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에디로봇아카데미
임베디드 마스터 Lv2 과정

제 1기

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김태훈

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Double Pointer란?
- 포인터의 포인터. 포인터가 변수의 주소값을 저장하는 변수이므로,
Double Pointer는 포인터의 주소값을 저장함

Double Pointer는 왜 쓸까?
- 현재 call 한 function의 stack frame이 아니라 다른 stack frame에 있는 'pointer'를 제어하고 싶을 때 사용. Parameter로 제어하고 싶은 pointer의 주소값을 받으면 현재 함수의 stack frame에서 다른 stack frame으로 접근이 가능하다.

Single Pointer를 쓰면 안 되나?
- C는 parameter 전달 방식이 Call by value이기 때문에 single pointer를 전달한 다음에 수정을 해도 main의 stack frame의 변수는 변경되지 않는다. 따라서 return 과정을 통해서 main함수에서 변수를 변경해야 하는 과정이 추가로 필요하다.

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Double Pointer를 이용하면 return을 이용하지 않아도 다른 stack frame에 있는 값을 변경할 수 있다.
물론 pointer만 받아도 다른 stack frame에 있는 variable의 값을 변경할 수 있지만 Pointer의 값(주소값)을 바꾸려면 double pointer를 써야 한다.

이번 수업 시간에 double pointer을 쓴 이유는 정리하면
1) Function의 stack frame에서
2) Main stack frame에 있는 pointer에 있는 값을
3) Heap에 할당되어있는 struct의 주소로 수정하기 위해서이다.

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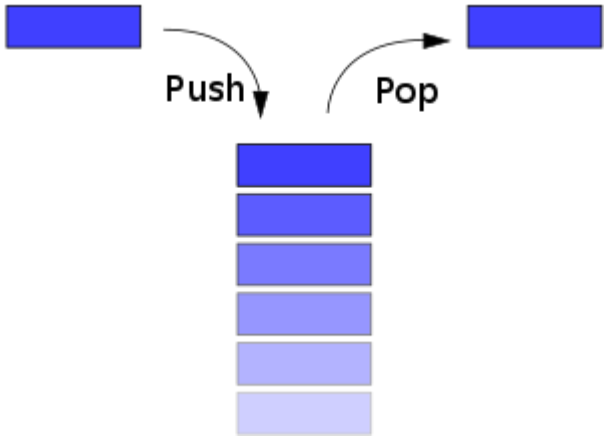
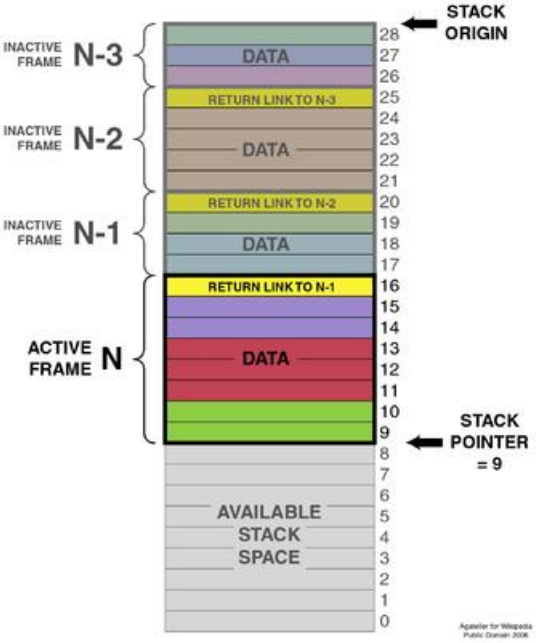
Stack이란?

LIFO : 후입선출 구조를 가지는 자료구조.



