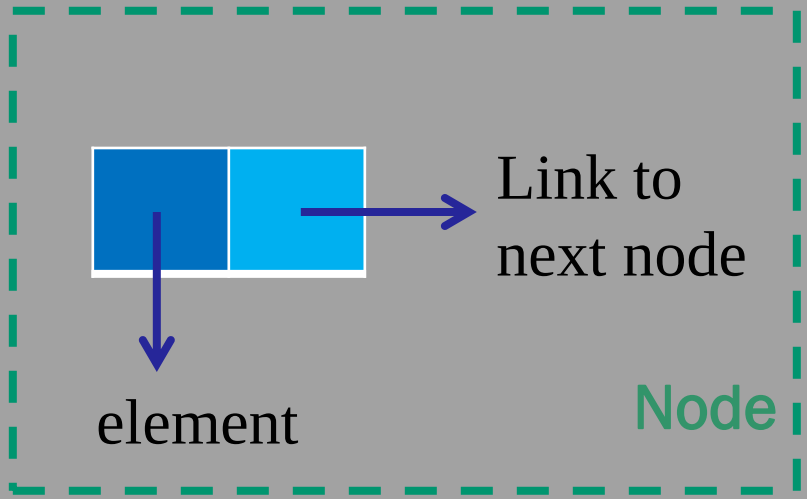
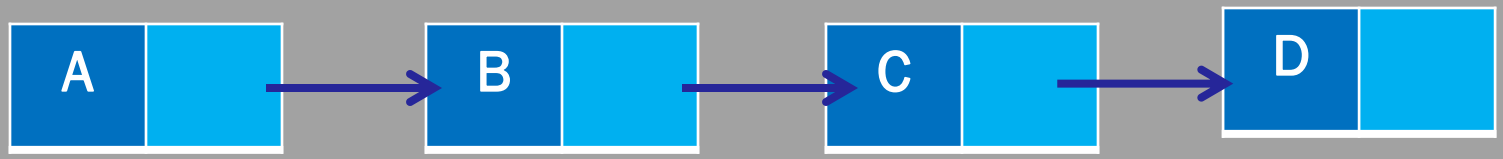
LINKED LIST

