	80	7,50%	100%	984	$(164-161,66)^2 \cdot 6 = 32,85$

$\sum f_i (80)$ $\sum f_R = 100\%$ $\sum x_i f_i = 12.933$ $\sum (x_i - \bar{X})^2 \cdot f_i = 129,89$

$\bar{X} = 12.933 / 80 = 161,66$

$M_o = 160$

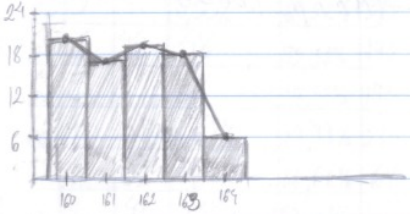
$Md = X_{40} + X_{41} / 2 \rightarrow 162+162/2 \rightarrow Md = 162$

Variância Amostral

$S_x^2 = \sum (x_i - \bar{X})^2 / N-1$ $S_x^2 = 1,64$

Desvio Padrão

$S_x = \sqrt{1,64} \rightarrow S_x = 1,28$



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Coluna 3

X_i	f_i	F_i	f_a	F_a	$X_i \cdot f_i$	$(X_i - \bar{X})^2 \cdot f_i$
0	3	3	6%	6%	0	$(0-9,74)^2 \cdot 3 = 284,6$
1	3	6	6%	12%	3	$(1-9,74)^2 \cdot 3 = 229,16$
2	3	9	6%	18%	6	$(2-9,74)^2 \cdot 3 = 179,72$
3	2	11	4%	22%	6	$(3-9,74)^2 \cdot 2 = 90,86$
4	3	14	6%	28%	12	$(4-9,74)^2 \cdot 3 = 98,84$
5	2	16	4%	32%	10	$(5-9,74)^2 \cdot 2 = 44,94$
6	2	18	4%	36%	12	$(6-9,74)^2 \cdot 2 = 27,98$
7	1	19	2%	38%	7	$(7-9,74)^2 \cdot 1 = 7,51$
8	2	21	4%	42%	16	$(8-9,74)^2 \cdot 2 = 6,06$
10	1	22	2%	44%	10	$(10-9,74)^2 \cdot 1 = 0,07$
11	6	28	12%	56%	66	$(11-9,74)^2 \cdot 6 = 9,53$
12	6	34	12%	68%	72	$(12-9,74)^2 \cdot 6 = 30,65$
13	2	36	4%	72%	26	$(13-9,74)^2 \cdot 2 = 21,26$
14	3	39	6%	78%	42	$(14-9,74)^2 \cdot 3 = 54,94$
15	1	40	2%	80%	15	$(15-9,74)^2 \cdot 1 = 27,69$
16	1	41	2%	82%	16	$(16-9,74)^2 \cdot 1 = 39,19$
17	3	44	6%	88%	51	$(17-9,74)^2 \cdot 3 = 158,12$
19	3	47	6%	94%	57	$(19-9,74)^2 \cdot 3 = 257,24$
20	3	50	6%	100%	60	$(20-9,74)^2 \cdot 3 = 315,80$
	$\sum f_i = 50$		$\sum f_a = 100\%$		$\sum X_i \cdot f_i = 487$	$\sum (X_i - \bar{X})^2 \cdot f_i = 1.883,64$

$\bar{X} = 487/50 \quad \bar{X} = 9,74$

$M_o = 11$ e 12

$Md = X_{25} + X_{26} / 2 \rightarrow Md = 11 + 11 / 2 \rightarrow Md = 11$

Variância Amostral

$S_x^2 = \sum (X_i - \bar{X})^2 \cdot f_i / N-1 \rightarrow S_x^2 = 38,44$

Desvio Padrão

$S_x = \sqrt{\text{Variância}} \rightarrow S_x = 6,20$

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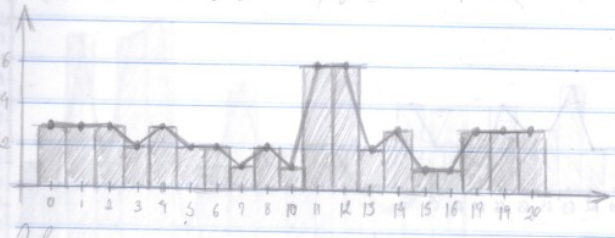
Histograma e polígono de frequência



