Hi all,

A few hundreds years ago in Japan, people were using specially crafted division tables for some specific tasks.

The first task is 'division by 44' (in then Japan, 1 measurement unit for gold was 44 momme (approx. 160g).

The second task is 'division by 43' (this is for silver.)

And the third table is 'division by 16'. I believe it was imported from China, since Chinese mass unit 1 斤 (catty) equals to 16 両 (tael). (In Edo period in Japan, same mass units was used, but they were obsoleted when Meiji period began.)

Div by 16 table is somewhat different than other division tables including Chinese division one, since dividing operation by 16 itself doesn't yield recurring decimals, so we don't need to use 'quotient-remainder pair' approach.
The table is like this...(it's very straight forward)

When 1, clear the rod and add 625 to the right.
When 2, make the rod 1 and add 25 to the right.
When 3, make the rod 1 and add 875 to the right.
When 4, make the rod 2 and add 5 to the right.
When 5, make the rod 3 and add 125 to the right.
When 6, make the rod 3 and add 75 to the right.
When 7, make the rod 4 and add 375 to the right.
When 8, make the rod 5.
When 9, make the rod 5 and add 625 to the right.

These rules are applied from the right digits to the left.
So, for instance 123/16 is

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abcdef
123    : Looking at [c]: it's 3, so make 1 and add 875.
121875 : Looking at [b]: it's 2, so make 1 and add 25.
114375 : Looking at [a]: it's 1, so clear and add 625.
076875 : It's 7.6875!  done.  (decimal point shifts just 1 digit)
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If you add extra operations and some rules, it could be used as yet another decimal to hexadecimal conversion.

For instance, conversion decimal 1478 to hexadecimal number.

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abcdef :
1478   : Looking at [d]: it's 8, so make 5.
1475   : Looking at [c]: it's 7, so make 4, add 375.
144875 : Looking at [b]: it's 4, so make 2, add 5.
129875 : Looking at [a]: it's 1, so clear and add 625.
092375 : Then looking at a fraction part, it's 375, so reverse
       : look up the table and find the number 6.
       : That's the least significant hexadecimal digit. put it somewhere.
       : Clear the 375 part.
092000 : Looking at [c]: it's 2, so make 1, add 25.
09125  : Looking at [b]: it's 9, so make 5, add 625.
05750  : Then looking at a fraction part, it's 75, so reverse
       : look up the table and find the number.
       : If you can't find the number, the hexadecimal digit must be
       : between A and F.  Just apply the rule below.
       :   if it's first half of 6, it must be A.
       :   if it's latter half of 6, it must be B.
       :   if it begins with 7, it must be C.
       :   if it's first half of 8, it must be D.
       :   if it's latter half of 8, it must be E.
       :   else (it should begin with 9), it must be F.
       : in this point, it's 75 so we can determine it's C. Put is somewhere.
       : Clear the 75 part.
05     : It's less than 16, so the most significant digit would be 5.
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Very straight forward approach, but after remembering the table, the operation would be so easy. :-)

And one more tweak for decimal to hexadecimal conversion.
When we put or add numbers, just do the whole operations on 'one rod to the right', rather than the rod itself (and the next few right rods), so we could fix the decimal point.

For instance.

abcdefg :
1478 : Looking at [d]: it's 8, so clear [d] and make 5 on [e].
14705 : Looking at [c]: it's 7, so clear [c], make 4 on [d], add 375 to [efg].
1404875 : Looking at [b]: it's 4, so clear [b], make 2 on [c], add 5 to [d].
1029875 : Looking at [a]: it's 1, so clear [a], and add 625 to [cde].
0092375 : clear [efg]. (omitted some explanations.)
0092000 : Looking at [d]: it's 2, so clear [d] make 1 on [e], add 25 to [fg].
0090125 : Looking at [c]: it's 9, so clear [c], make 5 on [d], add 625 [efg].
0005750 : clear [efg] (omitted some explanations.)
0005 : It's less than 16, so the most significant digit would be 5.

I think this is one of the most unpractical division table in the current world (^o^;), but once
it was the indispensable division table in 17th-19th century Japan.
The name is '金子四十四割' (Kinsu shijuu-shi wari), which means 'divide by 44 for gold calculation.'

In Edo period (1603-1868), gold had its own measurement unit, '両' (Ryou). This unit was originally (it was imported from China) used to measure weight of the object, but it gradually became the unit to denote the value of gold, and 1 Ryou was defined as 4.4 匁 (Momme).
(BTW, Momme is defined as 3.75g in 1891, but before that, it might be a bit lighter.)

