전산 SMP 10주차

2015. 12. 01

김범수

bskim45@gmail.com

Special thanks to 박기석 (kisuk0521@gmail.com)

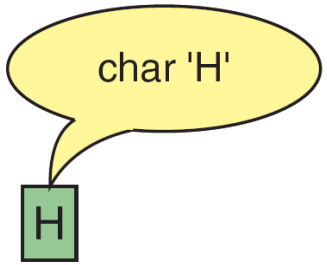
지난 내용 복습

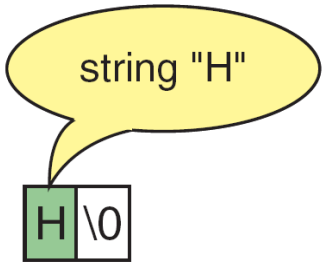
String Advanced

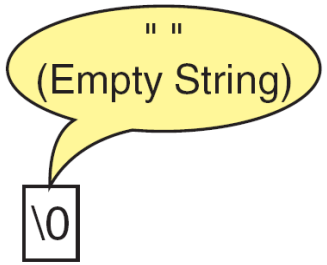
String

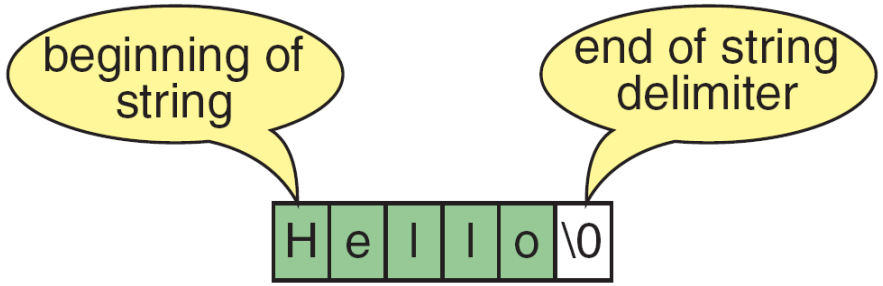
문자열(string)도 결국은 배열이다

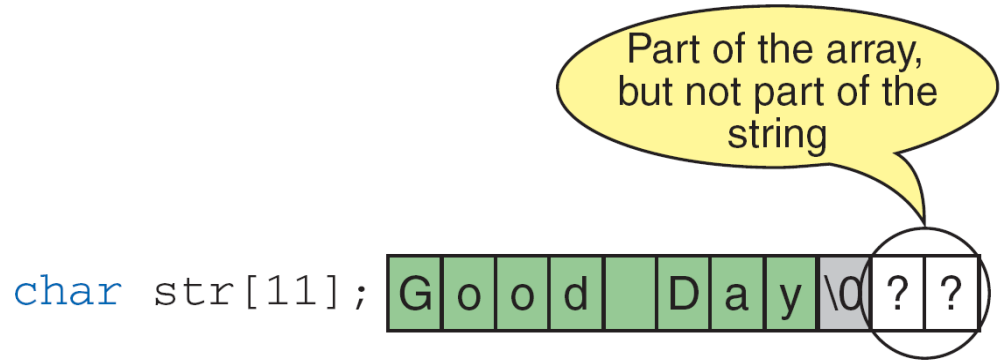
- char 형의 배열
- 끝에 널문자 '₩0'

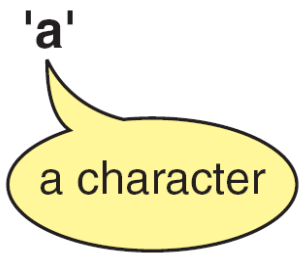


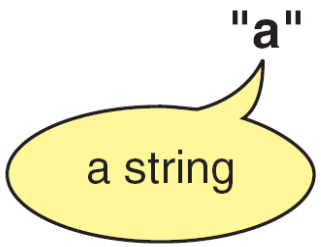


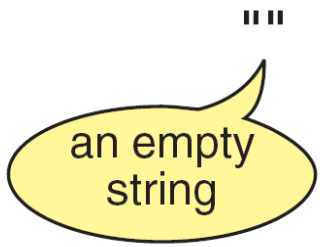






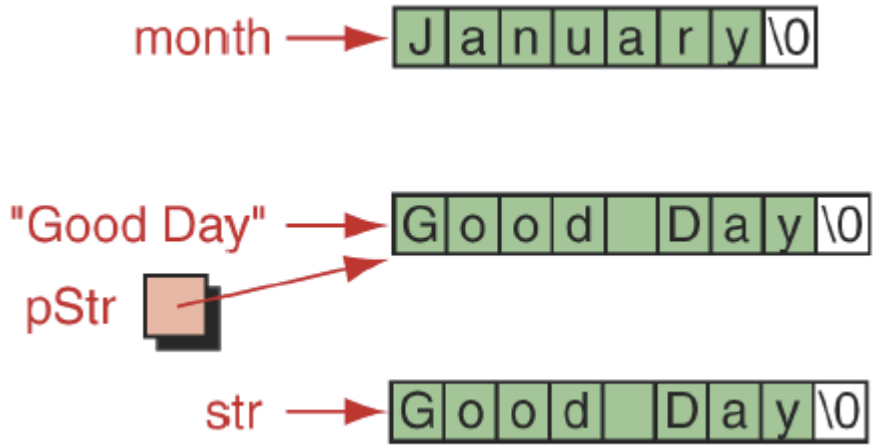






문자열의 선언

- char str[15] = “Good Day”;
  - 할당한 용량을 모두 사용할 필요는 없습니다.
- char month[] = “January”;
  - 배열크기가 문자열의 길이에 맞춰 자동으로 설정
- char *pStr = “Good Day”;
- char str[9] = {‘G’, ‘o’, ‘o’, ‘d’, ‘ ‘, ‘D’, ‘a’, ‘y’, ‘₩0’};

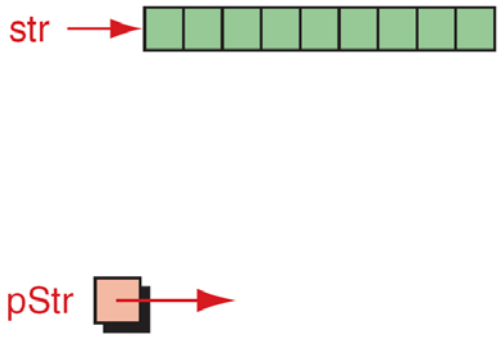



```
// Local Declarations
   char str[9];
```

(a) String Declaration

```
// Local Declarations
   char* pStr;
```

(b) String Pointer Declaration



문자열의 포인터

- 배열의 이름은 첫번째 element의 주소와 같다.
- 그래서 scanf로 %s 받을 때 & 안 붙인다!

문자열 포인터 사용 주의점

```
// Local Declarations
   char str[9];
```

(a) String Declaration


```
// Local Declarations
   char* pStr;
```

(b) String Pointer Declaration

- 반드시 동적 할당 해주거나 어떤 문자열의 주소를 넣어주어야 한다.

String Copy?

- char str1 [6] = “Hello”;
  char str2 [6];
  str2 = str1; // ?

String Input/Output Functions

formatted input/output functions

- scanf/fscanf
- printf/fprintf

special set of string-only functions

- get string (gets/fgets)
- put string (puts/fputs).

FLUSH

- 스트림 버퍼를 비우는 역할을 한다.
- Scanf 등 입력받는 함수 사용 시

→ The string conversion code(s) skips whitespace.