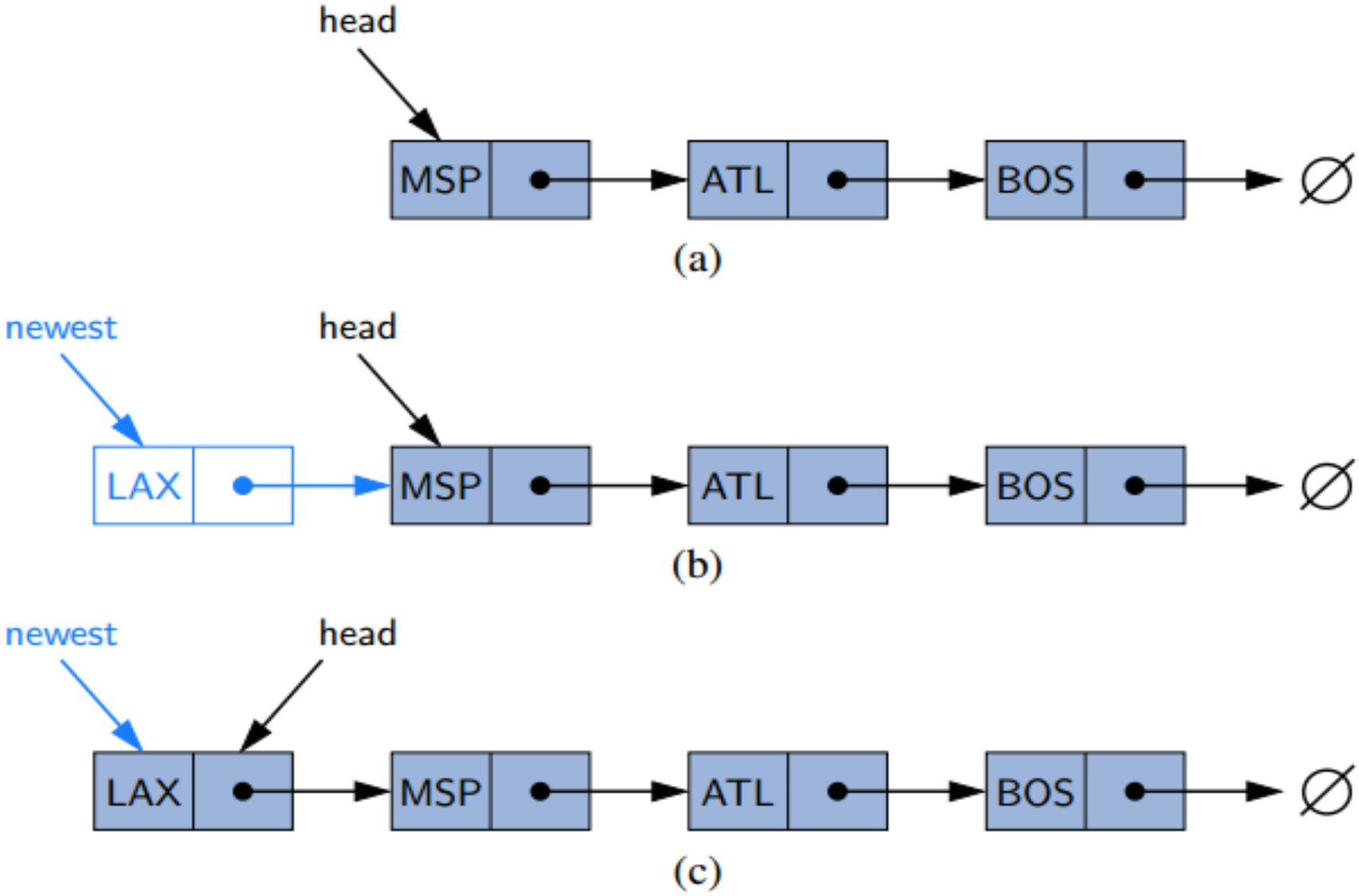
SINGLY LINKED LISTS

- Each node stores a reference to an object that is an element of the sequence, as well as a reference to the next node of the list.
- Each node stores:
  - element
  - link to the next node





ADD FIRST


head
MSP
ATL
BOS
(a)
newest
head
LAX
MSP
ATL
BOS
(b)
newest
head
LAX
MSP
ATL
BOS
(c)

ADD FIRST

Algorithm addFirst(e):

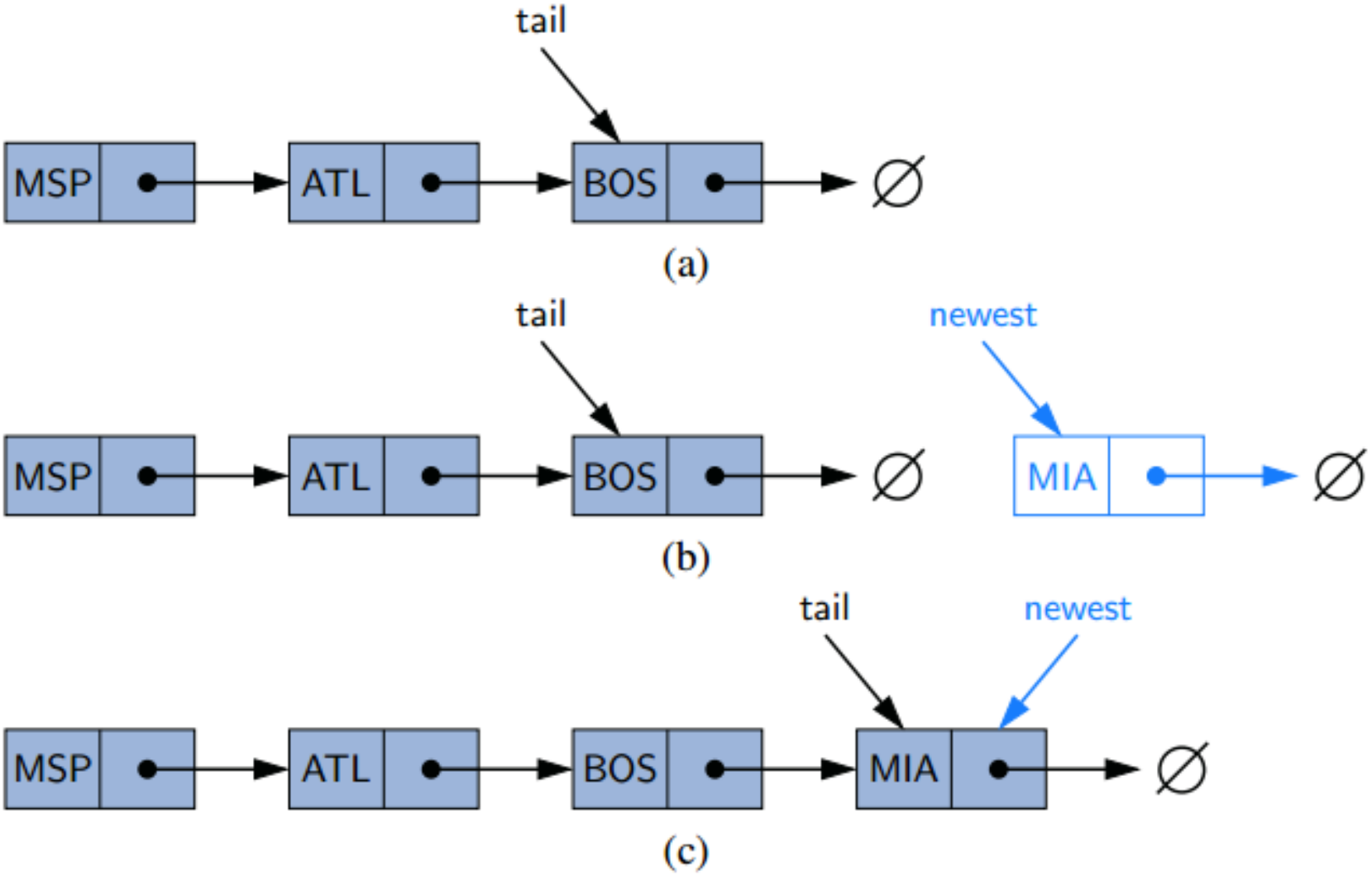
newest=Node(e) {create new node instance storing reference to elemente}

newest.next=head {set new node's next to reference the old head node}

head=newest {set variableheadto reference the new node}

size=size+1 {increment the node count}

ADDLAST


tail
MSP
ATL
BOS
(a)
tail
newest
MSP
ATL
BOS
MIA
(b)
tail
newest
MSP
ATL
BOS
MIA
(c)

