I

Classes	X_i	f_i	F_i	f_a	F_a	$X_i \cdot f_i$	$(X_i - \bar{X})^2 \cdot f_i$
40 ⊢ 44	42	2	2	7,69%	7,69%	84	$(42 - 50,77)^2 \cdot 2 = 153,83$
44 ⊢ 48	46	5	7	19,23%	26,92%	230	$(46 - 50,77)^2 \cdot 5 = 113,76$
48 ⊢ 52	50	9	16	34,62%	61,54%	450	$(50 - 50,77)^2 \cdot 9 = 5,34$
52 ⊢ 56	54	6	22	23,08%	84,62%	324	$(54 - 50,77)^2 \cdot 6 = 62,60$
56 ⊢ 60	58	4	26	15,38%	100,00%	232	$(58 - 50,77)^2 \cdot 4 = 209,09$

$\sum f_i = 26 \ ; \ \sum f_a = 100\% \ ; \ \sum X_i \cdot f_i = 1320 \ ; \ \sum (X_i - \bar{X})^2 \cdot f_i = 544,62$

$\bar{X} = 1320/26 = 50,77$

$CM_i = 48 \vdash 52$

$CM_o = 48 \vdash 52$

VARIANCIA

$S_x^2 = 544,62/25$

$S_x^2 = 21,78$

Desvio

$S_x = \sqrt{21,78}$

$S_x = 4,67$

1) II
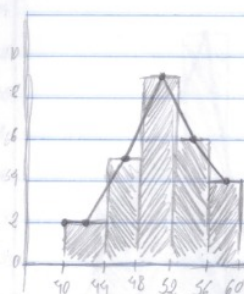
Clases	X_i	f_i	F_i	f_n	F_n	$X_i \cdot f_i$	$(X_i - \bar{X})^2 \cdot f_i$
150 ⊢ 156	153	1	1	3,33%	3,33%	153	207,36
156 ⊢ 162	159	5	6	16,67%	20%	795	352,80
162 ⊢ 168	165	8	14	26,67%	46,67%	1320	96,08
168 ⊢ 174	171	13	27	43,33%	90%	2223	168,48
174 ⊢ 180	177	3	30	10%	100%	531	276,48

$\Sigma f_i = 30$; $\Sigma f_n = 100\%$; $\Sigma X_i \cdot f_i = 5022$; $\Sigma (X_i - \bar{X})^2 \cdot f_i = 1051,20$

$\bar{X} = 5022/30$

$\bar{X} = 167,40$

$CMd = 168 \vdash 174$

$CMo = 168 \vdash 174$

VARIANCIA

$S_x^2 = 1051,20/29$

$S_x^2 = 36,25$

DESVIO

$S_x = \sqrt{36,25}$

$S_x = 6,02$

III
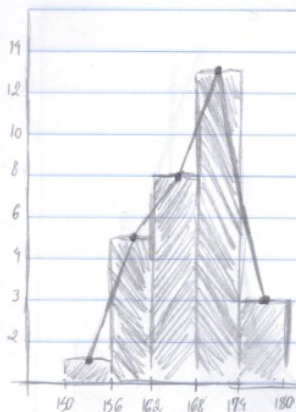
Clases	X_i	f_i	F_i	f_n	F_n	$X_i \cdot f_i$	$(X_i - \overline{X})^2 \cdot f_i$
500 ⊢ 700	600	8	8	18,18%	18,18%	4800	764293,02
700 ⊢ 900	800	20	28	45,45%	63,63%	16000	238012,56
900 ⊢ 1100	1000	7	35	15,91%	79,54%	7000	57852,40
1100 ⊢ 1300	1200	5	40	11,36%	90,90%	6000	423143,14
1300 ⊢ 1500	1400	2	42	4,55%	95,45%	2800	481985,26
1500 ⊢ 1700	1600	1	43	2,27%	97,72%	1600	477356,63
1700 ⊢ 1900	1800	1	44	2,28%	100%	1800	793720,63

$\sum f_i = 44 \; ; \; \sum f_n = 100\% \; ; \; \sum X_i \cdot f_i = 40000 \; ; \; \sum (X_i - \overline{X})^2 \cdot f_i = 3236363,64$

