Count digits in 1 to n.

$\log(1)$ — $\log 1$

$\log(2)$ — $\log 1$

$\vdots$

$\log(n)$ — $\log n$

$= O(n \log n)$.

$N = 1123$

$n = 1123$

1s place = 1123

10s place = 1123 - 9.

100s place = 1123 - 99.

1000s place = 1123 - 999

10,000s place =

1s place = 1123 $= n - (1-1)$

10s place = 1123 - 9. $= n - (10-1)$

100s place = 1123 - 99. $= n - (100-1)$

1000s place = 1123 - 999 $= n - (1000-1)$.

$$\left[\begin{array}{l} i = 1; (i < n+1); \quad i = i * 10 \\ \text{pres} += \underline{n - (i-1)}; \end{array}\right]$$

pres = 0 25. 41

n = 25.

$i = 1$.

$25 - (1-1) = 25$.

$i = 10$.

$25 - (10-1) = 16$.

$i = 100$.

$25 - (100-1)$

$= 25 - 99$ $\boxed{< 0}$

$n - (i-1) > 0$

$n > i - 1$

$i - 1 < n$

$\boxed{i < n+1}$

$i \leq n$.

$TC = O(\log n)$

$AS = O(1)$.

$\left(i = 0; \underline{i < n}; i{+}{+}\right)$ $O(n)$. $n = 100$

$= O(\log n)$.

$i = 0, 1$, $i < n$; $i *= 10$

$$\left[\begin{array}{c} 1 \\ 10 \\ 100 \\ \vdots \\ n \end{array}\right] \log_{10} n \qquad \left[\begin{array}{c} 1 \\ 2 \\ 4 \\ 8 \\ 16 \\ \vdots \\ n \end{array}\right] \underline{n = \log_2 n}$$

Prime.

$$\left[\begin{array}{l} i = 2; \quad i \leq n-1, \; i{+}{+} \\ \quad \text{if } n \% i == 0 \\ \quad \text{return false.} \end{array}\right] \quad TC = O(n)$$

return true.

$2 \rightarrow n-1$ $\rightarrow O(n)$

$2 \rightarrow n/2$ $\rightarrow O(n)$.

$\boxed{\text{Factors always occur in pairs.}}$

$n = 20$

1, 2, 4, 5, 10, 20

$n = 36$

1, 2, 3, 4, 6, 9, 12, 18, 36

$\sqrt{n}$

$i: 2 \longrightarrow \sqrt{n}$. $\Big]$ $TC = O(\sqrt{n})$.

$i \leq \sqrt{n}$

$i * i \leq n$.

$n = 20$

$O(n - \sqrt{n})$

$= O(n^{3/2})$.

~~1~~ ~~2~~ ~~3~~ ~~4~~ ~~5~~ ~~6~~ ~~7~~ ~~8~~ ~~9~~ ~~10~~

11 ~~12~~ 13 ~~14~~ ~~15~~ ~~16~~ 17 ~~18~~ 19 ~~20~~

2: 4, 6, 8, 10, 12, 14, 16, 18, 20

3: 6, 9, 12, 15, 18.

5: 10, 15, 20

i

$2 * i = 10$

$3 * i = 15$

$= 20$

$= 25$

$\rightarrow i * i$

$(i+1) * i$

$i = 5$

(base 10) $n = \frac{2}{10^2} \; \frac{3}{10^1} \; \frac{1}{10^0}$

$(1 * 10^2) + (3 * 10^1) + (2 * 10^0)$

$1 + 30 + 200 = \underline{231}$

(Base 2) $n = \frac{1}{2^3} \; \frac{0}{2^2} \; \frac{1}{2^1} \; \frac{0}{2^0}$

$(0 * 2^0) + (1 * 2^1) + (0 * 2^2) + (1 * 2^3)$

$0 + 2 + 0 + 8 = \underline{10}$

0 & 1 = 0

0 & 0 = 0

1 & 0 = 0

1 & 1 = 1

0 | 0 = 0

0 | 1 = 1

1 | 1 = 1

1 | 0 = 1

XOR

1 ^ 1 = 0

1 ^ 0 = 1

0 ^ 1 = 1

0 ^ 0 = 0

n1 = 1010.

n2 = 1100.

n1 & n2 = 1000

n1 | n2 = 1110

n1 ^ n2 = 0110

Left Shift.

n = 1010 (10)

n << 1 = 10100 (20)

Right Shift.

n = 1010 (10)

n >> 1 = 101 (5)

n = 1011 (11)

n >> 1 = 101 (5)