ADDLAST

Algorithm addLast(e):

newest=Node(e) {create new node instance storing reference to elemente}

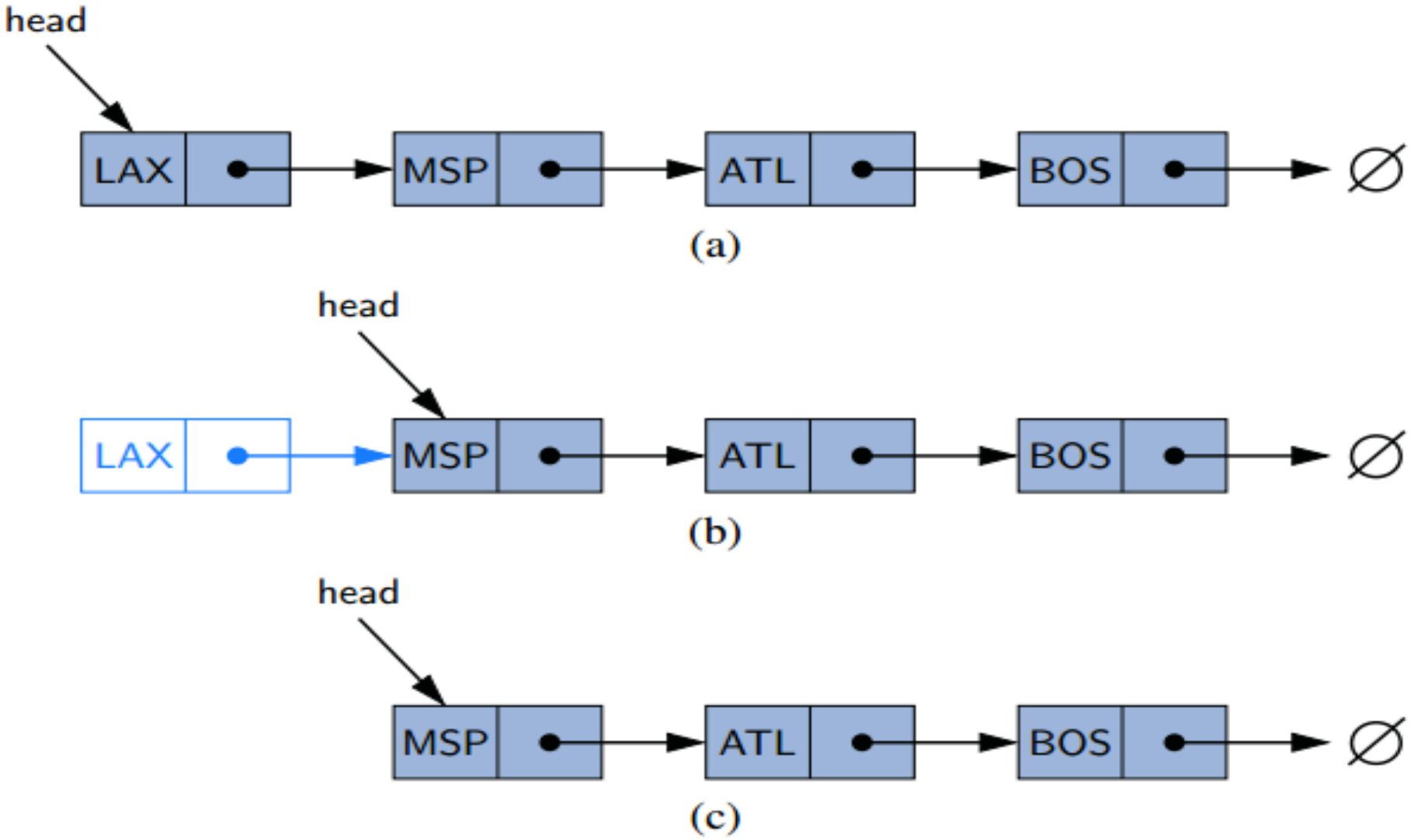
newest.next=null {set new node's next to reference thenullobject}

tail.next=newest {make old tail node point to new node}

tail=newest {set variabletailto reference the new node}

size=size+1 {increment the node count}

REMOVE



REMOVE

Algorithm RemoveFirst( ):

If (head==null) then

the list is empty.

head=head.next {make head point to next node (or null)}

size=size−1 {decrement the node count}

IMPLEMENTING A SINGLY LINKED LIST CLASS

size( ): Returns the number of elements in the list.

isEmpty( ): Returns **true** if the list is empty, and **false** otherwise.

first( ): Returns (but does not remove) the first element in the list.

last( ): Returns (but does not remove) the last element in the list.

addFirst(*e*): Adds a new element to the front of the list.