Abstract stack



Memory using stack

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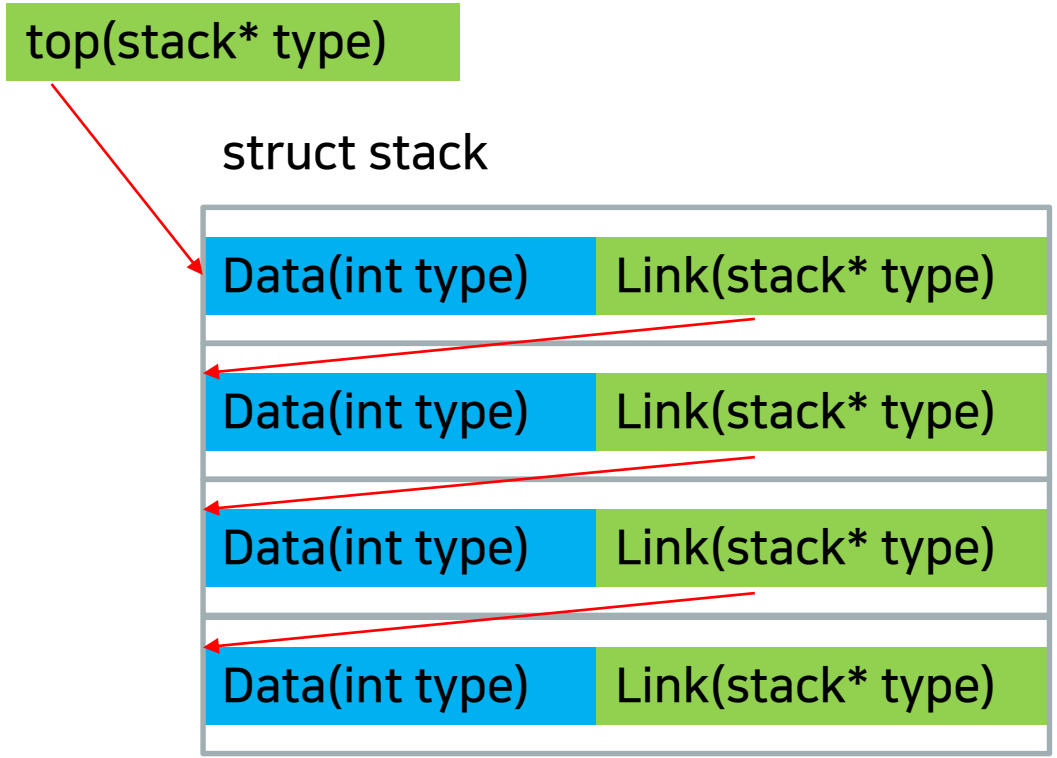
Stack 구조체

```
typedef struct _stack stack;
struct _stack
{
    int data;
    struct _stack *link;
};
```



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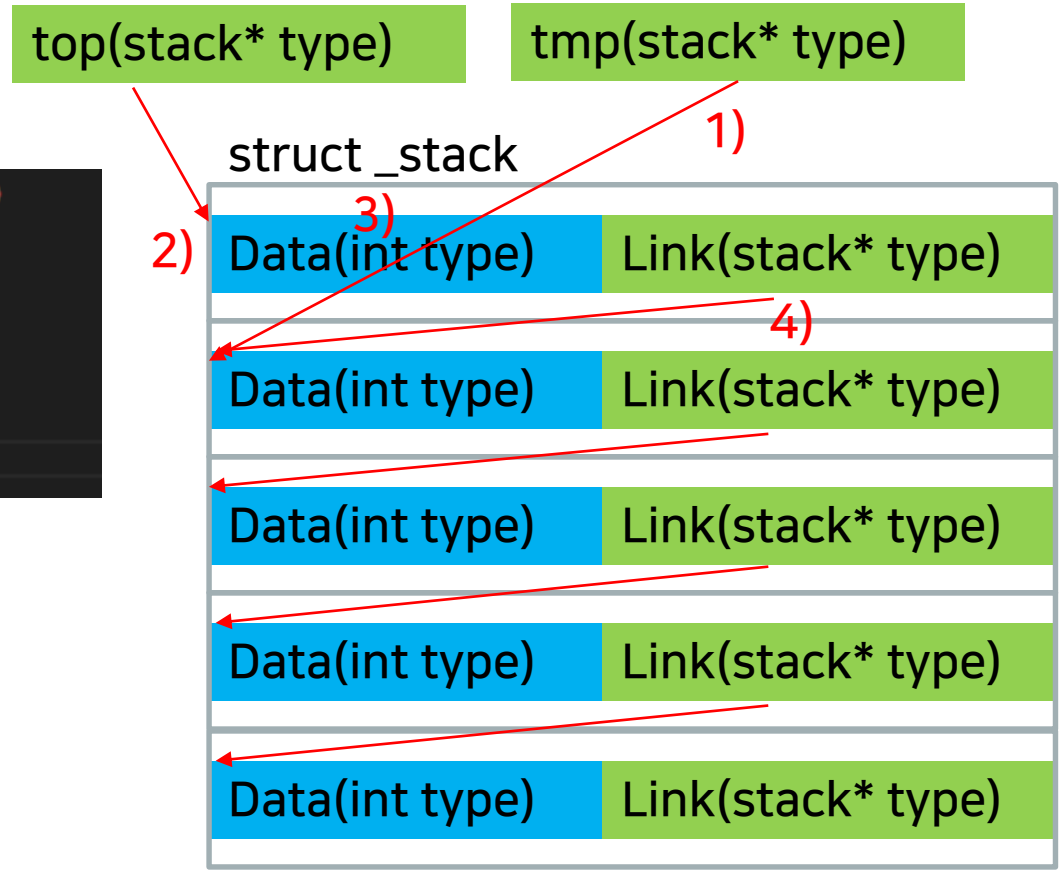
Push

```
void push_data(stack **top, int data)
{
1) stack *tmp = *top;

2) *top = create_stack_node();
3) (*top)->data = data;
4) (*top)->link = tmp;
}
```



