

8bit log table generator

Logarithm tables are often used in C64 and for much the same reason they were originally invented, that is exploiting the same identities your old slide rule uses for transforming multiplication and division into addition and subtraction:

$$\begin{aligned}\lg(x*y) &= \lg(x) + \lg(y) \\ \lg(x/y) &= \lg(x) - \lg(y)\end{aligned}$$

Typically they'd be used together with an exponentiation table (to get the approximate result), with the exponent built-in to another table (such as in my atan routine), or on their own for comparison purposes (as for dot products and the like.)

Yet they're also poorly compressible so a generator routine comes in handy. This version is an eight-bit implementation of the classic shift-add algorithm where you repeatedly try to factorize $(x^2-1)/x^2$ factors out of a normalized number, with the factors' logarithms stored in a pre-calculated table. An alternative would be to use BASIC to get a much smaller, more precise, and frustratingly slow generator. But this seems like a fair tradeoff between size, speed and precision (saving some 145 bytes or so after compression.)

Note that the result is scaled to fit in eight-bits. This can most naturally be viewed a base-two logarithm in 3:5 fixed-point.

```
table    = $c000          ;page aligned

seed     .byte $00,$00
         .byte $02,$05
         .byte $0c,$1f

reduce  pla
        adc seed,y
        sec
next     pha
        ldy #5
        txa
        sta shift+4

shift   ror shift+4
        sbx #$00
        bcs reduce
        tax
        dey
        bpl shift

        pla
store   sbc #$1f
        sta table
        lsr store+3
        bcc store
```

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```
enter   dec  *+4
        lda  #$00
        sta  store+3
        asl  a
        tax
        lda  #$00
        bcs  next

;   sta  table      ;do whatever makes most sense for log(0)
        rts
```

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