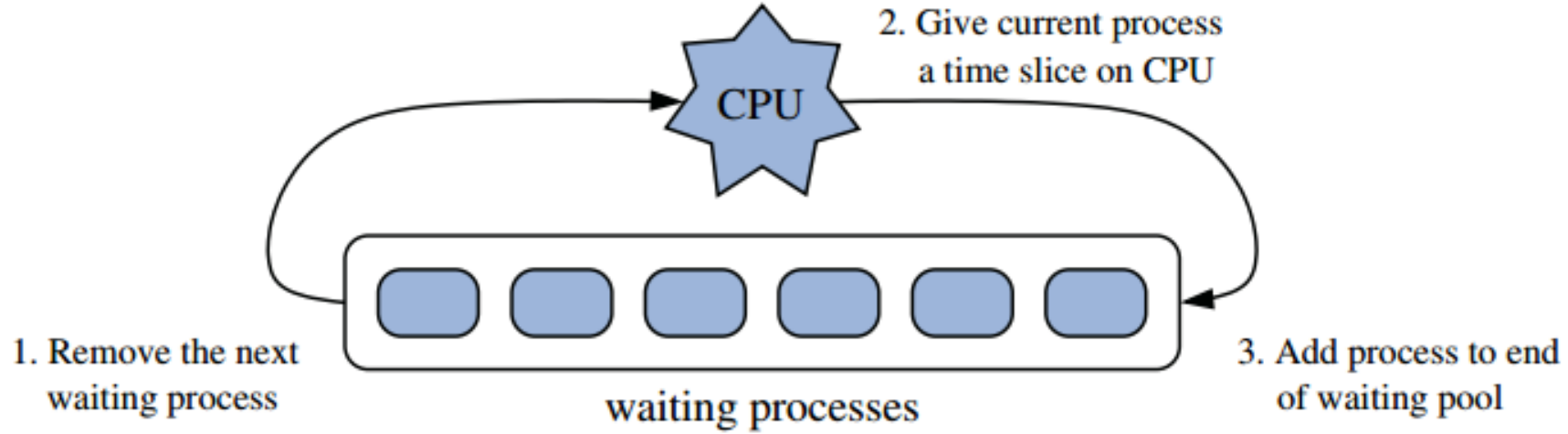
addLast(*e*): Adds a new element to the end of the list.

removeFirst( ): Removes and returns the first element of the list.

