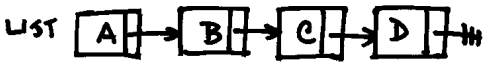
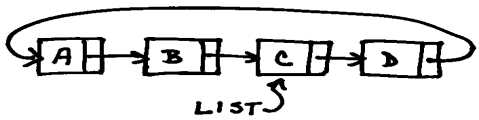
List Variations

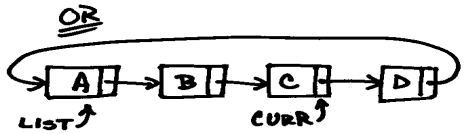
- Linear Linked List
- Circular Lists
- List with header nodes
- Doubly-linked list
- Multi-linked List



List Variations: Circular

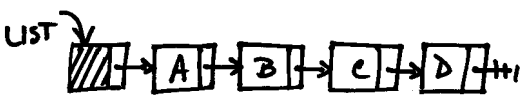
- Useful to process any item by going forward
- Can reach items behind current location without starting over





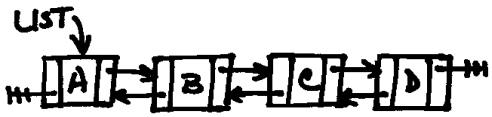
List Variations: Header nodes

- Useful for working with lists that are frequently empty



List Variations: Doubly-linked lists

- Useful for changing direction in list frequently
- Useful for frequent deletions



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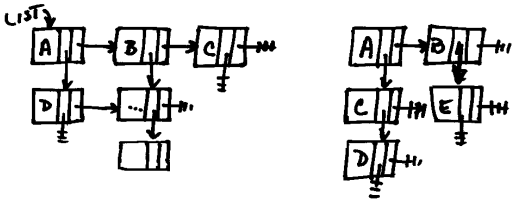
List Variations: Multi-linked Lists

- Useful to follow more than one kind of path through data
- Can becomes Inverted or Threaded file
  - (see Horowitz and Sahni)



List Examples

- Josephus problem
  - Once you start, current position is all that matters.
- Very long Integers
- Polynomial Arithmetic
- Sparse Matrices

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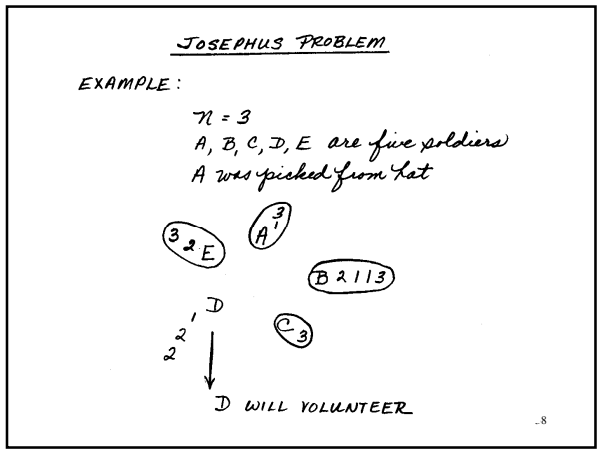
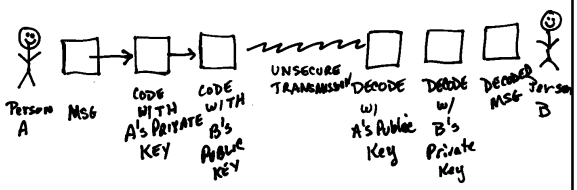


List Examples: Very Long Integers

Motivation: Public Key/Private Key Encryption



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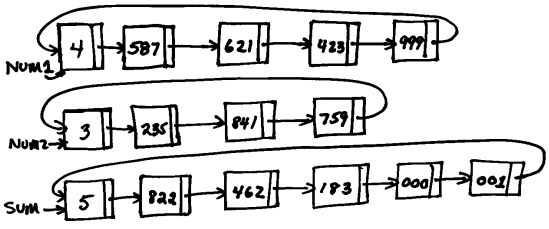
List Example: Very Long Integers

999423621587
\+ 759841235
1000183462822

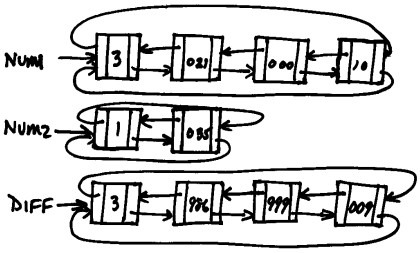


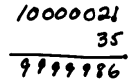
List Examples: Very Long Integers

- Use pointers in each list to move through them in parallel.
- Use of header keeps track of original start of list.
- Note size of sum is different from size of addends.

List Examples: Very Long Integers

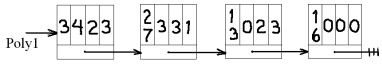
- Use double linked list to support subtraction. Why?

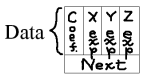




List Examples: Polynomial arithmetic

$$3x^4y^2z^3 + 27x^3y^3z + 13y^2z^3 + 16$$





List Variations: Multi-linked Lists