Coluna 4

N_i	f_i	F_i	f_r	F_r	$x_i \cdot f_i$	$(x_i - \bar{x})^2 \cdot f_i$	
50	3	3	5%	5%	150	$(50-59,3)^2 \cdot 3 = 259,47$	$\sum f_i = 60$
51	7	10	11,67%	16,67%	357	$(51-59,3)^2 \cdot 7 = 482,23$	$\sum f_r = 99,99\% \to 100\%$
52	3	13	5%	21,67%	156	$(52-59,3)^2 \cdot 3 = 159,87$	$\sum (x_i \cdot f_i) = 3.558$
53	2	15	3,33%	25%	106	$(53-59,3)^2 \cdot 2 = 79,38$	$\sum (x_i - \bar{x})^2 \cdot f_i = 2.458,6$
54	3	18	5%	30%	162	$(54-59,3)^2 \cdot 3 = 84,27$	
55	3	21	5%	35%	165	$(55-59,3)^2 \cdot 3 = 55,59$	$\bar{X} = 3558/60 \to \bar{X} = 59,30$
56	3	24	5%	40%	168	$(56-59,3)^2 \cdot 3 = 32,67$	$M_o = 51$
57	3	27	5%	45%	171	$(57-59,3)^2 \cdot 3 = 15,87$	$M_d = X_{30} + X_{31}/2 \to M_d = 58+59/2 = 58,5$
58	3	30	5%	50%	174	$(58-59,3)^2 \cdot 3 = 5,07$	
59	2	32	3,33%	53,33%	118	$(59-59,3)^2 \cdot 2 = 0,18$	Variancia Amostral
60	2	34	3,33%	56,66%	120	$(60-59,3)^2 \cdot 2 = 0,98$	$S_x^2 = 2458,6/59 \to S_x^2 = 41,69$
62	2	36	3,33%	59,99%	124	$(62-59,3)^2 \cdot 2 = 14,58$	
63	5	41	8,33%	68,32%	315	$(63-59,3)^2 \cdot 5 = 68,45$	Desvio Padrão
64	3	44	5%	73,32%	192	$(64-59,3)^2 \cdot 3 = 66,27$	$S_x = \sqrt{\text{VARIANCIA}}$
65	3	47	5%	78,32%	195	$(65-59,3)^2 \cdot 3 = 97,47$	$S_x = 6,46$
66	4	51	6,67%	84,99%	264	$(66-59,3)^2 \cdot 4 = 179,56$	
67	1	52	1,67%	86,66%	67	$(67-59,3)^2 \cdot 1 = 59,29$	
68	2	54	3,33%	89,99%	136	$(68-59,3)^2 \cdot 2 = 151,38$	
69	2	56	3,33%	93,32%	138	$(69-59,3)^2 \cdot 2 = 188,18$	
70	4	60	6,68%	100%	280	$(70-59,3)^2 \cdot 4 = 457,96$	

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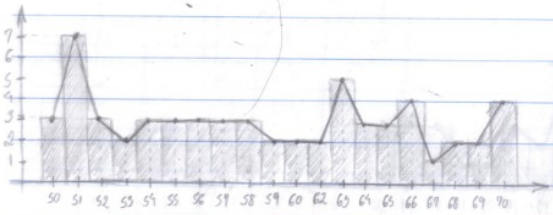
Histograma e polígono de frequência