IMPLEMENTING A SINGLY LINKED LIST CLASS

- Read and do exercise in pg127

CIRCULARLY LINKED LISTS



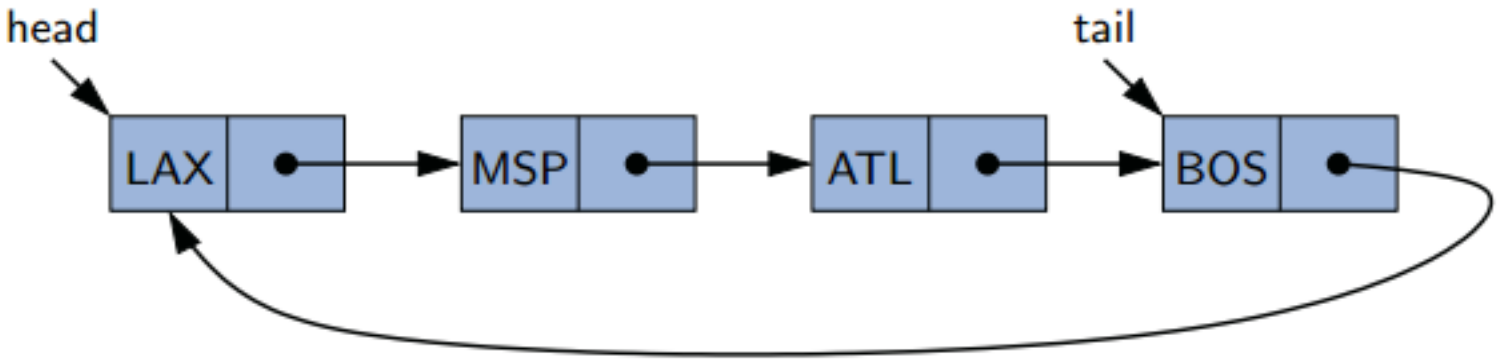
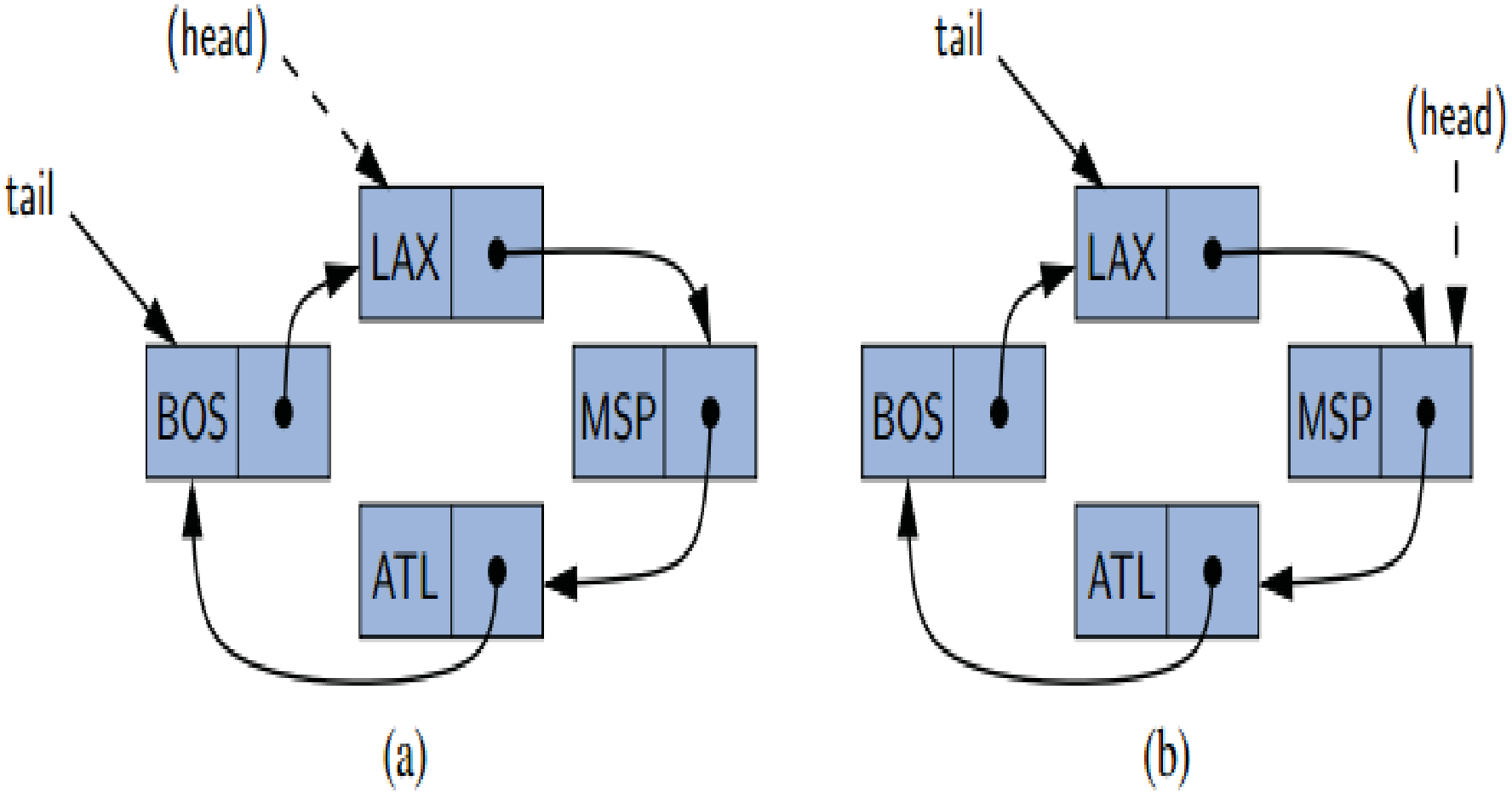
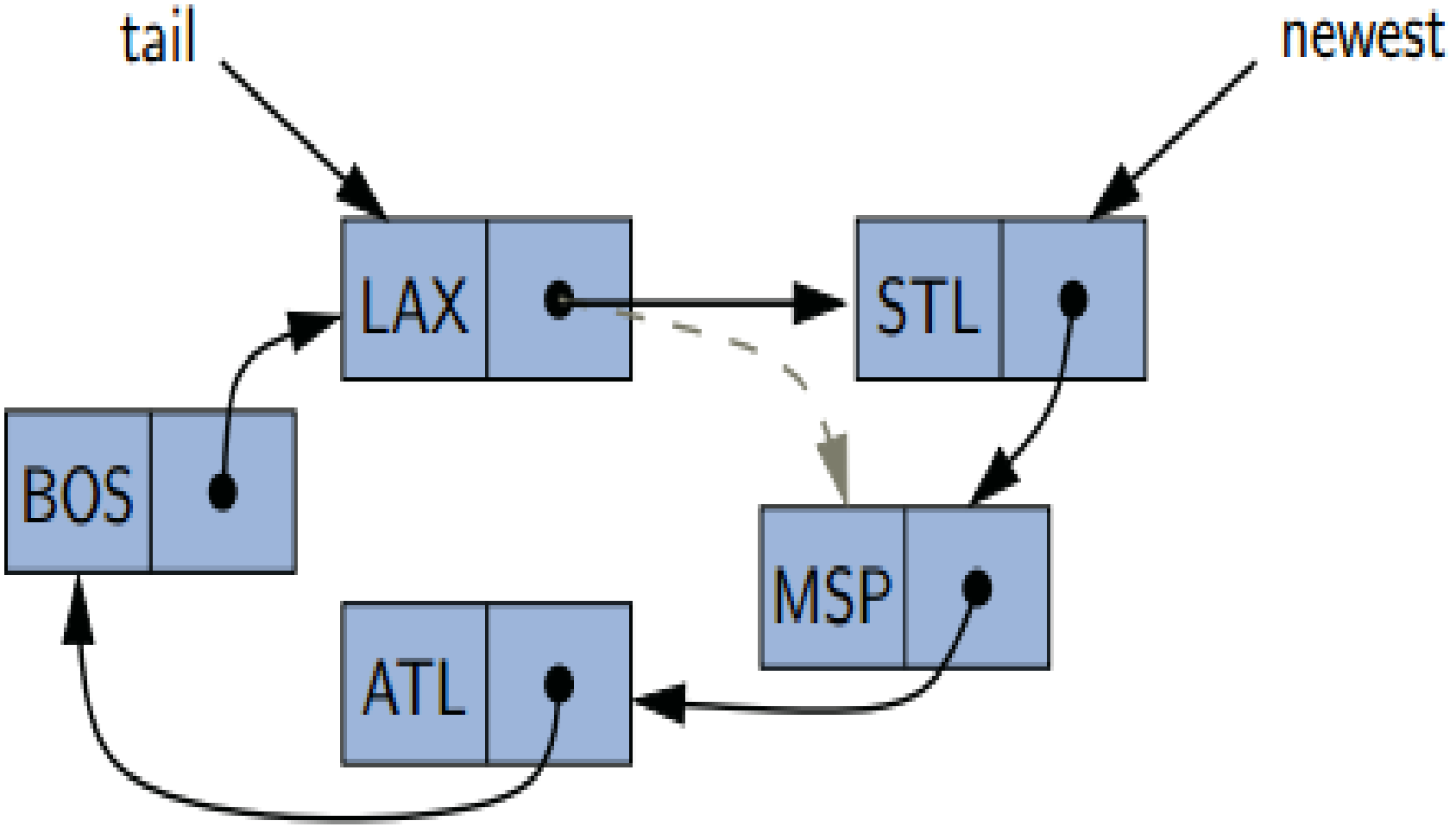