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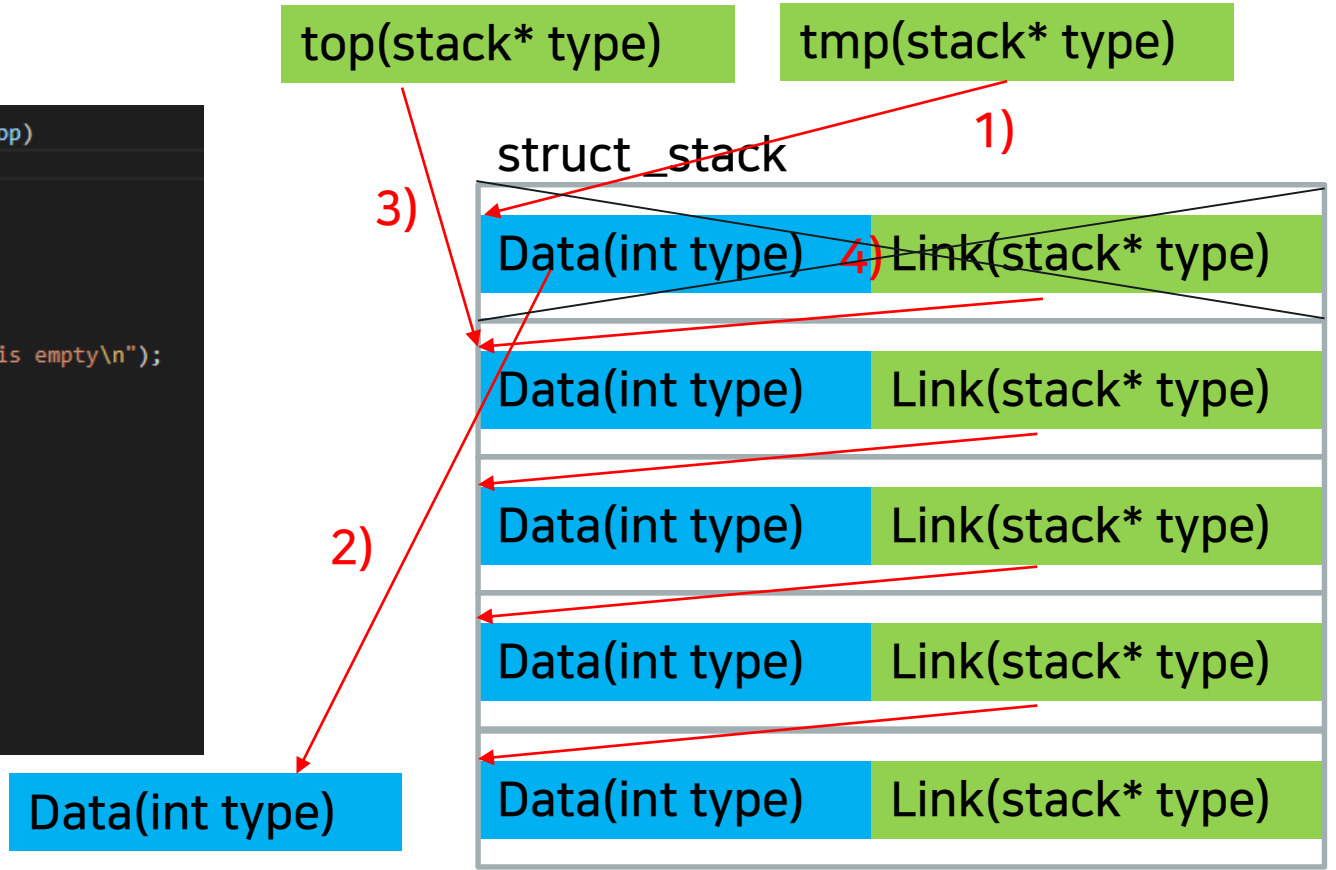
Pop

```
int pop_data(stack **top)
{
    int data;
    stack *tmp;

    if (!(*top))
    {
        printf("Stack is empty\n");
        return -1;
    }

1)  tmp = *top;
2)  data = tmp->data;
3)  *top = tmp->link;
4)  free(tmp);

    return data;
}
```



