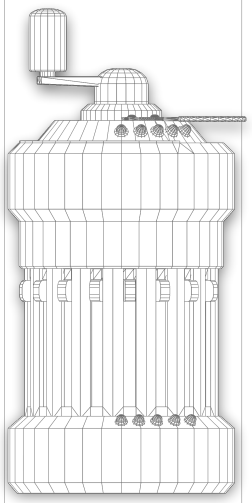
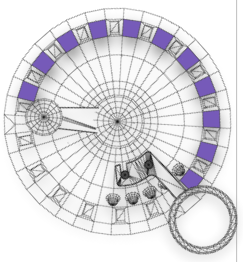
CURTA

ALGORITHMS

5

STATISTICS





a	Calculation of a **sum and a sum of squares** - Type II
b	Calculation with the '9' bridge - Type II
c	**Serial Percentages** with simultaneous control - Type II
d	**Computation of arithmetic mean and standart deviation**

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Calculation of a **sum and a sum of squares** - Type II

6925+3289−1721+2987=?, $6925^2+3289^2-1721^2+2987^2$=?	Setting	Carriage/Inverter	Turns	Counter	Product
$a + b - c + d = s$, $a^2 + b^2 - c^2 + d^2 = S$	Clear	⬆		Clear	Clear
1 Set 1 in left hand, and a in right hand Calculate a^2 Develop a in the left hand of PR (and in CR) The right hand of PR shows a^2	1 6925	8 7 6 5 4 < > 1	22 +	6925	6925 47955625
2					Clear left hand
3 Set b Calculate a + b and $a^2 + b^2$ Develop b in the left hand of PR (as a check) On CR, a + b , on right hand of PR, $a^2 + b^2$	1 3289	8 7 6 5 4 < > 1	22 +	10214	3289 58773146
4		⬇			Clear left hand
5 Set c Calculate a + b + c and $a^2 + b^2 + c^2$ Develop c in the left hand of PR Note that c^2 is of course positive	1 1721	8 7 6 5 4 < > 1	11 +	8493	1721 61734987
6		⬆			Clear left hand
7 Set d Calculate s = a + b + c + d and $S = a^2 + b^2 + c^2 + d^2$ Develop d in the left hand of PR Result: s = 11,480, S = 70,665,156	1 2987	8 7 6 5 4 < > 1	26 +	11480	2987 70657156

Source: " Computing examples for the Curta", Contina / Bernard Stabile - 2023

Calculation with the '9' bridge - Type II

Let be a number from which we want to deduce several numbers successively:

$X - a = X_1$

$X_1 - b = X_2$

$X_2 - c = X_3$

We want to know the successive results X_1, X_2, X_3 as well as the sum of the deductions for each operation:

a + b, a + b + c, …

X=847814, a=13, b=156, c=-1267		Setting	Carriage/Inverter	Turns	Counter	Product
X – a, X_1 – b, X_2 – c		Clear	⬆		Clear	Clear
1	Set X Bring it to PR	8 4 7 8 1 4 11 10 9 8 7 6 5 4 3 2 1	8 7 6 5 4 3 2 1 ▲	1 +	1 ▲	8 4 7 8 1 4 15 14 13 12 11 10 9 8 7 6 5 4 3 2 ▲
2					Clear	
3	Set the '9' bridge Develop a in CR. it was deducted from X and added at the left hand of PR	9 9 9 9 9 9 11 10 9 8 7 6 5 4 3 2 1	8 7 6 5 4 3 2 1 ▲ ▲	4 +	1 3 ▲ ▲	1 3 8 4 7 8 0 1 15 14 13 12 11 10 9 8 7 6 5 4 3 ▲ ▲
5					Clear	
6	Develop b in CR. it was deducted from X_1 and added at the left hand of PR (a + b) In the right hand of PR: X_2	9 9 9 9 9 9 	8 7 6 5 4 3 < 1 ▲ ▲	12 +	1 5 6 ▲ ▲	1 6 9 8 4 7 6 4 5 15 14 13 12 11 10 9 8 7 6 5 4 ▲ 2 ▲
7					Clear	
8	Develop c in CR. it was deducted from X_2 and added at the left hand of PR (a + b + c) In the right hand of PR: X_3	9 9 9 9 9 9 	8 7 6 5 4 < > 1 ▲ ▲	16 +	1 2 6 7 ▲ ▲	1 4 3 6 8 4 6 3 7 8 15 14 13 12 11 10 9 8 7 6 5 ▲ 3 2 ▲

Source: " Exemples de calcul avec la Curta", Contina, Thanks to Richard E. Deutsch - curta.li / Bernard Stabile - 2023

Serial Percentages with simultaneous control - Type II

We want to know the proportion (in percentages) of a follows numbers compared to their sum: A + B + C = S
a = (A ÷ S) × 100, b = (B ÷ S) × 100, c = (C ÷ S) × 100, and automatically check that a + b + c = 100

