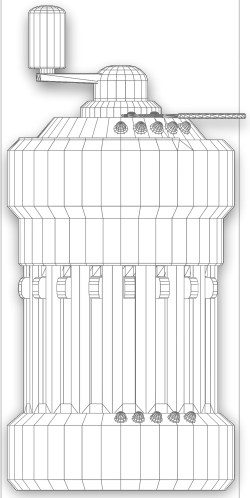
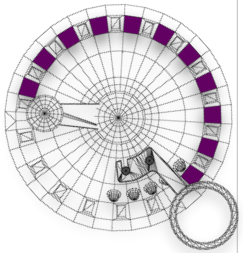
# CURTA

## ALGORITHMS

3

## SERIAL CALCULATIONS





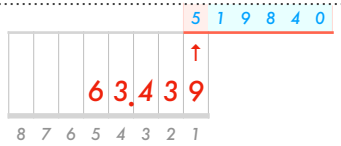
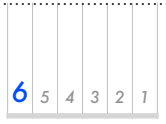
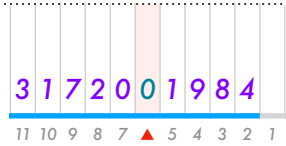
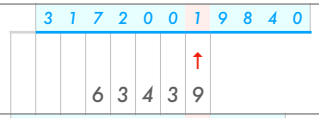
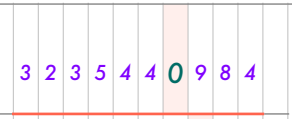
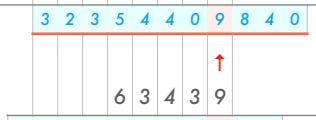
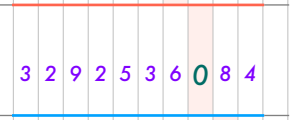
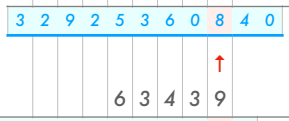
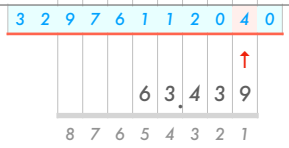
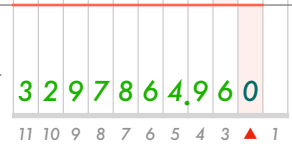


3

## Continued multiplication 1 - with optical control

| 38 x 24 x 57 x 63.44 = ? | | Setting | Carriage/Inverter | Turns | Counter | Product |
|---|---|---|---|---|---|---|
| a x b x c x d = ? | | Clear | ⬆ | | Clear | Clear |
| 1 | Set a<br>Develop 24 in CR. Partial product 1: 912 | 38 | 21 | 6 + | 24 | 912 |
| 2 | Set the last figure of c diminished by 0.1: 56.9<br>and place the last figure on the right of SR<br>under the first figure of the partial product 1 (Carriage 3)<br>Positive turns until the 1st figure in PR above the '9' of SR goes to 0 | 912<br>56.9 | 3 | 9 + | 924 | 513012 |
| 4 | Same thing with Carriage 2… | 513012<br>569 | 2 | 1 + | 934 | 518702 |
| 5 | … And Carriage 1<br>Partial product 2: 51,984 = (56.9 x Partial product 1) + 0.1<br>One decimal place in PR because 56.9 was set instead of 57 | 518702<br>56.9 | 1 | 2 + | 936 | 5198 4.0 |

## 38 x 24 x 57 x 63.44 = ?

| | | Setting | Carriage/Inverter | Turns | Counter | Product |
|---|---|---|---|---|---|---|
| 6 | Set the last figure of d diminished by 0.1: 63.439<br>Place the last figure of SR under the 1st figure of partial product 2<br>Positive turns until the 1st figure in PR above the '9' in SR goes to 0 |  |  | 5 + | 500936 |  |
| 8 | Continue with Carriage 5 |  |  | + | 510936 |  |
| 9 | Continue in the same way… |  |  | 9 + | 519936 |  |
| | |  |  | 8 + | 520736 |  |
| 10 | Decimal rule: dpSR + dpPR = dpR, 3 + 1 = 4<br>The last digit is already 0. Result: 3297864.9600 |  |  | 4 + | 520776 |  |

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

## Continued multiplication 2

This method differs from the previous one in that the third factor is reduced by a unit in the last figure. Products development is also different.