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main

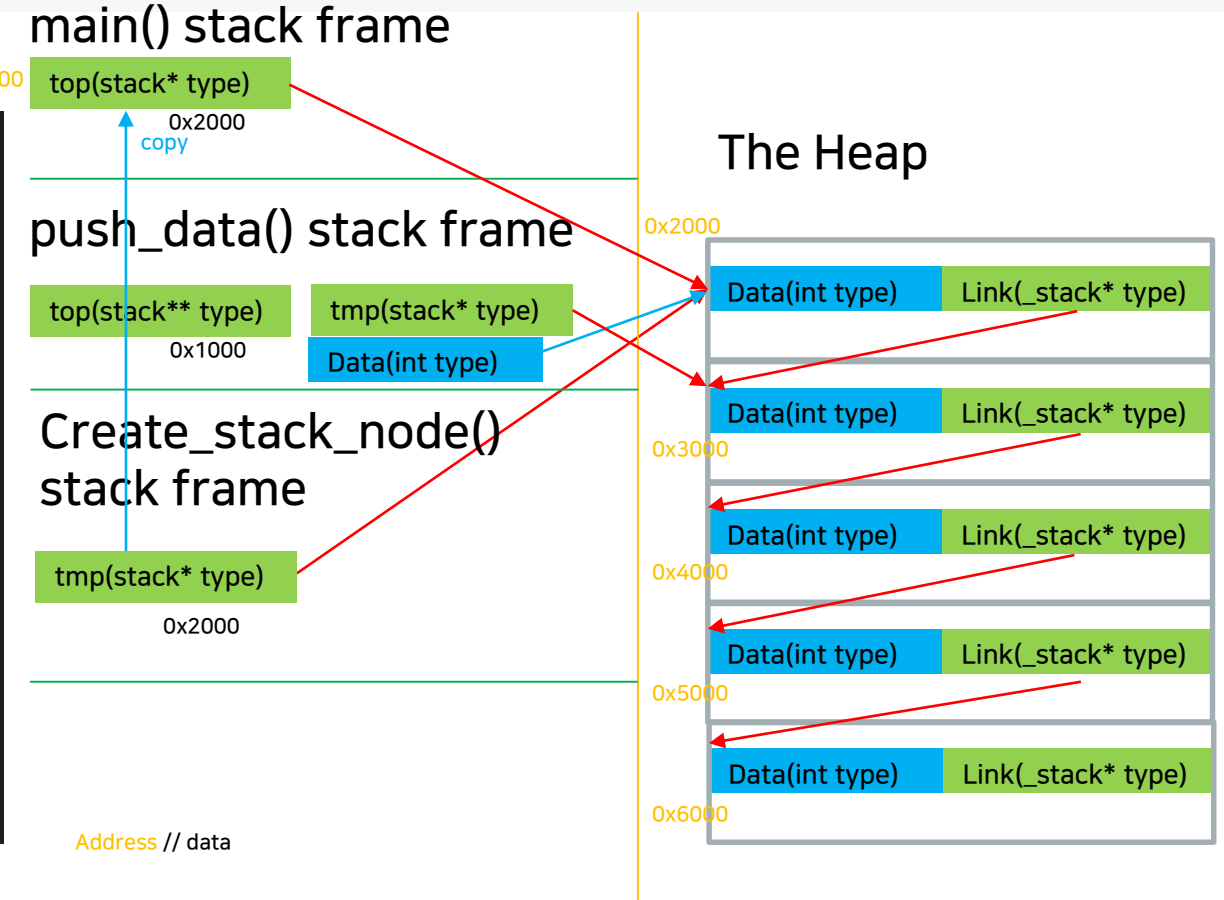
```
int main(void)
{
    stack *top = NULL;
    int data[] = { 10, 20, 30, 40, 50, 60, 70 };
    int i;

    for (i = 0; i < 7; i++)
    {
        push_data(&top, data[i]);
    }

    print_stack_data(top);

    for (i = 0; i < 8; i++)
    {
        printf("pop = %d\n", pop_data(&top));
        print_stack_data(top);
    }

    return 0;
}
```