Test)
int a; char b;
scanf("%d", &a);
scanf("%c",&b);
printf("%d %c₩n", a, b);

fflush();
#define FLUSH while(getchar != '₩n')

```
1  {  // Read Month
2     #define FLUSH while (getchar() != '\n')
3     char month[10];
4
5     printf("Please enter a month. ");
6     scanf("%9s", month);
7     FLUSH;
8  }  // Read Month
```

Formatted String Input

- char str[10];
- scanf("%9s", str);
- str – 배열 포인터 → &가 붙지 않음

- 입력 문자 개수를 반드시 정의해 주자

String Manipulation Functions

- #include ⟨string.h⟩

- String Length and String Copy
- String Compare and String Concatenate
- Character in String
- Search for a Substring and Search for Character in Set
- String Span and String Token
- String to Number

More at

- http://www.cplusplus.com/reference/string/

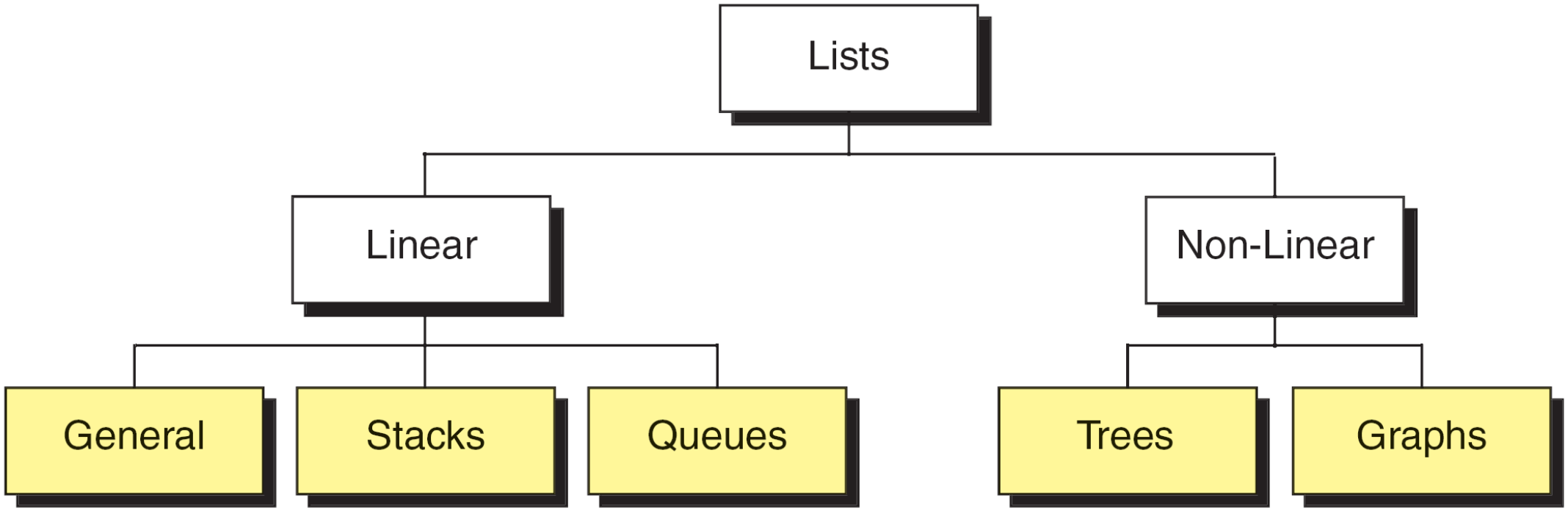
- 수업시간에 한 것들은 한 번씩 찾아 보고 사용법 익히기

오늘 할 것

- Lists and various Data Structures

List

What to learn…



Linked List

- 각각의 Element가 다음 Element의 위치를 저장하여 이어진 데이터 스트럭쳐
- 연속으로 쭉 이어졌다면 왜 배열(Array)를 안쓸까??
  - Array의 장점? 단점?
- Linked List의 장점? 단점?

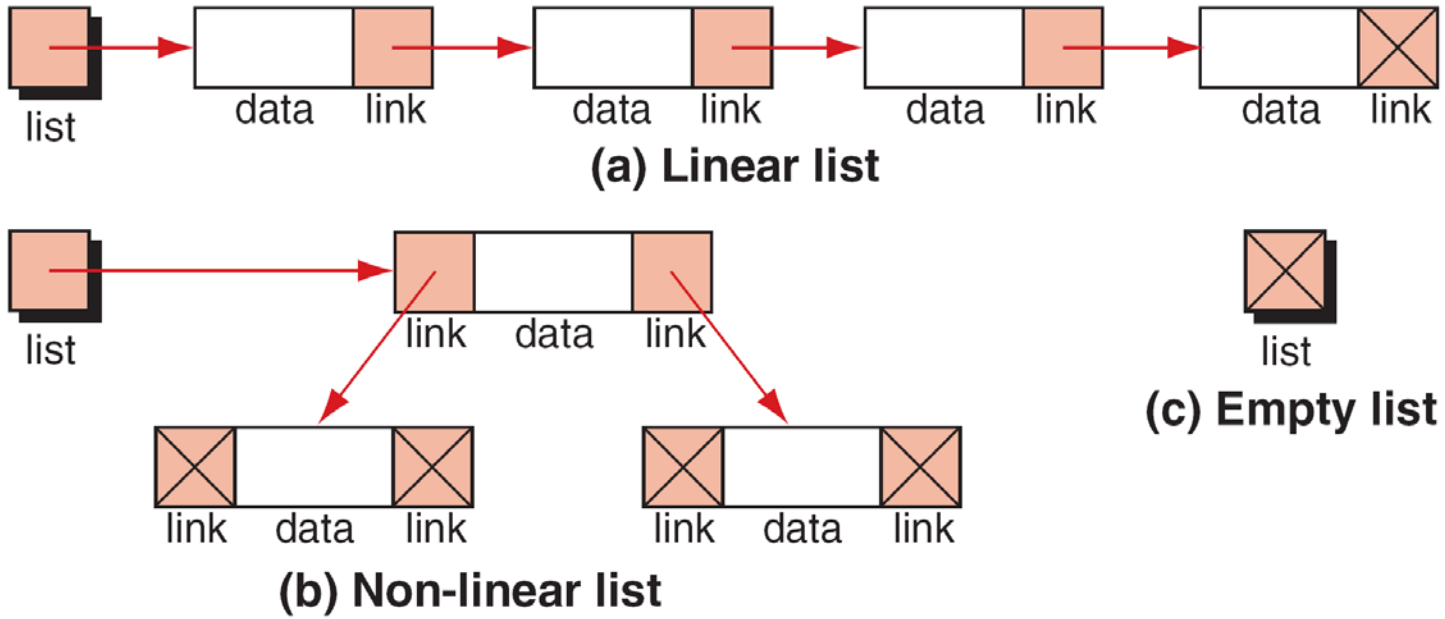
	List	Linked List
Space Complexity	O(n)	
At	O(1)	O(n)
Insert	O(n)	O(1)
Remove	O(n)	O(1)

Array – List Pros and Cons

항목	연결 리스트	배열
임의의 위치 접근	어려움	한번에 가능
임의의 위치 삽입/삭제	쉬움	어려움
가변 개수 데이터 지원	쉬움	최대 수용 가능 개수 이하로만 쉬움
데이터 정렬	어려움	쉬움
기억 공간 차지	(데이터의 크기 + 포인터의 크기 + α) * 연결 개수	최대 수용 가능 개수 * (데이터 당 크기 + β)
사용하지 않는 기억 공간으로 인한 낭비	없음	최대 수용 가능 개수 – 실제로 사용하는 데이터 수
초기화 후 유지/관리	포인터 사용으로 인해 까다로움	배열의 인덱스 값만 조절하면 되므로 쉬움
특정 값을 가지는 데이터 찾기	정렬 여부에 관계없이 어려움	정렬된 배열에서는 쉬움

