cse 101 2-21-25

Addition

Pab arithmetic in base $b = 100$

$= 10^2$ so $p = 2$.

$$\begin{array}{cccc} & 1 & 1 & 0 \\ & (88 & 21 & 35) = 882,135 \\ & (65 & 91 & 79) = 659,179 \\ \hline (1 & 54 & 13 & 12) = 1,541,312 \end{array}$$

another way:

88 21 33

65 91 79

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1 1 1 0

(153 112 112) vector sum

154 113 -100

-100 -100

(1 54 13 12) normalize

subtraction

-1 -1 0

88 21 33

65 91 79

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22 29 54

another day

88 21 33

65 91 79

$\overset{-1}{23}\ \overset{-1}{-70}\ -46$ Vector sub.

100 100

22 29 54 normalize

Subtraction again

65 91 79

88 21 33

(-23 70 46) vector diff.

↑

leftmost digit negative

-1 -1

23 -70 -46

-1 100 100

↑

Pull out -1, normalize

(22 29 54) normalize helper fcn.

return -1 to caller

Multiplication ! $b=10$, $p=1$

$$
\begin{array}{r}
123 \\
\times\ 456 \\
\hline
,738 \\
.6150 \\
49200 \\
\hline
56088
\end{array}
$$

(1 2 3) ← len. n digits

(4 5 6) ← len m digits

shift

→ (0 0 0) 0

(6 12 18) scalar mult

(6 12 18) add

→ (7 3 8) normalize

(5 10 15 0) scalar mult 1

(5 17 18 8) add

→ (6 8 8 8) normalize

(4 8 12 0 0) scalar mult 2

(4 14 20 8 8) add

→ (5 6 0 8 8) normalize

Runtime: $\Theta(nm)$

long mults $= m \cdot n$

long additions $= 2mn + m^2$