Coluna S

x_i	f_i	F_a	f_a	F_a	$x_i \cdot f_i$	$(x_i - \bar{x})^2 \cdot f_i$	
2	5	5	5%	5%	10	$(2-8,98)^2 \cdot 5 = 243,6$	$\sum f_i = 100$
3	4	9	4%	9%	12	$(3-8,98)^2 \cdot 4 = 143,04$	$\sum f_a = 100\%$
4	11	20	11%	20%	44	$(4-8,98)^2 \cdot 11 = 272,8$	$\sum (x_i \cdot f_i) = 898$
5	5	25	5%	25%	25	$(5-8,98)^2 \cdot 5 = 79,2$	$\sum (x_i - \bar{x})^2 \cdot f_i = 1.987,92$
6	11	36	11%	36%	66	$(6-8,98)^2 \cdot 11 = 97,68$	
7	12	48	12%	48%	84	$(7-8,98)^2 \cdot 12 = 47,04$	$\bar{X} = 898/100 \quad \bar{X} = 8,98$
8	2	50	2%	50%	16	$(8-8,98)^2 \cdot 2 = 1,92$	$Mo = 7$
9	5	55	5%	55%	45	$(9-8,98)^2 \cdot 5 = 0$	$Md = X_{50} + X_{51}/2 \rightarrow Md = 8+9/2 \quad Md = 8,5$
10	9	64	9%	64%	90	$(10-8,98)^2 \cdot 9 = 9,36$	
11	5	69	5%	69%	55	$(11-8,98)^2 \cdot 5 = 20,40$	Variância Amostral
12	6	75	6%	75%	72	$(12-8,98)^2 \cdot 6 = 54,72$	$S_x^2 = 1.987,92/99 \rightarrow S_x^2 = 20,08$
13	6	81	6%	81%	78	$(13-8,98)^2 \cdot 6 = 96,96$	
14	4	85	4%	85%	56	$(14-8,98)^2 \cdot 4 = 100,80$	Desvio Padrão
15	3	88	3%	88%	45	$(15-8,98)^2 \cdot 3 = 108,72$	$S_x = \sqrt{20,08} \rightarrow S_x = 4,48$
16	4	92	4%	92%	64	$(16-8,98)^2 \cdot 4 = 197,12$	
17	8	100	8%	100%	136	$(14-8,98)^2 \cdot 8 = 514,56$	

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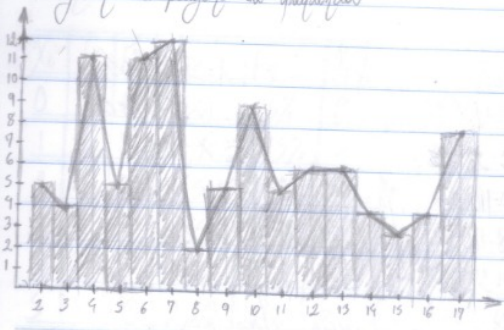
Histograma e polígono de frequência



Coluna 6

X_i	f_i	F_i	f_r	F_r	$(X_i \cdot f_i)$	$(X_i - \bar{X})^2 \cdot f_i$
5	1	1	3,85%	3,85%	5	$(5-11,23)^2 \cdot 1 = 38,81$
7	5	6	19,23%	23,08%	35	$(7-11,23)^2 \cdot 5 = 89,86$
8	4	10	15,38%	38,46%	32	$(8-11,23)^2 \cdot 4 = 41,73$
9	3	13	11,54%	50,00%	27	$(9-11,23)^2 \cdot 3 = 14,92$
10	3	16	11,54%	61,54%	30	$(10-11,23)^2 \cdot 3 = 4,54$
12	3	19	11,54%	73,08%	36	$(12-11,23)^2 \cdot 3 = 1,78$
15	2	21	7,69%	80,77%	30	$(15-11,23)^2 \cdot 2 = 28,33$
18	3	24	11,54%	92,31%	54	$(18-11,23)^2 \cdot 3 = 137,50$
20	1	25	3,85%	96,16%	20	$(20-11,23)^2 \cdot 1 = 76,91$
23	1	26	3,84%	100,00%	23	$(23-11,23)^2 \cdot 1 = 138,53$

$\Sigma f_i = 26$; $\Sigma f_r = 100\%$; $\Sigma (X_i \cdot f_i) = 292$; $\Sigma (X_i - \bar{X})^2 \cdot f_i = 592,61$