Figure 3.16: Example of a singly linked list with circular structure.

ROTATE



ADD FIRST

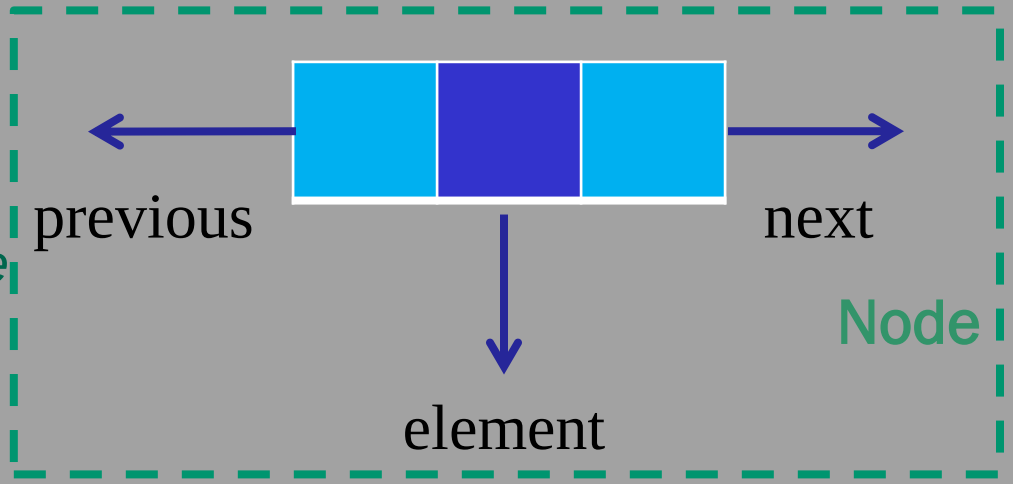


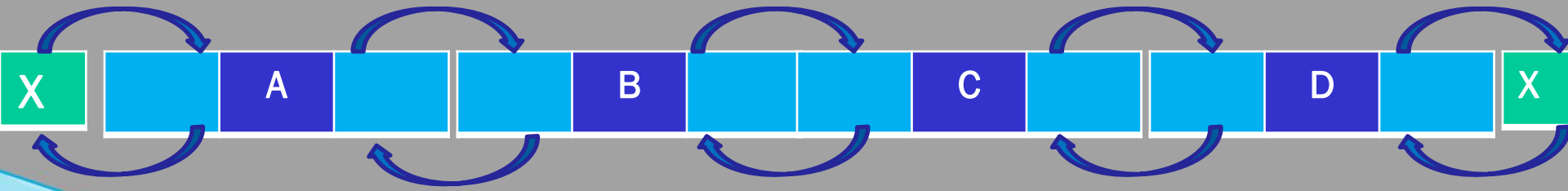
IMPLEMENTING A CIRCULARLY LINKED LIST CLASS

Read and do exercise in pg131

DOUBLY LINKED LISTS

- Each node stores a reference to an object that is an element of the sequence, as well as TWO references: the next node of the list, previous node of the list.
- Each node stores:
  - *element*
  - *link to the previous node*
  - *link to the next node*