| 38 x 24 x 57 x 63.44 = ? | | Setting | Carriage/Inverter | Turns | Counter | Product |
|---|---|---|---|---|---|---|
| a x b x c x d = ? | | Clear | ⬆ | | Clear | Clear |
| 1 | Set a<br>Develop 24 in CR (normal multiplication)<br>Partial product 1: 912. Note it | 38 | 21 | 6 + | 24 | 912 |
| 2 | | | | | Clear | |
| 3 | Set the next factor diminished by a unit (56)<br>Place the last figure in SR<br>under the first figure of the partial product 1 (Carriage 3) | 912<br>56 | 3 | 9 + | 9 | 51312 |
| | Develop the partial product 1 in CR | 56 | 2 | + | 91 | 51872 |
| | Partial product 2: 51,984. Note it | 56 | 1 | 2 + | 912 | 51984 |
| 4 | | | | | Clear | |
| 5 | Set the last factor with its last figure diminished by a unit: 63.43<br>and place the last figure on the right of SR under the first figure<br>of the partial product 2 | 51984<br>6343 | 5 | 5 + | 5 | 3172019844 |
| | Develop the partial product 51984 in CR with positive turns | 6343 | 4 | + | 51 | 3235449844 |
| | | 6343 | 3 | 9 + | 519 | 3292536844 |
| | Decimal rule: dpSR + dpPR = dpR, 2 + 0 = 2 | 6343 | 2 | 8 + | 5198 | 3297611244 |
| | Result: 3297864.96 | 6343 | 1 | 4 + | 51984 | 32978649 6 |

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

## Powers calculation in series

Using wisely the Carriage, the power calculation in series is fast and provides a visual control.

| | $32^2$, $32^3$, $32^4$, ... | Setting | Carriage/Inverter | Turns | Counter | Product |
|---|---|---|---|---|---|---|
| | $a^2$ , $a^3$ , $a^4$, ... | Clear | ⬆ | | Clear | Clear |
| 1 | Set a<br>Develop 32 in CR<br>Result in PR: $32^2 = 1024$ | 3 2 | 6 5 4 3 2 1 | 5 + | 3 2 | 1 0 2 4 |
| 2 | Place the PR arrow in front of the first digit of the result<br>Develop it in CR in front of the CR arrow | 1 0 2 4<br>3 2 | 4 | + | 1 0 3 2 | 3 3 0 2 4 |
| 3 | Carriage 3. The arrow targets 0, pass to the next Carriage | 3 3 0 2 4<br>3 2 | 3 | ∘ | 1 0 3 2 | 3 3 0 2 4 |
| 4 | Place the PR arrow in front of the next digit<br>Develop it in CR with a negative turn | 3 3 0 2 4<br>3 2 | 2 | − | 1 0 2 2 | 3 2 7 0 4 |
| 5 | And so on… Result: $32^3 = 32768$ | 3 2 7 0 4<br>3 2 | 6 5 4 3 2 1 | 2 + | 1 0 2 4 | 3 2 7 6 8 |
| 6 | Place the PR arrow in front of the first digit of the result<br>Buildit in CR in front of the CR arrow | 3 2 7 6 8<br>3 2 | 5 | 3 + | 3 1 0 2 4 | 9 9 2 7 6 8 |

## $32^2$, $32^3$, $32^4$, ...

| | | Setting | Carriage/Inverter | Turns | Counter | Product |
|---|---|---|---|---|---|---|
| 7 | Continue in the same way with successive Carriages | 9 9 2 7 6 8 ↑ 3 2 | 4 | + | 3 2 0 2 4 | 1 0 2 4 7 6 8 |
| | | 1 0 2 4 7 6 8 ↑ 3 2 | 3 | 7 + | 3 2 7 2 4 | 1 0 4 7 1 6 8 |
| | | 1 0 4 7 1 6 8 ↑ 3 2 | 2 | 4 + | 3 2 7 6 4 | 1 0 4 8 4 4 8 |
| 8 | Result: $32^4$ = 1048576<br>With a Type II we can continue until $32^6$ | 1 0 4 8 4 4 8 ↑ 3 2<br>8 7 6 5 4 3 2 1 | 6 5 4 3 2 1 ▲ | 4 + | 3 2 7 6 8 ▲ | 1 0 4 8 5 7 6<br>11 10 9 8 7 6 5 4 3 2 ▲ |

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

## Accumulation of quotients 1

Quotients can be accumulated on CR with division by additive division.

