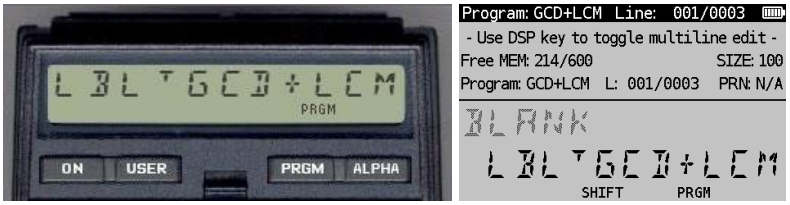
GCD+LCM

Display



(HP-41CX, Hewlett Packard 1983 and DM41X, SwissMicros 2020)

Overview[1]

Programs `GCD` calculates the Greatest Common Divider of two integer values. `GCD` uses a very simple and short algorithm. Its big friend `GCD+LCM` calculates both the Greatest Common Divider and the Least Common Multiple according to the Knuth algorithm (see also the similar program for the HP-67 at the MoHPc).:

Algorithm

Given two integer values **A** and **B** of which the GCD and LCM can be determined as follows:

$$y_{i+1} = s_i \qquad x_{i+1} = t_i$$

$$s_{i+1} = (a_i \text{ div } b_i).s_i + y_i \qquad t_{i+1} = (a_i \text{ div } b_i).t_i + x_i$$

$$a_{i+1} = b_i \qquad b_{i+1} = a_i \bmod b_i$$

where: $s_0 = 0,\ y_0 = 1 \qquad t_0 = 1,\ x_0 = 0$

and: $a_0 = A \qquad b_0 = B$

for: $i = 0, 1, 2, 3, \ldots, n$

The GCD follows from a_{i+1} if the value b_{i+1} equals 0 (zero): $a_{i+1} = \mathrm{GCD}(A,B)$

The LCM follows from: $\mathrm{LCM}(A,B) = A.B \ / \ \mathrm{GCD}(A,B)$

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Example (1)

KEYSTROKES	DISPLAY	COMMENTS
		Run GCD
[XEQ] [ALPHA] GCD [ALPHA]	A,B=?	Enter A and B, e.g. 468 and 228
468 [ENTER] 228 [R/S]	GCD= 12,00000	GCD(468,228) = 12
[R/S]	A,B=?	Run again for 9449 and 4994
9449 [ENTER] 4994 [R/S]	GCD= 11,00000	GCD(9449,4994) = 11
[R/S]	A,B=?	Run again for new values of A and B

Example (2)

KEYSTROKES	DISPLAY	COMMENTS
		Run GCD+LCM
[XEQ] [ALPHA] GCD+LCM [ALPHA]	A,B=?	Enter A and B, e.g. 155 and 55
155 [ENTER] 55 [R/S]	GCD= 5,00000	GCD(155,55) = 5
[R/S]	LCM= 1750	LCM(155,55) = 1750
[R/S]	A,B=?	Run again for A and B, e.g. 406 and 266
406 [ENTER] 266 [R/S]	GCD= 14,00000	GCD(406,266)
[R/S]	LCM= 7.7 14,00000	LCM(406,266)
[RDN]	2,00000	Value of s
[RDN]	-3,00000	Value of t
[R/S]	A,B=?	Run again for A and B, e.g. 792 and 495
792 [ENTER] 495 [R/S]	GCD= 99,00000	GCD(792,495)
[R/S]	LCM= 3.960,00000	LCM(792,495)
[RDN]	2,00000	Value of s
[RDN]	-4,00000	Value of t
[R/S]	A,B=?	Run again for new values of A and B

Program Listing

The listing of both the GCD and GCD+LCM programs is given below:

```
01▪LBL "GCD"
02 "A,B=?"
03 PROMPT
04▪LBL 01
05 MOD
06 LASTX
07 X<>Y
08 X#0?
09 GTO 01
10 "GCD="
11 ARCL Y
12 AVIEW
13 END

(32 bytes)
```

```
01▪LBL "GCD+LCM"
02 CLRG
03 "A,B=?"
04 PROMPT
05 STO 02
06 STO 07
07 X<>Y
08 STO 01
09 ST* 07
10 1
11 STO 04
12 STO 06
13▪LBL 01
14 RCL 01
15 STO 00
16 RCL 02
17 STO 01
18 ST/ 00
19 MOD
20 STO 02
```



```
21 X=0?
22 GTO 06
23 RCL 04
24 RCL 05
25 STO 04
26 RCL 00
27 INT
28 *
29 -
30 STO 05
31 RCL 03
32 RCL 06
33 STO 03
34 RCL 00
35 *
36 INT
37 -
38 STO 06
39 GTO 01
40▪LBL 06
41 RCL 07
42 RCL 06
43 RCL 05
44 RCL 01
45 ST/ T
46 "GCD="
47 ARCL X
48 PROMPT
49 "LCM="
50 ARCL T
51 AVIEW
52 END

(84 bytes)
```

Registers, Labels and Flags

REGISTERS	COMMENTS
R00	Work registers
R01	a_i
R02	b_i
R03	x_i
R04	y_i
R05	s_i
R06	t_i
R07	Product A,B

LABELS	COMMENTS
LBL00	-
LBL01	Loop around s_i and t_i
LBL02	-
LBL03	-
LBL04	-
LBL05	-
LBL06	Show outcomes

FLAGS	COMMENTS
-	-

Downloads

The RAW/TXT format of the program is available via the website: GCD+LCM (in zip file).