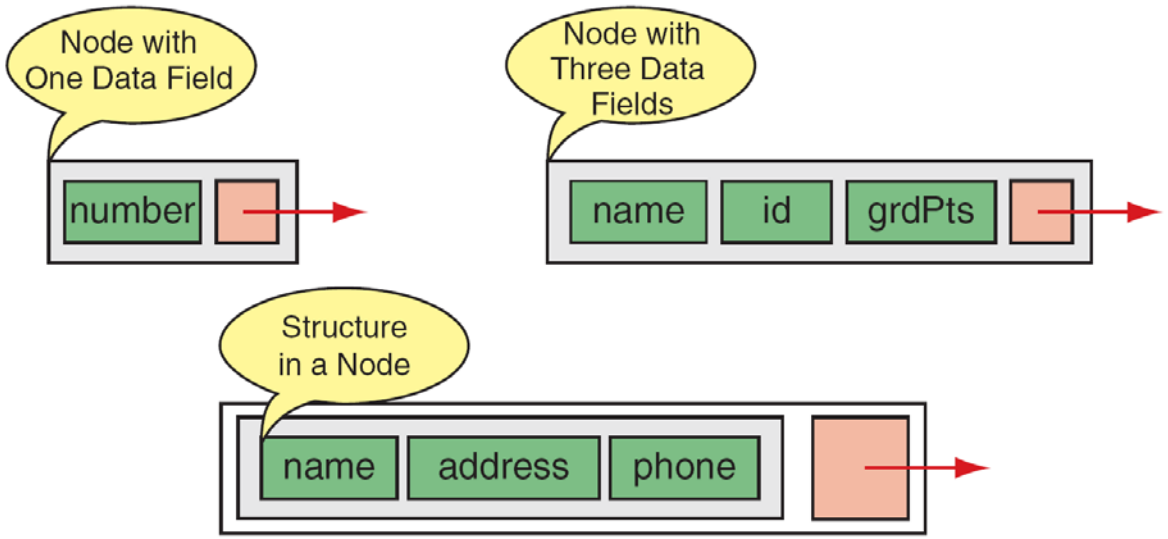
Linked List

- 한개만 가리킬 수도 있고, 여러개를 가리킬 수도 있고…



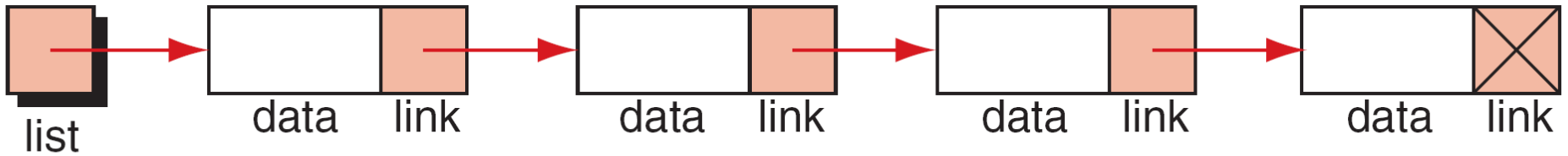
Linked List Node Structures

- 데이터 부분 + 포인터 부분(다른 Element를 가리킴)



General Linear Lists

- 가장 일반적인 직렬 리스트
  - Retrieve
  - Insert
  - Change
  - Delete
  - Traversing
  - Building



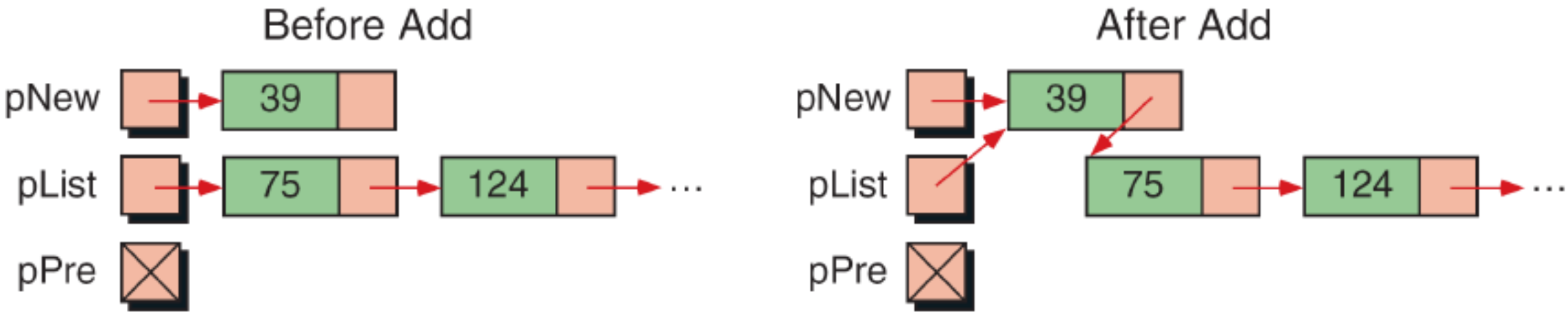
(a) Linear list

Insert a Node to Empty List

```
pNew->link  =  pList ;
pList       =  pNew ;
```

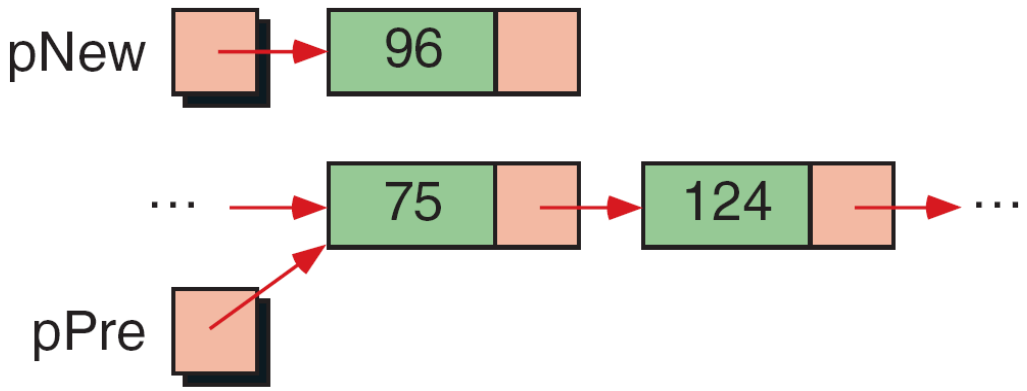
Insert a Node at Beginning

```
pNew->link  =  pList ;
pList       =  pNew;
```