And in early Edo period, there were 2 kinds of gold coins, Oban (face value=10 Ryou) and Koban (face value=1 Ryou). Oban (https://en.wikipedia.org/wiki/%C5%8Cban), which was minted for rewards to vassals, not for circulation, is made of 97% gold (3% copper) and weighs 44 Momme, and Koban (https://en.wikipedia.org/wiki/Koban_(coin)) is made of alloy of gold and silver.

The weight of Kobans and the grade of materials were different from time to time (since Edo period lasted such a long years), but the grade of the gold was always represented by the weight of alloy which contains 44 Momme of gold. For instance, '52.2 Momme grade' means the alloy contains 44 Momme of gold and 8.2 Momme of silver. (approx. 85% gold)

In this manner, 44 was frequently used constant in gold calculations.

The table for 'div by 44' sounds like complicated, but table itself is very simple.
There are only 5 entries, and it goes like this.

<1> If 1, make 2, and add 12 to the right. 一二加下十二 (ichi ni kaka juu-ni)
<2> If 2, make 4, and add 24 to the right. 二四加下二十四 (ni shi kaka nijuu-shi)
<3> If 3, make 6, and add 36 to the right. 三六加下三十六 (san roku kaka sanjuu-roku)
<4> If 4, make 9, and add 04 to the right. 四九加下下四 (shi ku kaka ka shi)
<5> if larger or equal than 44, add 1 to the left, and subtract 44. 逢四十四進一十 (ou shijuu-shi shin ichi-juu)

That's all! So let's divide 43428 by 44

abcdef
043428 : At first, look at the top 2 digits ([bc]) to find out the value exceeds 44 or not.
: If it's larger or equal than 44, we would apply rule <5>, but it isn't,
: so from now on, rod [b] is going to be a quotient area, and [cdef] is
: going to be a remainder area.
: Look at [b], and apply rule <4>, meaning place 9 to [b], and add 04 to [cd].
093828 : Then look at the [cd] to find out the value exceeds 44 or not.
: It's 38, so no need to apply rule <5>, it means quotient at [b] is settled.
: From now on, rod [bc] is going to be a quotient area, and [def] is going to
: be a remainder area.
: Look at [c], and apply rule <3>, meaning place 6 to [c], and add 36 to [de].
: When we add 36 to [de], we have to watch out NOT TO INTRUDE THE QUOIENT AREA,
: that means we have to remember whether overflow happened or not unless we
: use 2:5 soroban, or Chinese abacus.
096B88 : Then look at the [de] to find out the value exceeds 44 or not.
: It's B8, or 118, so apply rule <5> until [de] becomes less than 44.
098308 : From now on, rod [bcd] is going to be a quotient area, and [ef] is going to
: be a remainder area.
: Look at [d], and apply rule <3>, meaning place 6 to [d], and add 36 to [ef].

098644 : Then look at the [ef] to find out the value exceeds 44 or not.
        : It's 44, so apply rule <5>.
098700 : Done.

Now the sister table, '銀子四十三割' (Ginsu shijuu-san wari), which means 'divide by 43 for silver calculation.'

In Edo period, silver money was circulated as the form of ingots or grains, not the form of coins. And the unit to denote the value of silver was Momme and 貫 (Kan=1000 Momme), which were the same unit symbol to weigh something. The weight of the ingots varied ingot by ingot, although they all were 30-40 something Momme. So balance scale was essential tool for people who handles silver money. It was very inconvenient, so certified money-exchange shop wrapped certain amount (43 Momme was very common) of silver in a sealed envelope for convenience. It is called '包み銀' (Tsutsumi-gin), literally means 'wrapped silver.' And there was a custom to reward silver to vassals. In this case the unit '枚' (Mai=43 Momme) was used.

So 43 was very common constant to handle silver.

The table for 'div by 43' is very similar to the 'div by 44' table, and it goes like this.

<1> If 1, make 2, and add 14 to the right. 一二加下十四 (ichi ni kaka juu-shi)
<2> If 2, make 4, and add 28 to the right. 二四加下二十八 (ni shi kaka nijuu-hachi)
<3> If 3, make 6, and add 42 to the right. 三六加下四十二 (san roku kaka shijuu-ni)
<4> If 4, make 9, and add 13 to the right. 四九加下十三 (shi ku kaka juu-san)
<5> if larger or equal than 43, add 1 to the left, and subtract 43. 逢四十三進一十 (ou shijuu-san shin ichi-juu)

If you understand how to employ 'div by 44' table, you should be already ready to go. :-)

masaaki