$\overline{X} = 40000/44 \to 909,09$

$CM_d = 700 \vdash 900$

$CM_o = 700 \vdash 900$

Variancia

$S_x^2 = 3236363,64/43$

$S_x^2 = 75264,27$

Desvío

$S_x = \sqrt{75264,27}$

$S_x = 274,34$

2)
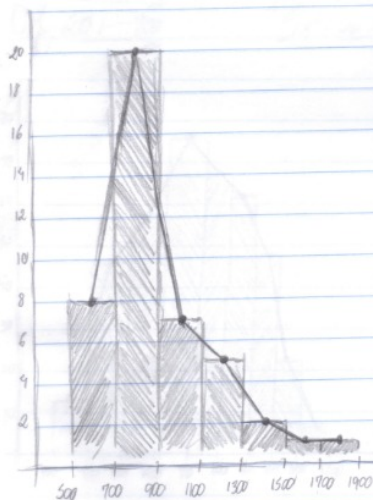
Clases	X_i	f_i	F_i	f_r	F_r	$X_i \cdot f_i$	$(X_i - \bar{X})^2 \cdot f_i$
300⊢400	350	14	14	3,50%	3,50%	4900	1870263,50
400⊢500	450	46	60	11,50%	15%	20700	924255,50
500⊢600	550	58	118	14,50%	29,50%	31900	158863,40
600⊢700	650	96	194	19%	48,50%	49400	326059
700⊢800	750	68	262	17%	65,50%	51000	80959
800⊢900	850	62	324	15,50%	81%	52700	1121595,50
900⊢1000	950	48	372	12%	93%	45600	2639532
1000⊢1100	1050	22	394	5,50%	98,50%	23100	2461585,50
1100⊢1200	1150	6	400	1,50%	100%	6900	1132741,50

$\Sigma f_i = 400$; $\Sigma f_r = 100\%$; $\Sigma X_i \cdot f_i = 286200$; $\Sigma (X_i - \bar{X})^2 \cdot f_i = 14463900$

$\bar{X} = 286200/400 = 715,50$

$C_{md} = 700 \vdash 800$

$C_{mo} = 600 \vdash 700$

Variancia

$S_x^2 = 14463900/399$

$S_x^2 = 36250,38$

Desvio

$S_x = \sqrt{36250,38}$

$S_x = 190,40$

3)
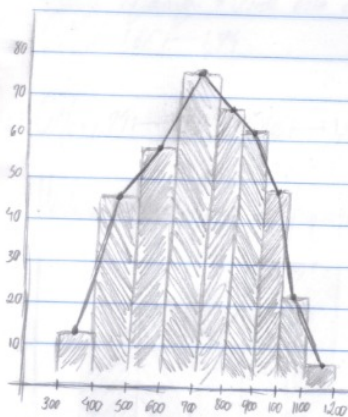
Classes	X_i	f_i	F_i	f_n	F_n	$X_i \cdot f_i$	$(X_i - \bar{X})^2 \cdot f_i$
$4 \vdash 8$	6	2	2	8%	8%	12	149,30
$8 \vdash 12$	10	5	7	20%	28%	50	107,65
$12 \vdash 16$	14	9	16	36%	64%	126	3,69
$16 \vdash 20$	18	6	22	24%	88%	108	67,74
$20 \vdash 24$	22	2	24	8%	96%	44	108,34
$24 \vdash 28$	26	1	25	4%	100%	26	129,05

$\sum f_i = 25$; $\sum f_n = 100\%$; $\sum (x_i \cdot f_i) = 366$; $\sum (x_i - \bar{x})^2 \cdot f_i = 565,77$