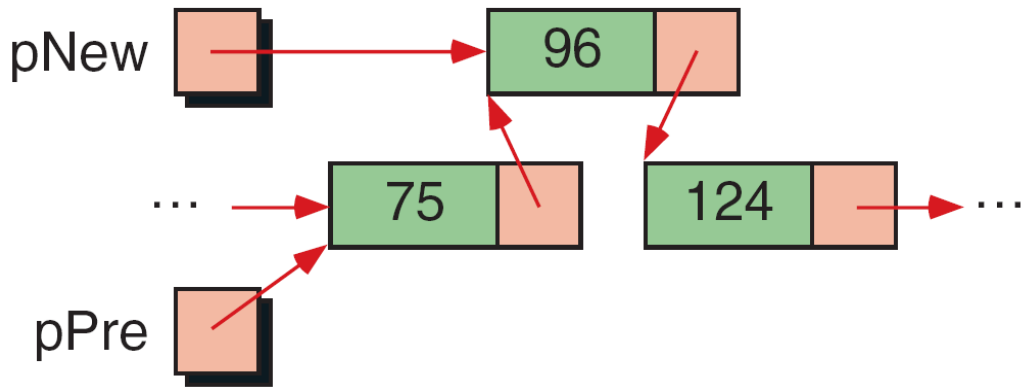


Insert a Node in Middle

```
pNew->link = pPre–>link;
pPre->link = pNew;
```



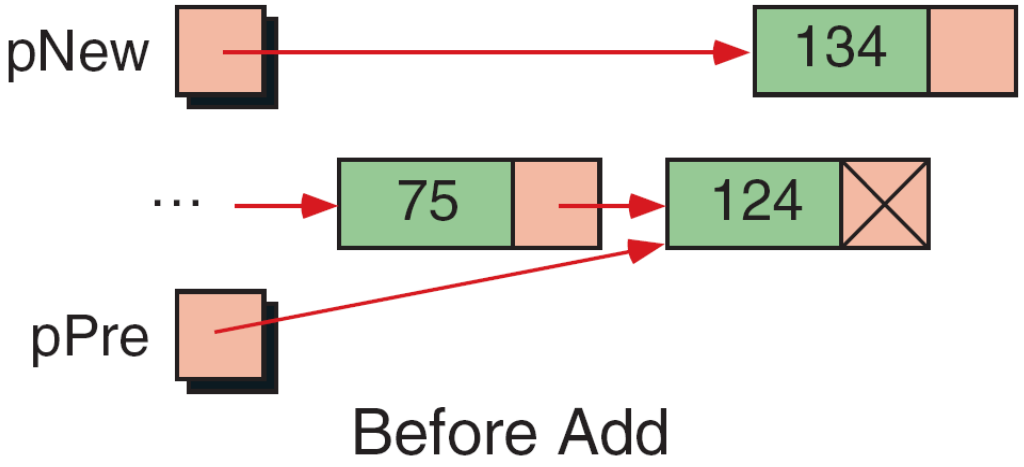
Before Add



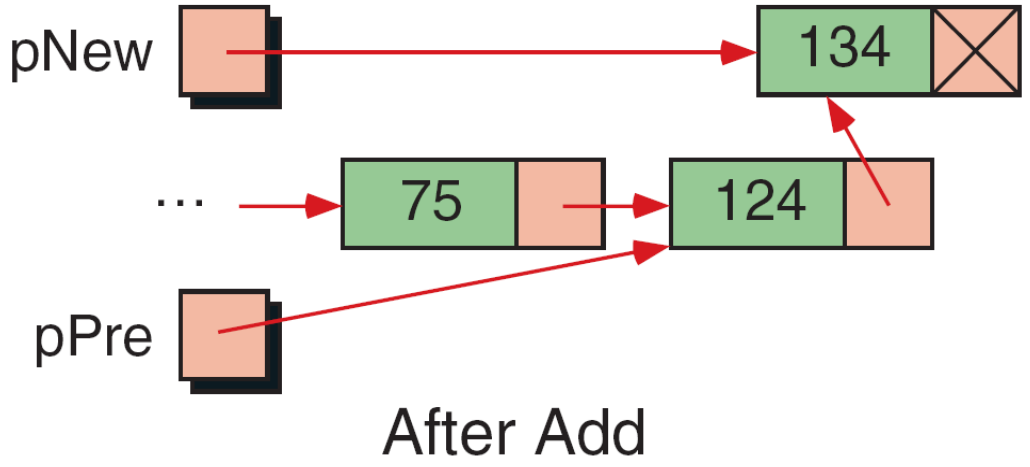
After Add

Insert a Node at End

```
pNew->link = pPre->link;
pPre->link = pNew;
```



Before Add

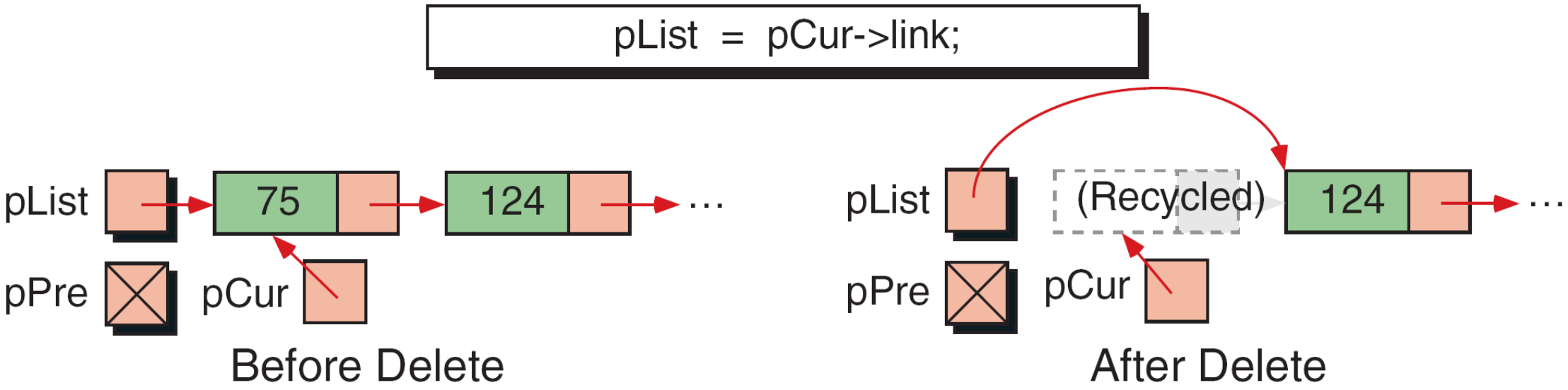


After Add

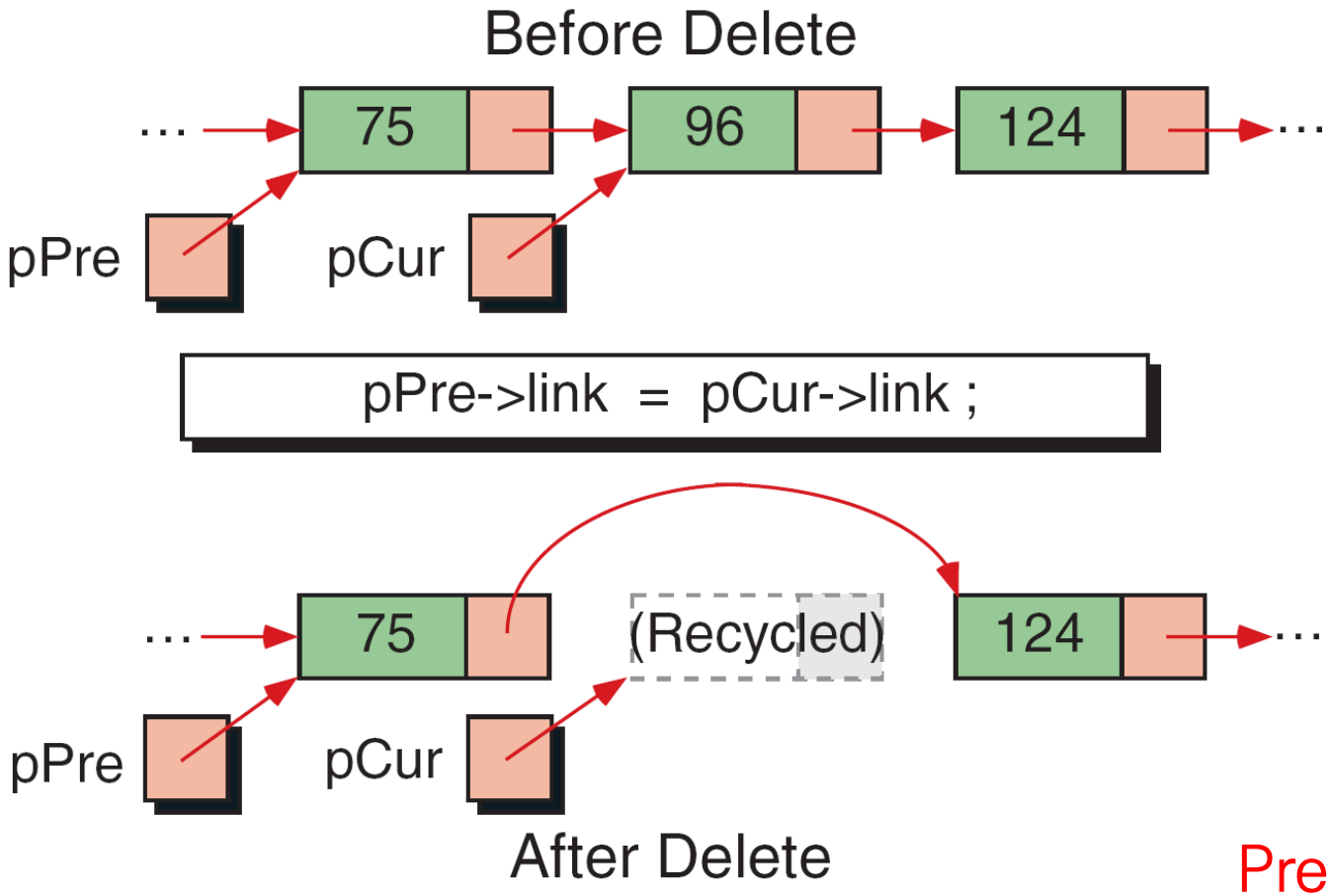
Insert a Node – Code

```
 8  NODE* insertNode (NODE* pList, NODE* pPre, DATA item)
 9  {
10  // Local Declarations
11     NODE* pNew;
12
13  // Statements
14     if (!(pNew  = (NODE*)malloc(sizeof(NODE))))
15         printf("\aMemory overflow in insert\n"),
16                exit (100);
17
18     pNew->data = item;
19     if (pPre == NULL)
20        {
21         // Inserting before first node or to empty list
22         pNew->link  = pList;
23         pList       = pNew;
24        } // if pPre
25     else
26        {
27         // Inserting in middle or at end
28         pNew->link = pPre->link;
29         pPre->link = pNew;
30        } // else
31     return pList;
32  }  // insertNode
```

Delete First Node



Delete – General Case



Pre, Cur 두 개가
같이 움직이는 거 주의!!