| (32.45 ÷ 1.39) + (69.8 ÷ 7.465) – (101.34 ÷ 11.7 ) | Setting | Carriage/Inverter | Turns | Counter | Product |
|---|---|---|---|---|---|
| (a ÷ b) + (c ÷ d) — (e ÷ f) | Clear | ⬆ | | Clear | Clear |
| | 1.39 | 6 | 2 + | 2 | 278 |
| 1 Set the first divisor b by checking decimal places (max 3) | 1 3 9 | 5 | 3 + | 2 3 | 3 1 9 7 |
| 1 Calculate a ÷ b with division by additive method. (See 1Ca) Develop PR as close as possible to 32.45 | 1 3 9 | 4 | 3 + | 2 3 3 | 3 2 3 8 7 |
| | 1 3 9 | 3 | 4 + | 2 3 3 4 | 3 2 4 4 2 6 |
| | 1 3 9 | 2 | 5 + | 2 3 3 4 5 | 3 2 4 4 9 5 5 |
| 2 Decimal rule, dpPR – dpSR = dpR, 7 – 3 = 4 Partial result 1: 23.3453 | 1.39 | 1 | 3 + | 23.3453 | 32.449967 |
| 3 | | | | | Clear |
| 4 Set the second divisor d | 7.465 | 6 | + | 3 3 3 4 5 3 | 7465 |
| 4 Calculate c ÷ d with division by additive method Develop PR as close as possible to 69.8 | 7 4 6 5 | 5 | – | 3 2 3 4 5 3 | 6 7 1 8 5 |
| | 7 4 6 5 | 4 | 3 + | 3 2 6 4 5 3 | 6 9 4 2 4 5 |

## (32.45 ÷ 1.39) + (69.8 ÷ 7.465) – (101.34 ÷ 11.7 )

| | | Setting | Carriage/Inverter | Turns | Counter | Product |
|---|---|---|---|---|---|---|
| 6 | | 7.465 | 3 | 5 + | 3 2 6 9 5 3 | 6 9 7 9 7 7 5 |
| | | 7.465 | 2 | o | 3 2 6 9 5 3 | 6 9 7 9 7 7 5 |
| 7 | Decimal rule, dpPR – dpSR = dpR, 7 – 3 = 4<br>Partial result 2: 32.6956 | 7.465 | 1 | 3 + | 32.6956 | 69.799895 |
| 8 | | | ⬇ | | | Clear |
| | | 11.7 | 6 | + | 226956 | 117 |
| 9 | Set the third divisor f by checking decimal places | 117 | 5 | 2 – | 246956 | 936 |
| | Calculate e ÷ f with division by additive method<br>Develop PR as close as possible to 101.34 | 117 | 4 | 6 + | 240956 | 10062 |
| | | 117 | 3 | 6 + | 240356 | 101322 |
| | | 117 | 2 | + | 240346 | 1013337 |
| 10 | Decimal rule, dpPR – dpSR = dpR, 7 – 3 = 4<br>Final result: 24.0341 | 11.7 | 1 | 5 + | 24.0341 | 101.33955 |

*Source: " Curta Calculating techniques" / Bernard Stabile - 2023*

## Accumulation of quotients 2

((a — b) ÷ c) + ((d + e) ÷ f) — (g ÷ h)

A = (a — b) ÷ c

B = (d + e) ÷ f

C = g ÷ h

| ((13.475 — 5.75) ÷ 6.29) + ((17.24 + 3.92) ÷ 7.86) — (18.715 ÷ 9.5 ) | | Setting | Carriage/Inverter | Turns | Counter | Product |
|---|---|---|---|---|---|---|
| | A + B + C | Clear | ⬇ | | Clear | Clear |
| 1 | Set the first term of the first dividend a<br>by checking decimal places (3 in SR, 4 in CR, 7 in PR)<br>Set it in PR with Inverter down | 13.475 | 65 | + | 99 | 13.475 |
| 2 | Set b<br>Calculate a — b | 5.75 | 5 | — | | 7.725 |
| 3 | | 6.29 | 5 | — | 1 | 1.435 |
| | Set the first divisor c | 629 | 4 | 2 — | 12 | 177 |
| | Calculate A with division by subtractive method. (See 1Cc) | 629 | 3 | 2 — | 122 | 512 |
| | | 629 | 2 | 8 + | 1228 | 88 |
| 4 | Result A: 1.2281 | 6.29 | 65432**1** | — | 1.2281 | 0.000251 |
| 5 | | | | | | Clear |

