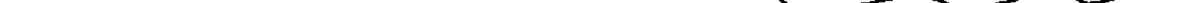


1



Questions on Pa I

- how to build List ADT?
- how to use List ADT?

#include <string.h> ← use this
or

III `include <strings.h>` ← don't use this

why do we want string.h

$$\text{for } \left\{ \begin{array}{lll} \text{strcmp}(s_1, s_2) < 0 & \text{if } s_1 < s_2 \\ \text{""} & == 0 & \text{"" } s_1 == s_2 \\ \text{""} & > 0 & \text{"" } s_1 > s_2 \end{array} \right.$$

Example for Pal :

index: 0 1 2 3
 $A = ("c", "a", "b", "d")$

want $L = [1, 2, 0, 3]$

start: $L = []$

insert 0: $L = [0]$

insert 1: $L = [0]$

$L = [1, 0]$ insertBefore()

insert 2: $L = [1, 0]$

$L = [1, 0]$ insertBefore()

$L = [1, 2, 0]$

insert 3: $L = [1, 2, 0]$

$L = [1, 2, 0]$

$L = [1, 2, 0]$

$L = [1, 2, 0]$

$L = [1, 2, 0, 3]$ append()

Part: BigIntegers - ADT

store a list of longs, representing
integer in base 10^p (for $1 \leq p \leq 9$)

Example:

$$N = 537204$$

$p=2$
 $* L = [53 \ 72 \ 04]$ base $100 = 10^2$
 $\{00, \dots, 99\}$
 $= (53) \cdot 100^2 + (72) \cdot 100^1 + (04) \cdot 100^0$

$p=3$
 $L = [537 \ 204]$ base $1000 = 10^3$
 $\{000, \dots, 999\}$

$p=4$
 $L = [0053 \ 7204]$ base $10000 = 10^4$
 $\{0000, \dots, 9999\}$

Ex. add. ($P=2$)

$$\begin{array}{r}
 \begin{array}{ccc}
 & 1 & 1 \\
 [35 & 57 & 97] \\
 + [14 & 90 & 82] \\
 \hline
 50 & 48 & 72
 \end{array}
 \end{array}$$

another way: vector-addition

$$\begin{array}{r}
 [35 \quad 57 \quad 97] \\
 [14 \quad 90 \quad 82] \\
 \hline
 \end{array}$$

$$\begin{array}{ccc}
 +1 & +1 & 0 \\
 [49 & 147 & 179] \\
 50 & 148 &
 \end{array}$$

Normalize:

$$\begin{array}{ccc}
 -100 & -100 & \\
 [50 & 48 & 79]
 \end{array}$$

Ex sub

$$\begin{array}{r} -1 \\ [55 \quad 57 \quad 97] \end{array}$$

$$- [14 \quad 90 \quad 82]$$

$$[20 \quad 67 \quad 15]$$

or vector-subtraction:

$$[55 \quad 57 \quad 97]$$

$$- [14 \quad 90 \quad 82]$$

$$\begin{array}{r} -1 \quad 0 \quad 0 \\ [21 \quad -33 \quad 15] \end{array}$$

100

$$[20 \quad 67 \quad 15]$$

Exercise: do some multiplication
 Probleme in this representation

say x, y are two base 10^p
 digits. might need at some
 point to compute $x \cdot y$

$$0 \leq x < b$$

$$0 \leq y < b$$

so $0 \leq xy < b^2$

need $b^2 \leq \text{max long value}$

i.e. $b^2 \leq 2^{63} - 1$

i.e. $b \leq \sqrt{2^{63} - 1} \approx 3,037,000,499.97...$

highest power of 10 satisfying

$$b \leq \sqrt{2^{63} - 1}$$

$$\Rightarrow b = 1,000,000,000 = 10^9$$

need to write a helper function
called `normalize()`

```
int normalize(List L);
```

$\left\{ \begin{array}{ll} +1 & \text{Pos. number} \\ -1 & \text{neg. number} \\ 0 & \text{zero} \end{array} \right.$

BigInteger ADT

internal state

list of longs

sign int = to +1, -1, 0

macros in C:

#define FOO BAR

#define POWER 6

#define ELEMENT_TYPE ~~int~~
long

↑
Put at top of h file, inside
include guards.