3,545 + 6,893 + 2,360 =12,798		Setting	Carriage/Inverter	Turns	Counter	Product
	A + B + C = S	Clear	⬆		Clear	Clear
1	Set S Calculate a = A ÷ S with additive method. (See **1**Ca) Develop A as close as possible in the right hand of PR	1 12798	5	3 +	3	3 38394
		1 12798	4	2 –	28	358344
2	First percentage a = 27.7 % appears in CR and in the left hand of PR	1 12798	3	3 –	27.7	27.7 3545046
3						Clear
4	Calculate b = B ÷ S with division by additive method Develop B as close as possible in the right hand of PR	1 12798	5	5 +	777	5 6399
		1 12798	4	4 +	817	53 691092
		1 12798	3	–	816	539 6898122
5	In PR, percentage b = 53.86 % In CR, the two percentages have been accumulated: 81.56 %	1 12798	2	4 –	81.56	53.86 68930028
6						Clear
7	Calculate c = C ÷ S with division by additive method Develop C as close as possible in the right hand of PR	1 12798	5	2 +	10156	2 255964
		1 12798	4	2 –	9956	18 230364
		1 12798	3	4 +	9996	184 2354832
8	In PR, percentage c = 18.44 % As a check, the sum of the three percentages in CR: 100 %	1 12798	2	4 +	100.0	18.44 23599512

Source: " Computing examples for the Curta", Contina / Bernard Stabile - 2023

Computation of arithmetic mean and standart deviation

Given N observations $x_1, x_2, ,\ldots x_n$. The arithmetic mean is given by: $x = (\sum (x_i - x_0)) \div N$ and the standard deviation by: $\Delta x = \pm \sqrt{ (\sum (x_i - x_0)^2 \div N (N - 1)) }$

In order to facilitate the calculation, we reduce each observation by a known constant x_0, and in this manner reduce the number of figures used in the calculation.

We have: $x = x_0 + \sum (x_i - x_0)^2 \div N$ and $\sum (x_i - x)^2 = \sum (x_i - x_0)^2 - N (x - x_0)^2$

The calculation can be carried out by the Curta I and Curta II if the number of figures is too large. Observations:

$x_1 = 215.3$, $x_2 = 216.4$, $x_3 = 214.7$, $x_4 = 217.1$, $x_5 = 213.8$, $x_6 = 217.3$, $x_7 = 216.6$

We proceed with $x_0 = 210$, thus $x_1 - x_0 = 5.3$, $x_2 - x_0 = 6.4$ and so on.

	$N = 7, x_0 = 210$	Setting	Carriage/Inverter	Turns	Counter	Product
	$x = x0 + \sum (x_i - x_0)^2 \div N$	Clear	⬆		Clear	Clear
1	Set $x_1 - x_0$ in left hand, and 1 in right hand of SR Multiply by 5.3 Set the decimal markers	5.3 1	6 5 4 3 2 1	8 +	5 3	2 8.0 9 5.3
2					Clear	
3	Set $x_2 - x_0$ in left hand of SR Multiply by 6.4 In PR: $(x_1 - x_0)^2 + (x_2 - x_0)^2 / (x_1 - x_0) + (x_2 - x_0)$	6.4 1	6 5 4 3 2 1	10 +	6 4	6 9.0 5 1 1.7
4					Clear	
5	Set $x_3 - x_0$ in left hand of SR Multiply by 4.7	4.7 1	6 5 4 3 2 1	11 +	4 7	9 1.1 4 1 6.4
6					Clear	
7	Set $x_4 - x_0$ in left hand of SR Multiply by 7.1	7.1 1	6 5 4 3 2 1	8 +	7 1	1 4 1.5 5 2 3.5
8					Clear	
9	Set $x_4 - x_0$ in left hand of SR Multiply by 3.8	3.8 1	6 5 4 3 2 1	11 +	3 8	1 5 5.9 9 2 7.3
10					Clear	

		Setting	Carriage/Inverter	Turns	Counter	Product
11	Set $x_4 - x_0$ in left hand of SR Multiply by 7.1	7.3 1	6 5 **4 3** 2 1	10 +	7 3	2 0 9.2 8 3 4.6
12					Clear	
13	Set $x_4 - x_0$ in left hand of SR Multiply by 3.8 In PR $\sum (x_i - x_0)^2 \ / \ \sum (x_i - x_0)$	6.6 1	6 5 **4 3** 2 1	12 +	3 8	2 5 2.8 4 4 1.2
14			⬇		Clear	
15	Set $\sum (x_i - x_0)$ in left hand, and N in right hand of SR Calculate $\sum (x_i - x_0) \div N$ with division by subtractive method. (See **1**Cc) Result: 5.885 Decimal rule, dpPR − dpSR = dpR, 3 − 0 = 3 The mean value of the observations is: x = 210 + 5.885 = 215.885	4 1.2 7	6 5 **4** > > **1**	26 −	5.8 8 5	1 0.3 7 8 5
16					Clear	
17	Reminder: $\Delta x = \pm \sqrt{ (\sum (x_i - x_0)^2 \div N (N - 1))}$ Set N (N − 1) = 42 Calculate $\sum (x_i - x_0)^2 \div N (N - 1)$ with division by subtractive method	4 2	6 5 4 **3** > **1**	13 −	.2 4 7	4 5
18			⬆		Clear	Clear
19	Calculate Δx with Herman's metho. See **2**f Set the initial approximation: 0.5 Develop 5 in CR. In PR 5^2	5	6 5 4 **3** 2 1	5 +	5	2 5
20	Set twice the approximation Develop PR as close as possible to 0.247	1 0	6 5 4 3 **2** 1	1 −	4 9	2 4
21	Result: 0.497 Thus x = 215.885 ± 0.497	1 0	6 5 4 3 2 **1**	7 +	.4 9 7	2 4 7

Source: " Computing examples for the Curta ", Contina / Bernard Stabile - 2023