## ((13.475 – 5.75) ÷ 6.29) + ((17.24 + 3.92) ÷ 7.86) – (18.715 ÷ 9.5 )

| | | Setting | Carriage/Inverter | Turns | Counter | Product |
|---|---|---|---|---|---|---|
| 6 | Set the first term of the second dividend d<br>Set it in PR | 17.24 | 5 | + | .2281 | 17.24 |
| 7 | Set e<br>Calculate d + e | 3.92 | 5 | + | 9.2281 | 21.16 |
| 8 | | Clear | | | | |
| 9 | Two negative turns to clear CR | | 5 | 2 – | 12281 | 2116 |
| 10 | | 7.86 | 5 | 2 – | 3.2281 | 5.44 |
| | Set the second divisor f | 786 | 4 | 6 – | 38281 | 724 |
| | Calculate A + B with division by subtractive method | 786 | 3 | 9 – | 39181 | 166 |
| | | 786 | 2 | 2 + | 39201 | 88 |
| 11 | Result A + B: 3.9202 | 7.86 | 000001 | – | 3.9202 | 0.000094 |
| 12 | | | | | | Clear |
| 13 | The last quotient can be obtained by building-up division,<br>but we keep the Inverter down because it has to be subtracted<br>Set the third divisor h<br>Calculate A + B — C<br>with division by additive method. (See 1Ca)<br>Develop PR as close as possible to the last dividend g<br>Final result: 1.95 | 9.5 | 5 | + | 2.9202 | 95 |
| | | 95 | 4 | 9 + | 20202 | 1805 |
| | | 9.5 | 3 | 7 + | 1.9502 | 18.715 |

*Source: " Curta Calculating techniques" / Bernard Stabile - 2023*

## Transfer multiplication

(a x b x c) ÷ (d x e), this calculation is made in stages:

A = a x b in PR

B = A ÷ d in CR

C = B x c in PR

D = C ÷ e in CR

| (123 x 345 x 567) ÷ (234 x 456) | | Setting | Carriage/Inverter | Turns | Counter | Product |
|---|---|---|---|---|---|---|
| | (a x b x c) ÷ (d x e) | Clear | ⬆ | | Clear | Clear |
| 1 | Set b<br>Calculate A = a x b. Develop 123 in CR<br>Partial result A = 42435 | 345 | 6 < 4 3 2 1 | 6 + | 123 | 42435,0 |
| 2 | | | ⬇ | | Clear | |
| 3 | | 234 | 6 5 4 3 2 1 | – | 1 | 19035 |
| | Set d | 234 | 5 | 8 – | 18 | 315 |
| | Calculate B = A ÷ d with division by subtractive method. (See 1Cc)<br>Bring PR as close as possible to 0 | 234 | 4 | – | 181 | 81 |
| | | 234 | 3 | 3 – | 1813 | 108 |
| | | 234 | 2 | 4 – | 18134 | 144 |
| 4 | dpPR – dpSR = dpR, 3 – 0 = 3<br>Partial result B = 181.346 | 234 | 6 5 4 3 2 1 | 6 – | 181,346 | 0,036 |
| 5 | | | | | | Clear |

## (123 x 345 x 567) ÷ (234 x 456)

| | | Setting | Carriage/Inverter | Turns | Counter | Product |
|---|---|---|---|---|---|---|
| | | 5 6 7 (8 7 6 5 4 3 2 1) | 1 | 6 + | 1 8 1 3 4 0 ▲ | 3 4 0 2 (11 10 9 8 7 6 5 4 3 2 ▲) |
| 6 | Set c | 5 6 7 | 2 | 4 + | 1 8 1 3 0 | 2 6 0 8 2 |
| | Calculate C = B x c with multiplication 2f<br>Bring CR to 0 whith successive carriages | 5 6 7 | 3 | 3 + | 1 8 1 0 | 1 9 6 1 8 2 |
| | | 5 6 7 | 4 | + | 1 8 0 | 7 6 3 1 8 2 |
| | | 5 6 7 | 5 | 8 + | 1 0 | 4 6 1 2 3 1 8 2 |
| 7 | Partial result C = 102823.182 | 5 6 7 | 6 5 4 3 2 1 ▲ | + | 0 ▲ | 1 0 2 8 2 3.1 8 2 (11 10 9 8 7 ▲ 5 4 3 2 1) |
| | | 4 5 6 (8 7 6 5 4 3 2 1) | 6 | 2 — | 2 ▲ | 1 1 6 2 3 1 8 2 (11 10 9 8 7 ▲ 5 4 3 2 1) |
| 9 | Set e | 4 5 6 | 5 | 2 — | 2 2 | 2 5 0 3 1 8 2 |
| | Calculate D = C ÷ e with division by subtractive method<br>Bring PR as close as possible to 0 | 4 5 6 | 4 | 5 — | 2 2 5 | 2 2 3 1 8 2 |
| | | 4 5 6 | 3 | 4 — | 2 2 5 4 | 4 0 7 8 2 |
| | | 4 5 6 | 2 | 8 — | 2 2 5 4 8 | 4 3 0 2 |
| 10 | dpPR – dpSR = dpR, (3 – 0) = 3<br>Final result D = 225.489 | 4 5 6 | 6 5 4 3 2 1 ▲ | 9 — | 2 2 5.4 8 9 ▲ | 0.1 9 8 (11 10 9 8 7 6 5 4 3 2 ▲) |