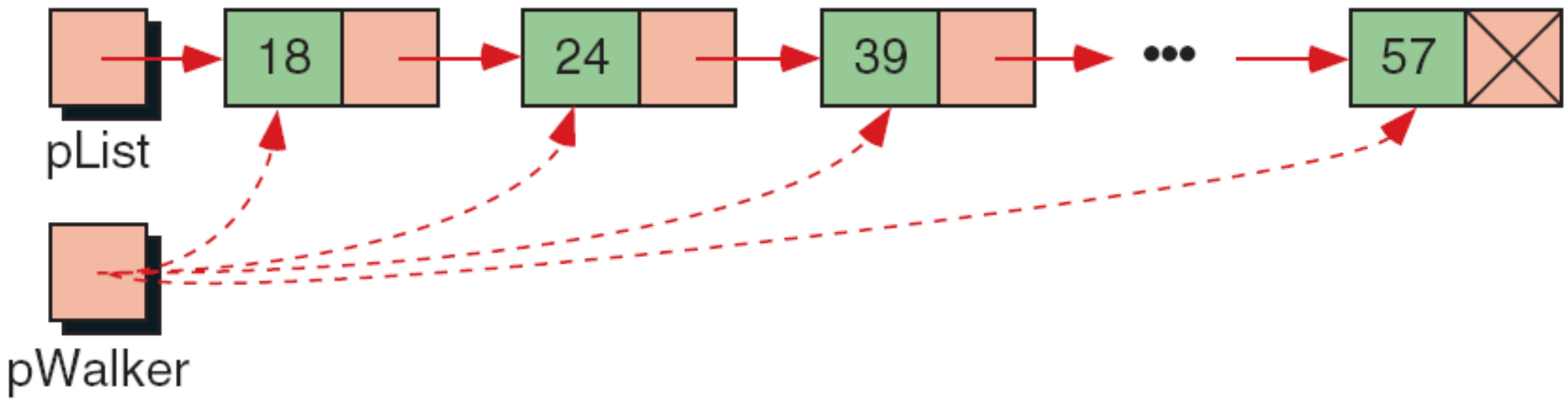
Delete a Node – Code

```
1  /* ==================== deleteNode ====================
2     This function deletes a single node from the link list.
3        Pre   pList is a pointer to the head of the list
4              pPre points to node before the delete node
5              pCur points to the node to be deleted
6        Post  deletes and recycles pCur
7              returns the head pointer
8  */
9  NODE* deleteNode (NODE* pList, NODE* pPre, NODE* pCur)
10 {
11 // Statements
12    if (pPre == NULL)
13       // Deleting first node
14       pList = pCur->link;
15    else
16       // Deleting other nodes
17       pPre->link = pCur->link;
18    free  (pCur);
19    return pList;
20 }  // deleteNode
```

Search Linear List

```
//리스트 pList가 있다.
struct Node *pWalker = pList;
while(pWalker)
{
        If(pWalker->data == 찾는 데이터)
                return 1;
        pWalker = pWalker->next;
}
return 0;
```

Linear List Traversal



Print Linear List

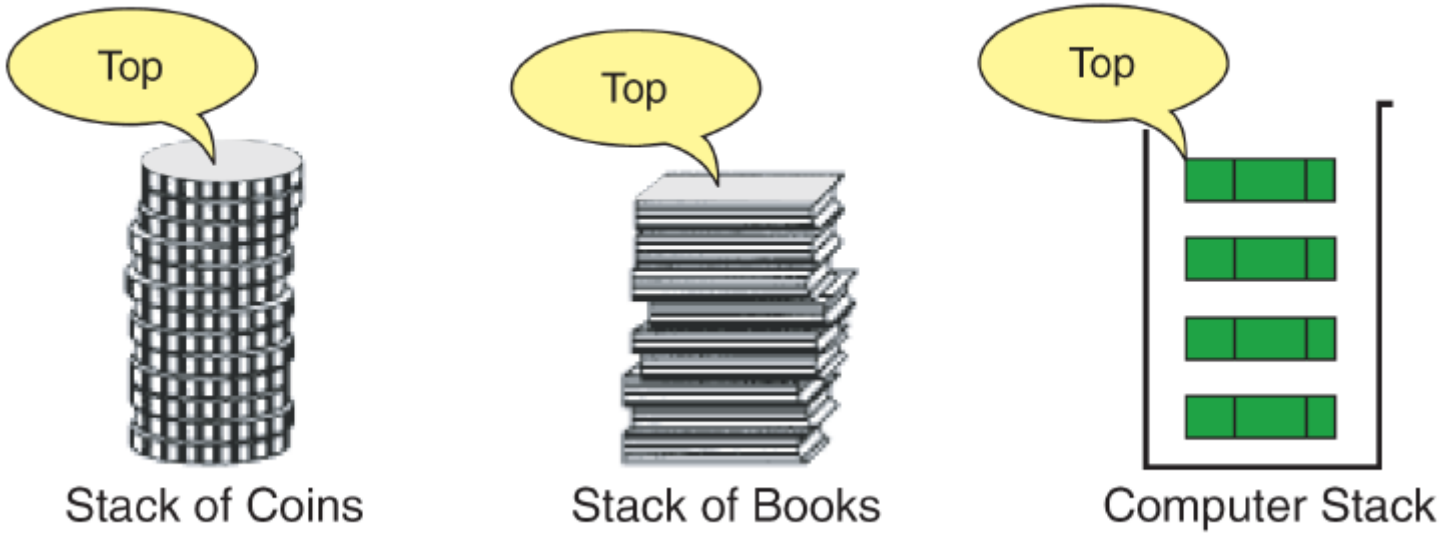
```
5  void printList (NODE* pList)
6  {
7  // Local Declarations
8     NODE* pWalker;
9
10 // Statements
11    pWalker = pList;
12    printf("List contains:\n");
13
14    while (pWalker)
15       {
16        printf("%3d ", pWalker->data.key);
17        pWalker = pWalker->link;
18       } // while
19    printf("\n");
20    return;
```

Average Linear List

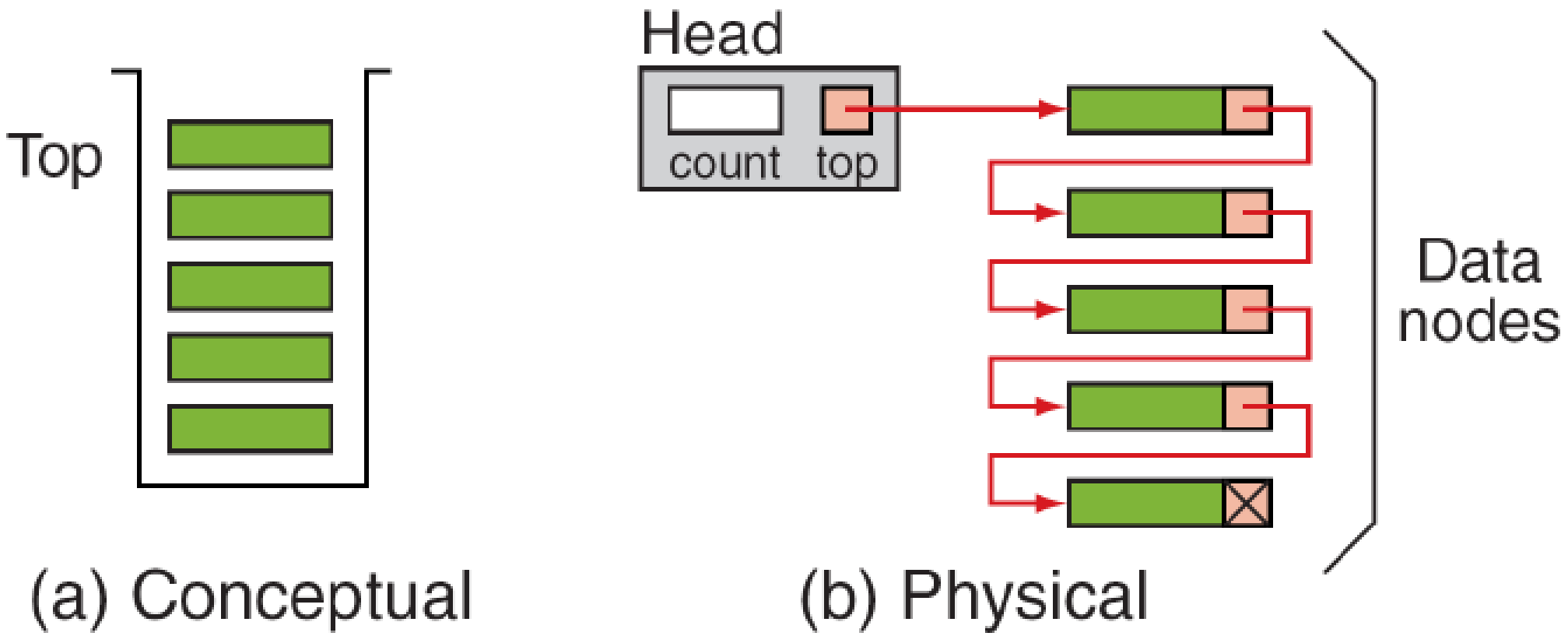
```
 5  double averageList (NODE* pList)
 6  {
 7  // Local Declarations
 8     NODE* pWalker;
 9     int   total;
10     int   count;
11
12  // Statements
13     total   = count = 0;
14     pWalker = pList;
15     while (pWalker)
16        {
17         total += pWalker->data.key;
18         count++;
19         pWalker = pWalker->link;
20        } // while
21     return (double)total / count;
22  } // averageList
```