$\bar{X} = \Sigma (X_i \cdot f_i) / N$

$\bar{X} = 292 / 26$

$\bar{X} = 11,23$

$M_o = 7$

$M_d = X_{13} + X_{14} / 2$

$M_d = 9,5$

Variância Amostral

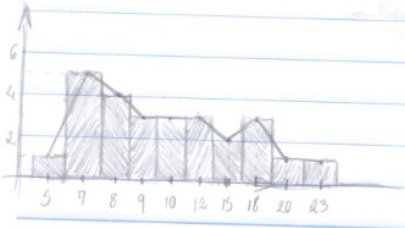
$S_x^2 = \Sigma (X_i - \bar{X})^2 \cdot f_i / N-1$

$S_x^2 = 22,90$

Desvio Padrão

$S_x = \sqrt{\text{Variância}}$

$S_x = 4,79$



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Obra 1

x_i	f_i	F_i	f_r	F_r	$(x_i \cdot f_i)$	$(x_i - \bar{x})^2 \cdot f_i$
13	1	1	5%	5%	13	$(13-25,5)^2 \cdot 1 = 156,25$
14	3	4	15%	20%	42	$(14-25,5)^2 \cdot 3 = 396,75$
15	1	5	5%	25%	15	$(15-25,5)^2 \cdot 1 = 110,25$
16	2	7	10%	35%	32	$(16-25,5)^2 \cdot 2 = 180,50$
20	1	8	5%	40%	20	$(20-25,5)^2 \cdot 1 = 30,25$
23	2	10	10%	50%	46	$(23-25,5)^2 \cdot 2 = 12,50$
24	1	11	5%	55%	24	$(24-25,5)^2 \cdot 1 = 2,25$
27	2	13	10%	65%	54	$(27-25,5)^2 \cdot 2 = 4,50$
31	1	14	5%	70%	31	$(31-25,5)^2 \cdot 1 = 30,25$
32	1	15	5%	75%	32	$(32-25,5)^2 \cdot 1 = 42,25$
35	1	16	5%	80%	35	$(35-25,5)^2 \cdot 1 = 90,25$
40	1	17	5%	85%	40	$(40-25,5)^2 \cdot 1 = 210,25$
41	1	18	5%	90%	41	$(41-25,5)^2 \cdot 1 = 240,25$
42	1	19	5%	95%	42	$(42-25,5)^2 \cdot 1 = 272,25$
43	1	20	5%	100%	43	$(43-25,5)^2 \cdot 1 = 306,25$

$\sum f_i = 20$; $\sum f_r = 100\%$; $\sum (x_i \cdot f_i) = 510$; $\sum (x_i - \bar{x})^2 \cdot f_i = 2.085$

$\bar{x} = \sum x_i \cdot f_i : N$

$\bar{x} = 510/20$

$\bar{x} = 25,5$

$M_o = 14$

$Md = X_{10} + X_{11} / 2 \Rightarrow Md = 23,5$

Variância Amostral

$S_x^2 = \sum (x_i - \bar{x})^2 \cdot f_i / N-1$

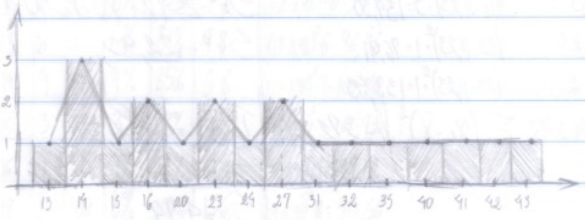
$S_x^2 = 2.085/19 = 109,74$

Desvio Padrão

$S_x = \sqrt{\text{Variância}}$

$S_x = \sqrt{109,74}$

$S_x = 10,84$



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Exemplo 8

x_i	f_i	F_i	f_a	F_a	$x_i \cdot f_i$	$(x_i - \bar{x})^2 \cdot f_i$
0	10	10	25%	25%	0	$(0-1,78)^2 \cdot 10 = 31,68$
1	5	15	12,50%	37,5%	5	$(1-1,78)^2 \cdot 5 = 3,04$
2	15	30	37,50%	75%	30	$(2-1,78)^2 \cdot 15 = 0,73$
3	5	35	12,50%	87,5%	15	$(3-1,78)^2 \cdot 5 = 7,44$
4	4	39	10%	99,5%	16	$(4-1,78)^2 \cdot 4 = 19,71$
5	1	40	2,5%	100%	5	$(5-1,78)^2 \cdot 1 = 10,31$