$\bar{X} = 366/25 = 14,64$

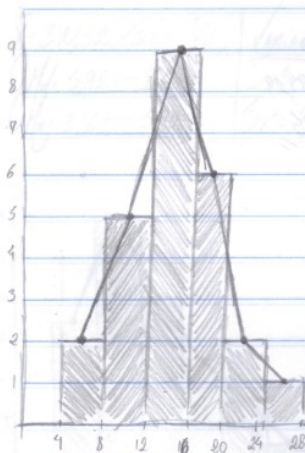$C_{Md} = 12 \vdash 16$

$C_{Mo} = 12 \vdash 16$

VARIANCIA

$S_x^2 = 565,77/24$

$S_x^2 = 23,57$

Desvio

$S_x = \sqrt{23,57}$

$S_x = 4,86$

2 a) 100 ⊢ 110

b) 110

c) 95

d) 14

e) 80 ⊢ 90 e 90 ⊢ 100

f) 50 ⊢ 60 e 120 ⊢ 130

g) 48

h) 25

3 a) Curva em forma de J

b) Curva em forma de S invertido

c) Curva em forma de U

d) Curva em forma de J

e) Curva em forma de U

6) $K = 1 + 3,33 \cdot \log 50 \to K = 6,66 \to 7$ classes

$AT = 98 - 33 = 65$

$AC = 65/6,66 = 9,76$

Classes	X_i	f_i	F_i	h	F_a	$X_i \cdot f_i$	$(X_i - \bar{X})^2 \cdot f_i$
$33 \vdash 42,76$	37,88	7	7	14%	14%	265,16	5301,45
$42,76 \vdash 52,52$	47,64	5	12	10%	24%	238,20	1577,09
$52,52 \vdash 62,28$	57,40	9	21	18%	42%	516,60	576
$62,28 \vdash 72,04$	67,16	10	31	20%	62%	671,60	30,98
$72,04 \vdash 81,80$	76,92	10	41	20%	82%	769,20	1327,10
$81,80 \vdash 91,56$	86,68	6	47	12%	94%	520,08	2719,03
$91,56 \vdash 101,32$	96,44	3	50	6%	100%	289,32	2890,44

$\sum f_i = 50; \sum h = 100\%; \sum X_i \cdot f_i = 3270,16; \sum (X_i - \bar{X})^2 \cdot f_i = 14420,09$

$\bar{X} = 3270,16 / 50 = 65,40$

$CM_d = 62,28 \vdash 72,04$

$CM_o = 62,28 \vdash 72,04$ e $72,04 \vdash 81,80$

Variância
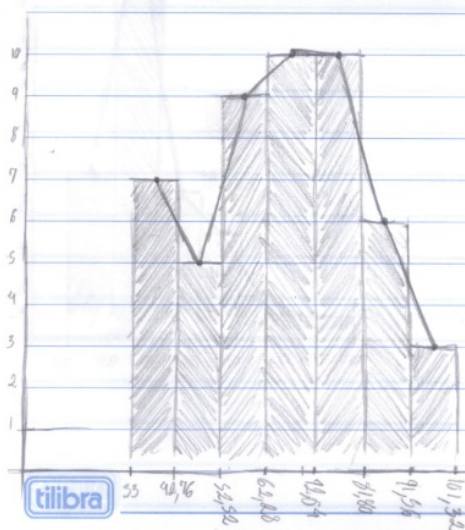
$S_x^2 = 14420,09/49$
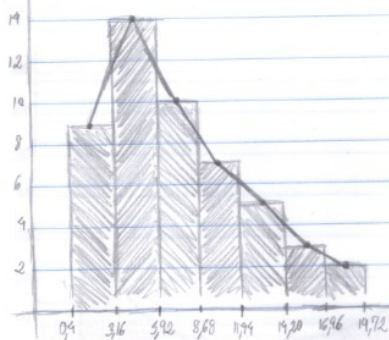
$S_x^2 = 294,29$

Desvio

$S_x = \sqrt{294,29}$

$S_x = 17,15$

7) $K = 1 + 3,33 \times \log 50 = 6,66 \Rightarrow 7$ classes

$AT = 18,8 - 0,9 = 18,4$

$AC = 18,4 / 6,66 = 2,76$

Classes	Xi	fi	Fi	fa	Fa	$Xi \cdot fi$	$(Xi-\bar{X})^2 \cdot fi$
$0,4 \vdash 3,16$	1,78	9	9	18%	18%	16,02	283,27
$3,16 \vdash 5,92$	4,54	14	23	28%	46%	63,56	115,32
$5,92 \vdash 8,68$	7,30	10	33	20%	66%	73	0,12
$8,68 \vdash 11,44$	10,06	7	40	14%	80%	70,42	49,16
$11,44 \vdash 14,20$	12,82	5	45	10%	90%	64,10	196,34
$14,20 \vdash 16,96$	15,58	3	48	6%	96%	46,74	200,25
$16,96 \vdash 19,72$	18,34	2	50	4%	100%	36,68	238,93