Stack

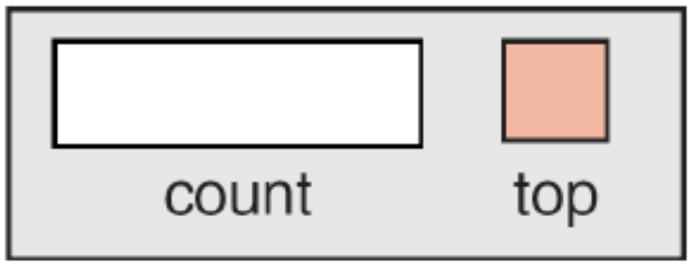
- Last in First out (LIFO)의 데이터 스트럭쳐
- Insertion과 deletion이 항상 한쪽 끝(Top)에서만 일어난다.
- Push : 새로운 것을 넣는 작업
- Pop : 젤 위에서 하나 빼는 작업



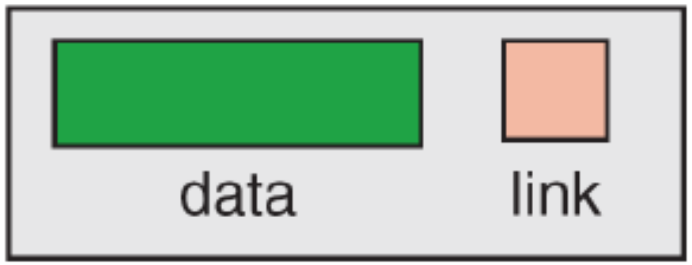
Stack Implementations



Stack Data Structure



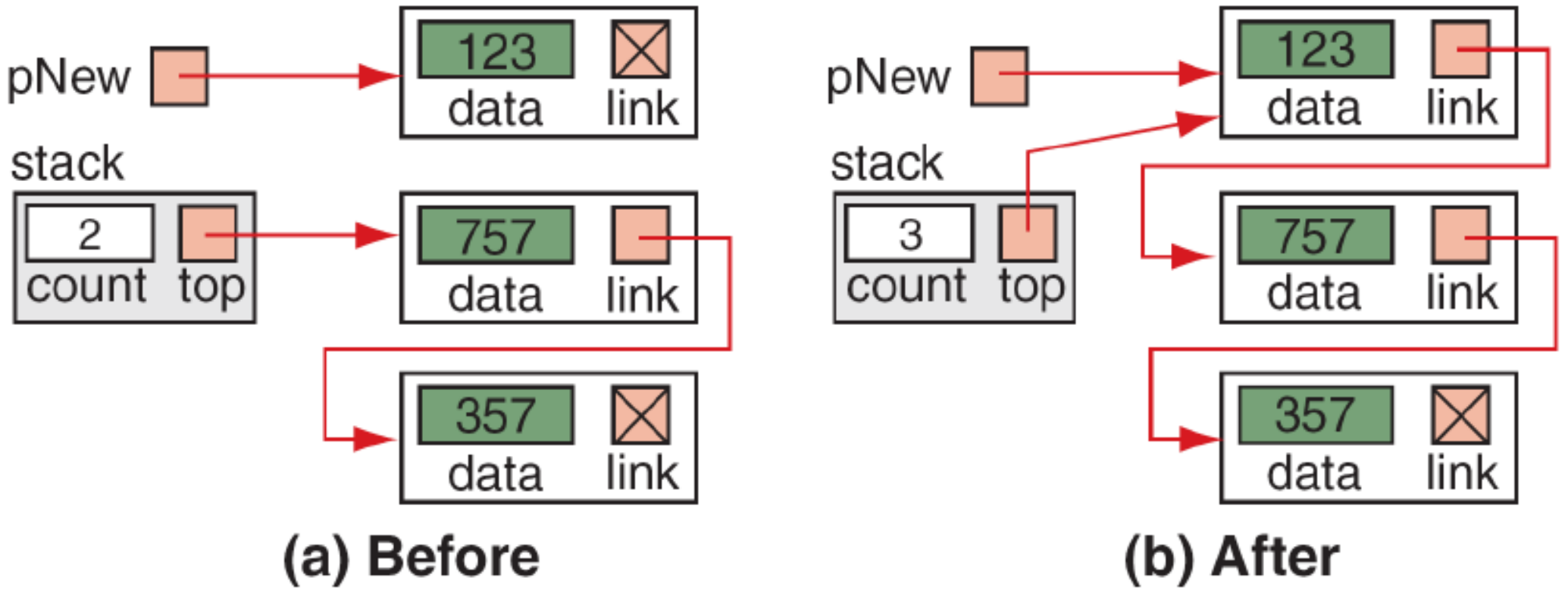
Stack Head Structure



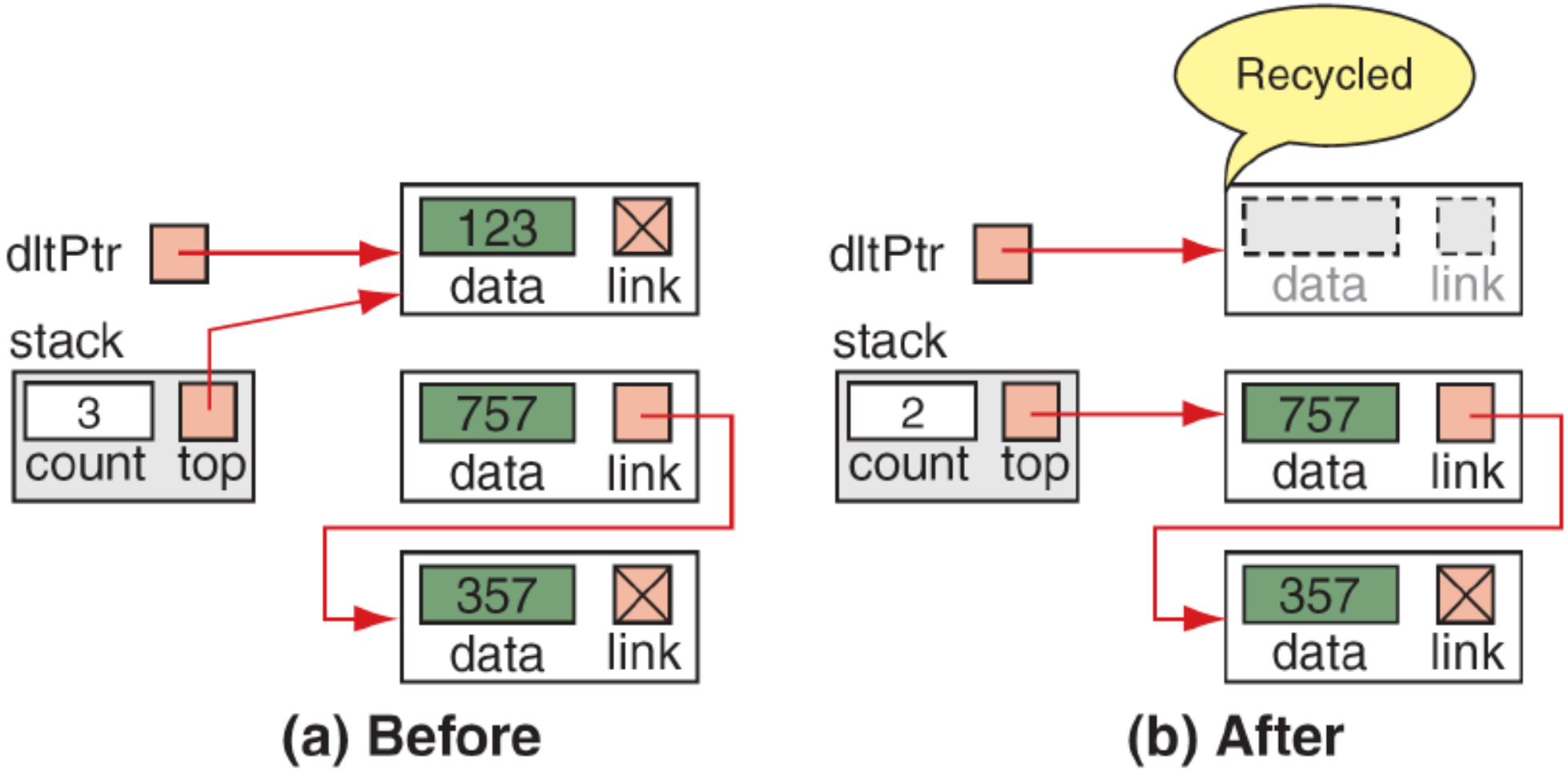
Stack Node Structure

```
typedef struct
    {
     int            count;
     struct node*   top;
    } STACK;
typedef struct node
    {
     int            data;
     struct node*   link;
    } STACK_NODE;
```