*Source: " Curta Calculating techniques" / Bernard Stabile - 2023*

## Evaluation of series

Convergent series can be evaluated on type II in a continuous operation.
We split SR and PR, and set $a_1$ on the left of SR and $a_2$ on the right. If we develop a up to 1 on the left of PR, we shall obtain $a_1 \div a_2$ on the right.
We may either clear the left side of PR or develop to 1 to the left of the 15th dial of PR, i.e. off the register.
So we now have 0 on the left and the 1st term of the series on the right of PR.
We change the settings to $b_1$ and $b_2$ and develop the left hand side of PR to the amount which showed on the right hand side, i.e. $a_1 \div a_2$.
Thus we add $(a_1 \div a_2) \times (b_1 \div b_2)$ to the right hand side.
We now have the 1st term on the left and the sum of the first two terms on the right. We proceed in this way until the left and right hand sides of PR agree to the required number of significant figures, obtaining the sum of n terms on the left and n + 1 terms on the right.

This is our convergent serie: $3 + \frac{0.3 \times 0.5}{2} + \frac{0.3 \times 0.5 \times 0.7}{2 \times 3} + \frac{0.3 \times 0.5 \times 0.7 \times 0.9}{2 \times 3 \times 4}$ ,.....

| | | Setting | Carriage/Inverter | Turns | Counter | Product |
|---|---|---|---|---|---|---|
| | | Clear | ⬆ | | Clear | Clear |
| 1 | Set 3 in right of PR<br>CR is purely anecdotal | 3 | 8 7 6 5 4 3 2 1 | + | 1 | 3 |
| 2 | Divisors in left hand SR. Dividends in right hand SR.<br>Note the right hand of PR (3). With setting 2 - 5,<br>develop it in left hand of PR with Carriage 7- 6 | 2 0.5 | 8 7 6 5 4 3 2 1 | 6 + | 1 1 5 | 3 .3 7 5 |
| 3 | With setting 3 - 7, develop 375 in left hand of PR | 3 0.7 | 8 7 6 5 4 3 2 1 | 7 + | 1 1 7 5 | .3 7 5 .3 9 2 5 |
| 4 | With setting 4 - 9, develop 3925 in left hand of PR | 4 0.9 | 8 7 6 5 > > 2 1 | 19 + | 1 1 7 9 3 7 5 | .3 9 2 5 .3 9 6 4 3 7 5 |
| 5 | Continue in the same way<br>Develop the right hand of PR in left hand of PR<br>as close as possible | 5 1.1 | 8 7 6 5 4 > > 1 | 27 + | 1 1 8 0 1 6 2 5 | .3 9 6 4 3 7 5 .3 9 7 3 0 3 7 5 |
| | | 6 1.3 | 8 7 6 5 4 > > 1 | 14 + | 1 1 8 0 3 0 6 9 | .3 9 7 3 0 3 9 .3 9 7 4 9 1 4 7 |

| | | Setting | Carriage/Inverter | Turns | Counter | Product |
|---|---|---|---|---|---|---|
| 5 | The two parts of PR are gradually converging | 7 1.5 | 8 7 6 5 4 3 > 1 | 16 + | 1 1 8 0 3 3 3 7 | .3 9 7 4 9 1 5 , 3 9 7 5 3 1 6 7 |
| | | 8 1.7 | 8 7 6 5 4 3 2 1 | 6 + | 1 1 8 0 3 3 8 7 | .3 9 7 5 3 1 5 , 3 9 7 5 4 0 1 7 |
| | | 9 1.9 | 8 7 6 5 4 3 2 1 | 9 + | 1 1 8 0 3 3 9 7 | .3 9 7 5 4 0 5 , 3 9 7 5 4 2 0 7 |
| | | 10 2.1 | 1 | + | 1 1 8 0 3 3 9 8 | .3 9 7 5 4 1 5 , 3 9 7 5 4 2 2 8 |
| 6 | Result: 0.3975426 | 11 2.3 | 1 | + | 1 1 8 0 3 3 9 9 | .3 9 7 5 4 2 6 , 3 9 7 5 4 2 5 1 |

*Source: " Curta Calculating techniques" / Bernard Stabile - 2023*