

CSE 101 2-22-24

- Pas: ext. 1 move day to Saturday
- Pa6: ext. 2 days to Friday

Ex. subtraction again

$$\begin{array}{r}
 (65 \ 91 \ 79) \\
 - (88 \ 21 \ 33) \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 -23 \ 70 \ 46 \\
 \uparrow
 \end{array}$$

vector diff.

left most digit negative

pull out (-1) normalize again

$$\begin{array}{r}
 \boxed{-1} \quad \begin{array}{r} -1 \quad -1 \quad 0 \\ 23 \quad -70 \quad -46 \\ \quad -71 \quad 100 \\ \quad 100 \end{array}
 \end{array}$$

$$(22 \ 29 \ 54) \text{ normalize}$$

Ex. Multiplication : $b=10, p=1$

$$\begin{array}{r}
 \begin{array}{ccc}
 & \cdot & \cdot \\
 1 & 2 & 3 \\
 \times & 4 & 5 & 6 \\
 \hline
 & 7 & 3 & 8 \\
 & 6 & 1 & 5 & 0 \\
 4 & 9 & 2 & 0 & 0 \\
 \hline
 5 & 6 & 0 & 8 & 8
 \end{array}
 \end{array}$$

$$\begin{array}{r}
 (1 \ 2 \ 3) \\
 (4 \ 5 \ 6) \\
 \hline
 \end{array}$$

shift

- | | | |
|-------------|--------------|---|
| (6 12 18) | scalar mult | 0 |
| (7 3 8) | no-normalize | |
| (5 10 15 0) | S.M. | 1 |
| (5 17 18 8) | add | |
| (6 8 8 8) | normalize | |

(4 8 12 0 0) s.m. 2 ³

(4 14 20 8 8) add

(5 6 0 8 8) normalize

Runtime!

(. . .) \swarrow #digits = n
(. .) \swarrow #digits = m

$$\text{Runtime} = n \cdot m = \Theta(nm)$$

\nearrow
#digit multiplications

$$\text{\#digit additions} = 2nm + m^2$$

Normalize $b = 10, p = 1$

$(1, -90, 9, 73, 0, -500)$

$$1 \cdot b^5 + (-90)b^4 + 9 \cdot b^3 + 73 \cdot b^2 + 0 \cdot b^1 + (-500) \cdot b^0$$

normalize

$$\begin{pmatrix} -9 & +1 & +6 & -5 & -50 & 0 \\ 1 & -90 & 9 & 73 & 0 & -500 \end{pmatrix}$$

$$\begin{matrix} -89 & 15 & 68 & -50 \\ +90 & -10 & -60 & +50 & +500 \end{matrix}$$

$$(-8 \quad 1 \quad 5 \quad 8 \quad 0 \quad 0)$$

$$\boxed{-1} \begin{pmatrix} -1 & -1 & -1 \\ 8 & -1 & -5 & -8 & 0 & 0 \\ -2 & -6 \end{pmatrix}$$

no-normalize again !

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10 10 10

$$\boxed{-1} \quad (7 \quad 8 \quad 4 \quad 2 \quad 0 \quad 0)$$

from-string const. vs. to-string

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Ex. $b = 1000, p = 3$

$$(1, 2, 3) = 1002003$$

$$"1|002|003" \rightarrow (1, 2, 3)$$

Ex $b = 100, p = 2$

$$(1, 2, 3) = 10203$$

$$"1|02|03" \rightarrow (1, 2, 3)$$

From long constructor

Ex. $b=100$ $P=2$

$X = 12345678$
→ $(12, 34, 56, 78)$

Ex. $b=1000$, $P=3$

$X = 12345678$
→ $(12, 345, 678)$