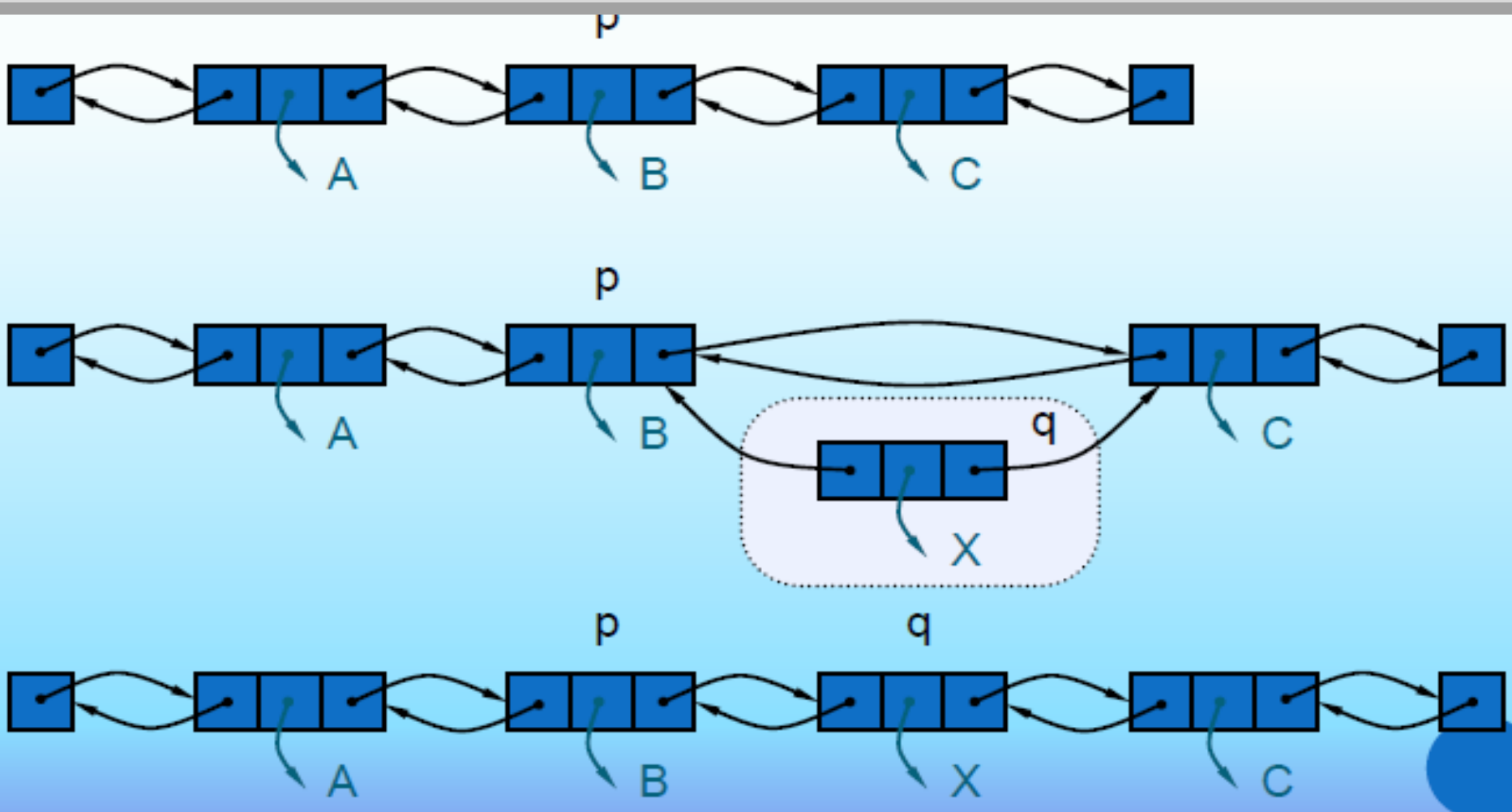




DOUBLY LINKED LIST

- *A doubly linked list is often more convenient!*
- *Nodes store:*
  - *element*
  - *link to the previous node*
  - *link to the next node*