Stack _ Push

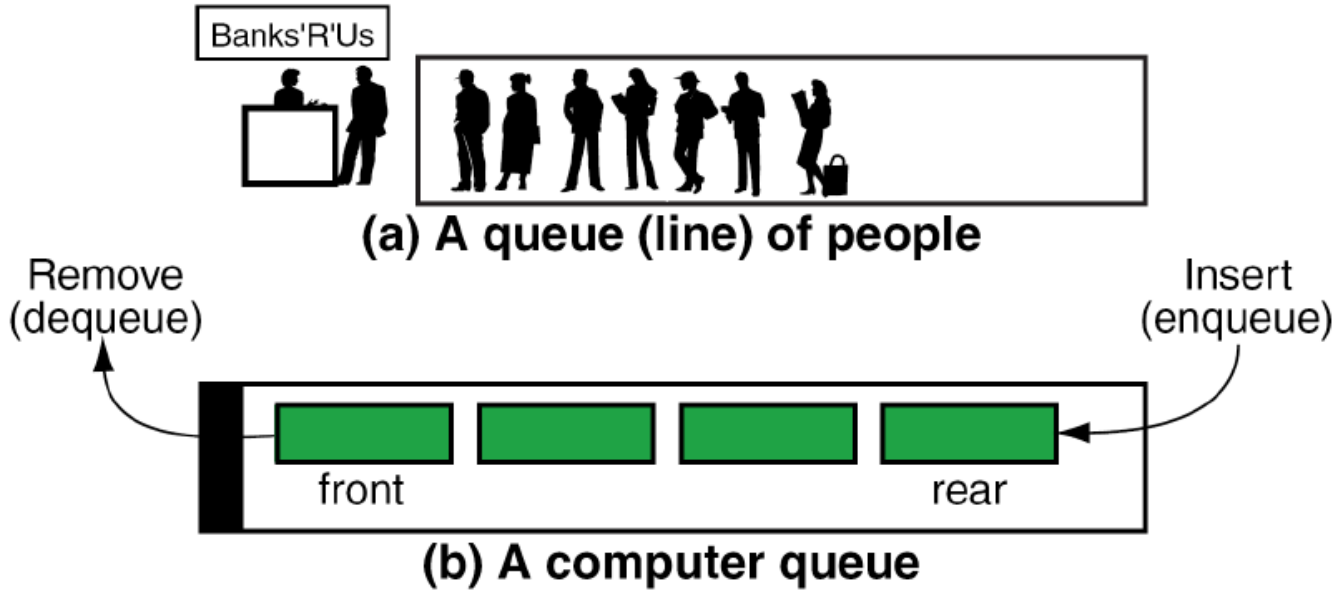

pNew
123
data
link
stack
2
count
top
757
data
link
357
data
link
(a) Before
pNew
123
data
link
stack
3
count
top
757
data
link
357
data
link
(b) After

Stack _ Pop

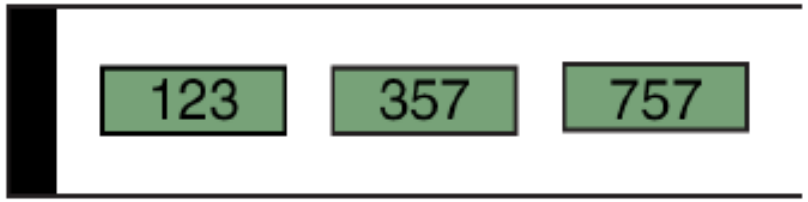

dltPtr
stack
3
count
top
123
data
link
757
data
link
357
data
link
(a) Before
Recycled
dltPtr
stack
2
count
top
data
link
757
data
link
357
data
link
(b) After

Queue

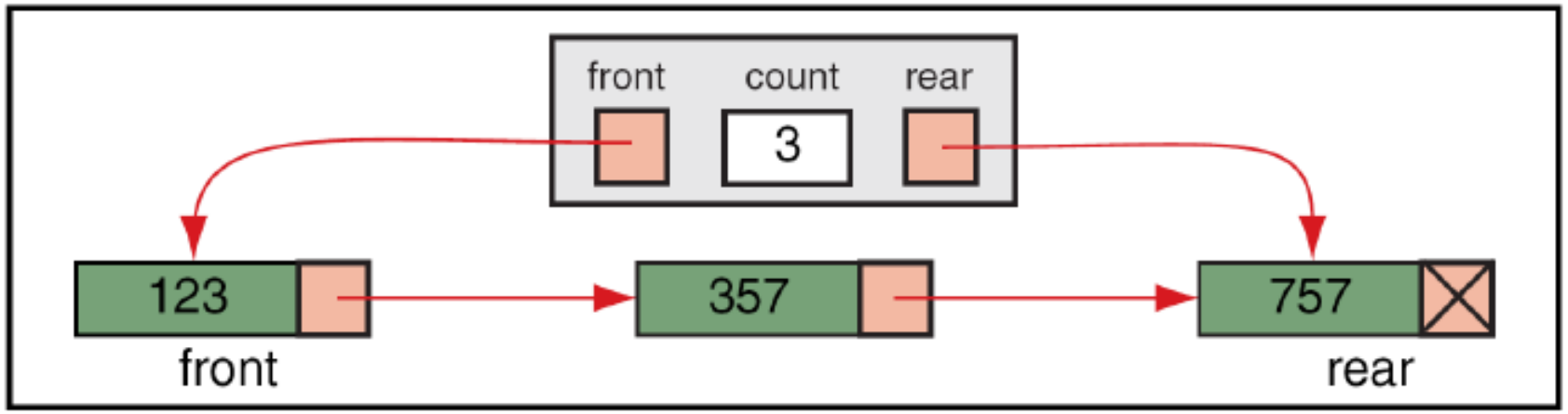
- First in First out(FIFO)의 데이터 스트럭쳐
- Insertion은 한쪽 끝, Deletion은 다른 한쪽 끝에서만 일어난다. :
- Enqueue : 큐에 새로운 걸 넣는 작업 (rear)
- Dequeue : 큐에서 하나를 제거하는 작업 (front)