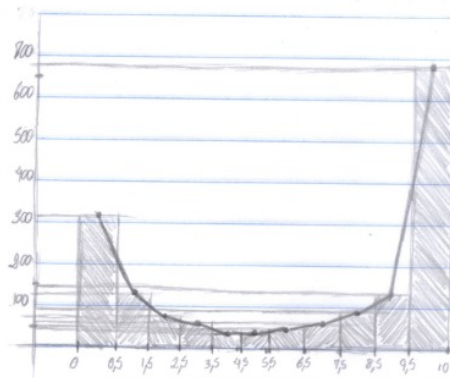$\Sigma fi = 50; \Sigma fa = 100\%; \Sigma Xi \cdot fi = 370,52; \Sigma (Xi-\bar{X})^2 fi = 1035,39$

$\bar{X} = 370,52 / 50 = 7,41$

$CMd = 5,92 \vdash 8,68$

$CMo = 3,16 \vdash 5,92$

Variância
$S_x^2 = 1035,39 / 49$
$S_x^2 = 21,13$

Desvio
$S_x = \sqrt{21,13}$
$S_x = 4,60$

8)

Classes	X_i	f_i	F_i	f_r	F_r	$X_i \cdot f_i$	$(X_i-\bar{X})^2 \cdot f_i$
0⊢0,5	0,25	320	320	18,76%	18,76%	80	10 839,17
0,5⊢1,5	1	125	445	7,33%	26,09%	125	3 213,11
1,5⊢2,5	2	75	520	4,40%	30,49%	150	1292,37
2,5⊢3,5	3	65	585	3,81%	34,30%	195	612,62
3,5⊢4,5	4	45	630	2,64%	36,94%	180	192,82
4,5⊢5,5	5	45	675	2,64%	39,58%	225	51,52
5,5⊢6,5	6	55	730	3,22%	42,80%	330	0,27
6,5⊢7,5	7	65	795	3,81%	46,61%	455	56,22
7,5⊢8,5	8	90	885	5,28%	51,89%	720	335,29
8,5⊢9,5	9	145	1030	8,50%	60,39%	1305	1244,81
9,5⊢10	9,75	676	1706	39,61%	100%	6591	9154,66

$\Sigma f_i = 1706$; $\Sigma f_r = 100\%$; $\Sigma X_i \cdot f_i = 10356$; $\Sigma(X_i-\bar{X})^2 \cdot f_i = 26942,81$

$\bar{X} = 10356/1706 = 6,07$

$CMd = 7,5 \vdash 8,5$

$CMo = 9,5 \vdash 10$

Variância

$S_x^2 = 26942,81/1705$

$S_x^2 = 15,80$

Desvio

$S_x = \sqrt{15,80}$

$S_x = 3,98$

9) Classes	Xi	fi	Fi	fr	Fn	Xi·fi	(Xi-X̄)²·fi
1⊢2	1,5	7	7	2,45%	2,45%	10,50	363,89
2⊢3	2,5	3	10	1,05%	3,5%	7,50	115,69
3⊢4	3,5	10	20	3,40%	7%	35	291,44
4⊢5	4,5	11	31	3,85%	10,85%	49,50	194,97
5⊢6	5,5	12	43	4,20%	15,05%	66	123,65
6⊢7	6,5	37	80	12,94%	27,99%	240,50	180,71
7⊢8	7,5	35	115	12,24%	40,23%	263,50	51,24
8⊢9	8,5	45	160	15,73%	55,96%	382,50	1,98
9⊢10	9,5	39	199	13,64%	69,60%	370,50	24,34
10⊢11	10,5	30	229	10,49%	80,09%	315	96,12
11⊢12	11,5	25	254	8,74%	88,83%	287,50	194,60
12⊢13	12,5	7	261	2,45%	91,28%	87,50	100,55
13⊢14	13,5	10	271	3,50%	94,78%	135	229,44
14⊢15	14,5	4	275	1,40%	96,18%	58	134,10
15⊢16	15,5	6	281	2,10%	98,28%	93	276,62
16⊢17	16,5	1	282	0,35%	98,63%	16,50	60,68
17⊢18	17,5	4	286	1,37%	100%	70	309,06

$\Sigma f_i = 286; \Sigma f_r = 100\%; \Sigma X_i \cdot f_i = 2490; \Sigma (X_i - \bar{X})^2 \cdot f_i = 3038,14$

$\bar{X} = 2490/286 = 8,71$

$C.Md = 8 \vdash 9$

$C.Mo = 8 \vdash 9$

VARIÂNCIA

$Sx^2 = 3038,14/285$

$Sx^2 = 10,66$

Desvio

$Sx = \sqrt{10,66}$

$Sx = 3,26$