$\sum f_i = 40$; $\sum f_a = 100\%$; $\sum x_i f_i = 71$; $\sum (x_i - \bar{x})^2 f_i = 94,91$

$\bar{x} = \sum x_i f_i / N$

$\bar{x} = 71/40 \Rightarrow \bar{x} = 1,78$

$M_o = 2$

$M_d = X_{20} + X_{21} / 2$

$M_d = 2+2/2 = 2$

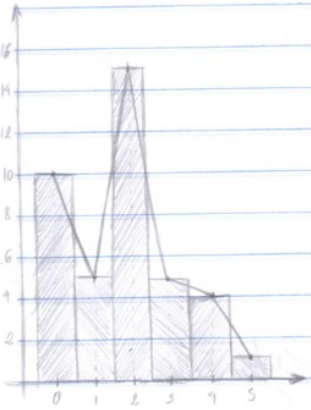
Variância Amostral

$S_x^2 = \sum (x_i - \bar{x})^2 \cdot f_i / N-1 = 1,92$

Desvio Padrão

$S_x = \sqrt{\text{Variância}}$

$S_x = 1,39$



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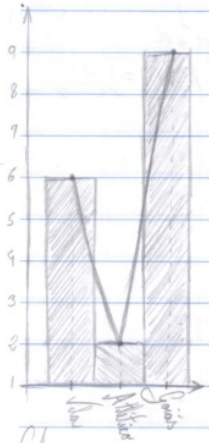
Questão 9

X_i	f_i	F_i	f_r	F_r
Vela	6	6	35,29%	35,29%
Atlético	2	8	11,76%	47,05%
Goiás	9	17	52,95%	100%

$\sum f_i = 17$; $\sum f_r = 99,99\% \rightarrow 100\%$



Questão 10

X_i	f_i	F_i	f_r	F_r	$X_i \cdot f_i$	$(X_i - \bar{X})^2 \cdot f_i$
1	1	1	10%	10%	1	$(1-16)^2 \cdot 1 = 225$
5	1	2	10%	20%	5	$(5-16)^2 \cdot 1 = 121$
7	2	4	20%	40%	14	$(7-16)^2 \cdot 2 = 162$
9	1	5	10%	50%	9	$(9-16)^2 \cdot 1 = 49$
15	1	6	10%	60%	15	$(15-16)^2 \cdot 1 = 1$
17	1	7	10%	90%	17	$(17-16)^2 \cdot 1 = 1$
18	1	8	10%	80%	18	$(18-16)^2 \cdot 1 = 4$
27	1	9	10%	90%	27	$(27-16)^2 \cdot 1 = 121$
54	1	10	10%	100%	54	$(54-16)^2 \cdot 1 = 1444$

$\sum f_i = 10$; $\sum f_r = 100\%$; $\sum X_i \cdot f_i = 160$; $\sum (X_i - \bar{X})^2 \cdot f_i = 2128$

$\bar{X} = \sum X_i \cdot f_i / N$ $\bar{X} = 16$

$Mo = 9$

$Md = X_5 + X_6 / 2 \rightarrow Md = 9 + 15 / 2 \rightarrow Md = 12$

Variância Amostral

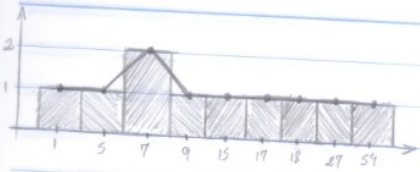
$S_x^2 = \sum (X_i - \bar{X})^2 \cdot f_i / N - 1$

$S_x^2 = 236,44$

Desvio Padrão

$S_x = \sqrt{\text{Variância}}$

$S_x = 15,38$


2
1
1
5
7
9
15
17
18
27
54