Queue Implementations



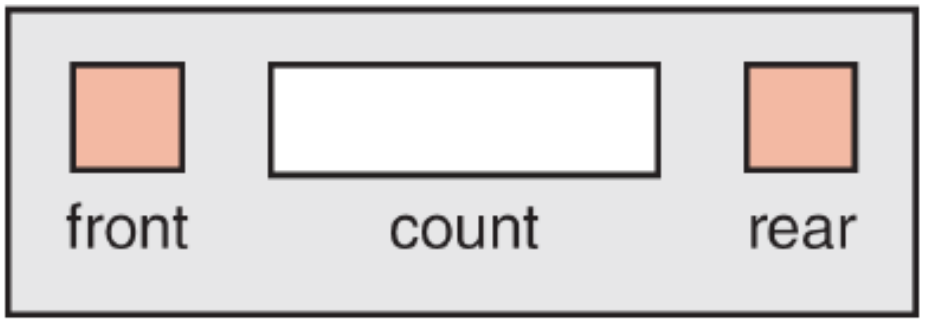
(a) Conceptual queue



(b) Physical queue

Queue Data Structure

Node Structure



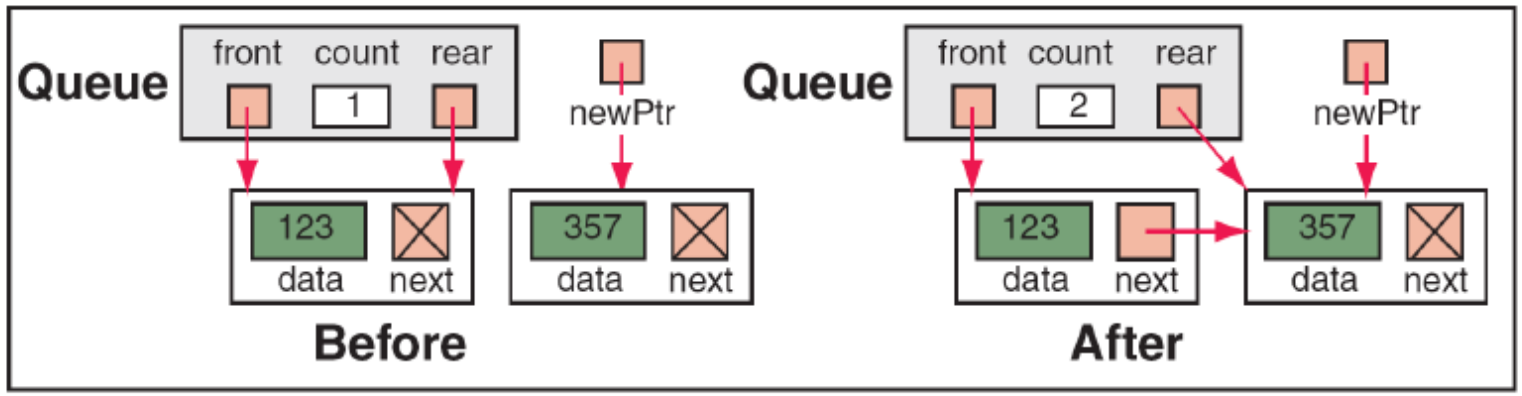
Head Structure

```
typedef struct node
    {
     int            data;
     struct node*   next;
    } QUEUE_NODE;

typedef struct
    {
     QUEUE_NODE*  front;
     int          count;
     QUEUE_NODE*  rear;
    } QUEUE;
```

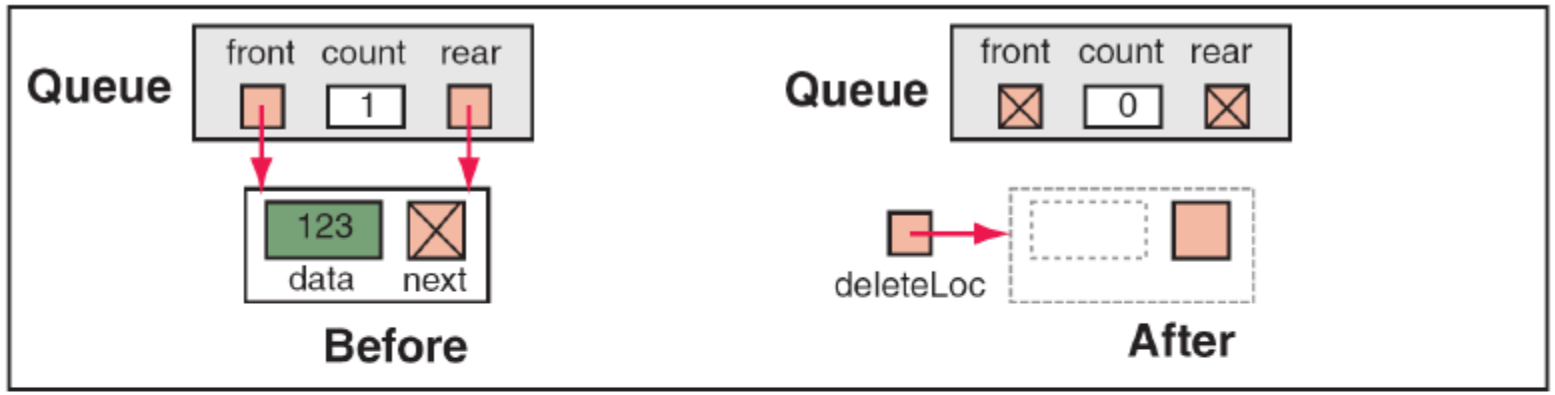
Enqueue

(a) Case 1: Insert into Null Queue

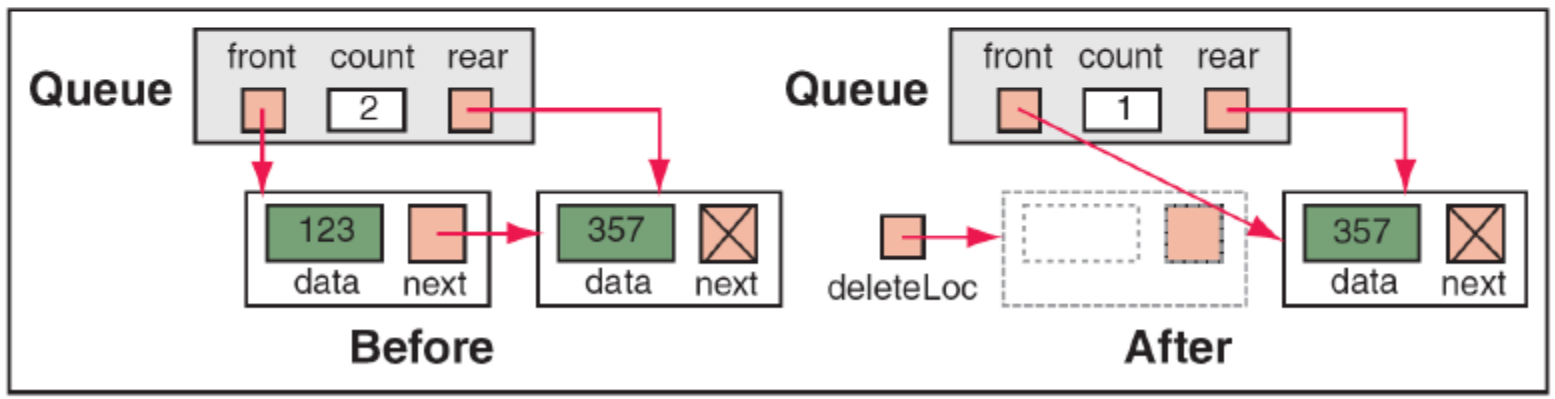


(b) Case 2: Insert into Queue with Data

Dequeue



(a) Case 1: Delete only item in queue



(b) Case 2: Delete item at front of queue

오늘 배운 것 정리

- 책에 사이사이 박스에 있는 예제 코드들 전부 다 한번씩 쭉 보고 이해하기. 코드가 있는 거는 충분히 시험에 코드 짜는 문제로 나올 수 있다!
- Data Structure에서는 다양한 Implementation이 있기 때문에 무작정 외우기 보다는 어떻게 구현하는지 Concept들을 꼭 기억
- DS부분은 코드 반드시 봐야 합니다.
- 빨간색 글씨로 된 거 기억하기

다음시간

- 기말고사 대비 총정리
- Assn #5 질문받기