INSERTION

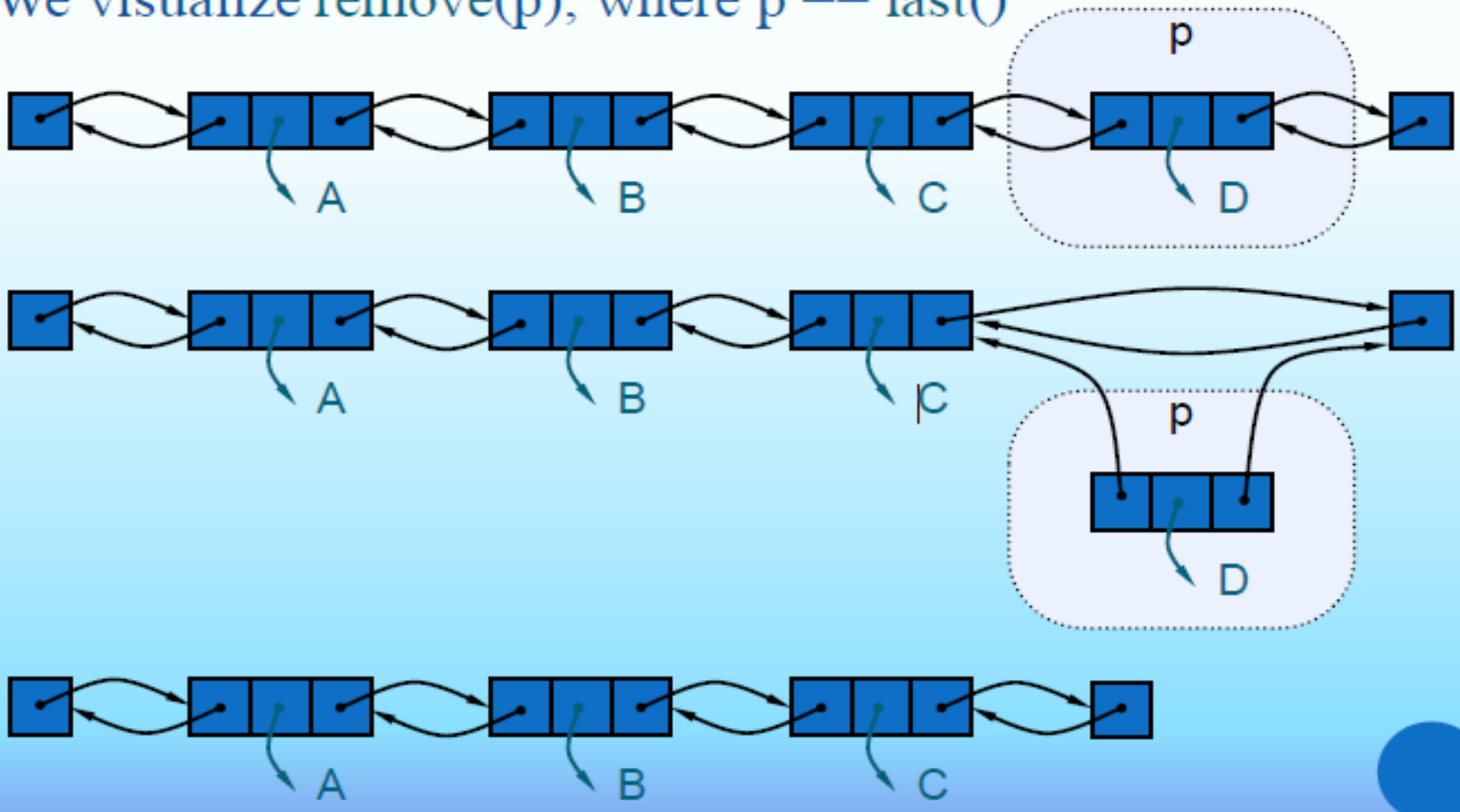


INSERTION ALGORITHM

Algorithm insertAfter(p,e):
Create a new node v
v.setElement(e)
v.setPrev(p) {link v to its predecessor}
v.setNext(p.getNext()) {link v to its successor}
(p.getNext()).setPrev(v) {link p's old successor to v}
p.setNext(v) {link p to its new successor, v}
return v {the position for the element e}

DELETE

We visualize remove(p), where p == last()



DELETION ALGORITHM

Algorithm remove(*p*):
t = *p.*element {a temporary variable to hold the return value}
(*p.*getPrev()).setNext(*p.*getNext()) {linking out *p*}
(*p.*getNext()).setPrev(*p.*getPrev())
*p.*setPrev(**null**) {invalidating the position *p*}
*p.*setNext(**null**)
return *t*

IMPLEMENTING A DOUBLY LINKED LIST

size( ):	Returns the number of elements in the list.
isEmpty( ):	Returns **true** if the list is empty, and **false** otherwise.
first( ):	Returns (but does not remove) the first element in the list.
last( ):	Returns (but does not remove) the last element in the list.
addFirst(*e*):	Adds a new element to the front of the list.
addLast(*e*):	Adds a new element to the end of the list.
removeFirst( ):	Removes and returns the first element of the list.
removeLast( ):	Removes and returns the last element of the list.

LINKEDLIST IN JAVA COLLECTION FRAMEWORK

CONSTRUCTORS

- *LinkedList() : constructs an empty linked list.*
- *LinkedList(Collection<? extends E> elements) : constructs a linked list and adds all elements from a collection.*

MAIN METHODS

- void addFirst(E element) : add an element to the beginning of the list.
- void addLast(E element) : add an element to the end of the list.
- E getFirst() : return the element at the beginning of the list
- E getLast() : return the element at the end of the list.

SMALL EXERCISE

1) *CHECK SOME METHODS OF LINKED LIST IN JAVA COLLECTION FRAME WORK*
2) *HOW TO COMBINE 2 LINKED LISTS TOGETHER ?*
3) *HOW TO REVERSE LINKED LIST?*

MANAGE SCORE OF CLASS

- *Pupil has: id, full name, average mark*
- *Class has: id, name, year and a list of sorted pupil by average mark.*
- *Requirements:*
- Sorting pupil by average mark(Hint: using addFirst(), addLast() in linked list to writing sort())
- Getting top pupils in class
- Getting bottom pupils in class
- Finding average of pupil if known name of pupil
- Getting average mark of class
- Remove all pupil has mark less than average mark of class

DIGITAL LOTTE

WINNING RESULTS MEGA 6/45

Draw No. #00045 | Draw Date 30/10/2016

Trực tiếp trên VTC 7 -Todaytv vào 18h00 thứ 4 - thứ 6 - CN hàng tuần

07 12 25 28 40 44

Jackpot amount

52.703.398.000 dong

Prize	Matching	Number of prize	Prize amount (dong)
Jackpot	○○○○○○	0	52.703.398.000
1st Prize	○○○○○	72	10.000.000
2nd Prize	○○○○	3160	300.000
3rd Prize	○○○	53369	30.000

See past draws ›

Vietlott

WARNING

FOR CUSTOMERS

DIGITAL LOTTE

- *Làm hệ thống quản lý các điểm bán vé, số vé phát hành tại điểm, quản lý vé trúng thưởng, tiền tích lũy qua các kỳ vé*

Mega 6/45

Prize level	Matching	Value (VNĐ)	Projected payout rate
Jackpot	●●●●●●	Min 12 billion (accumulated)	41.31%
1st	●●●●●	10.000.000	2.87%
2nd	●●●●	300.000	4.09%
3rd	●●●	30.000	6.73%
Total			**55.00%**

Note: ● is number matching with draw result