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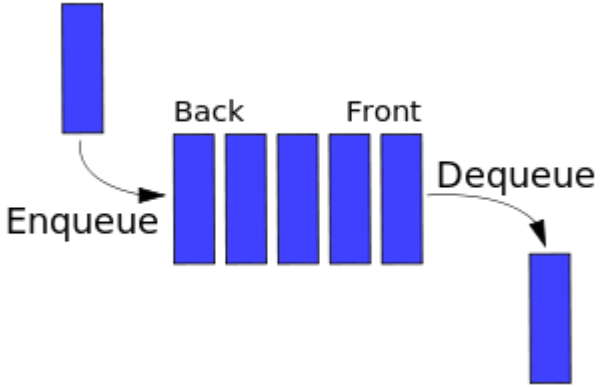
QUEUE이란?

FIFO : 선입선출 구조를 가지는 자료구조.



Abstract queue

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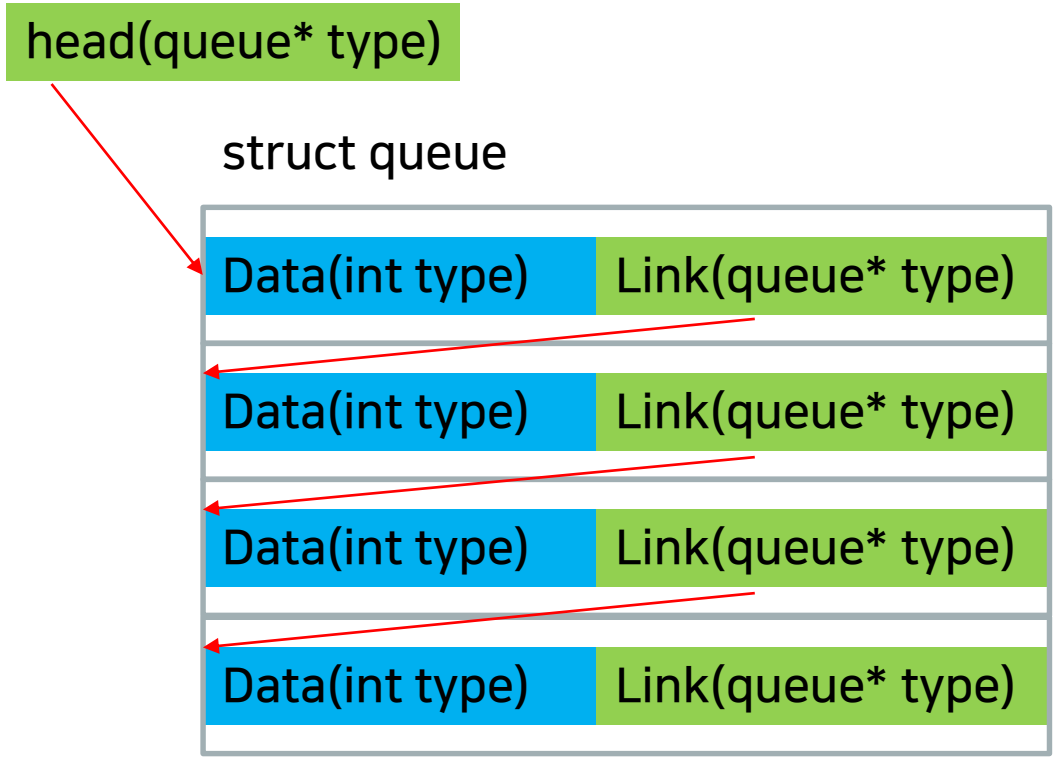
queue 구조체

```
typedef struct _queue queue;
struct _queue
{
    int data;
    struct _queue *link;
};
```



Stack 구조체랑 비슷하게 생김

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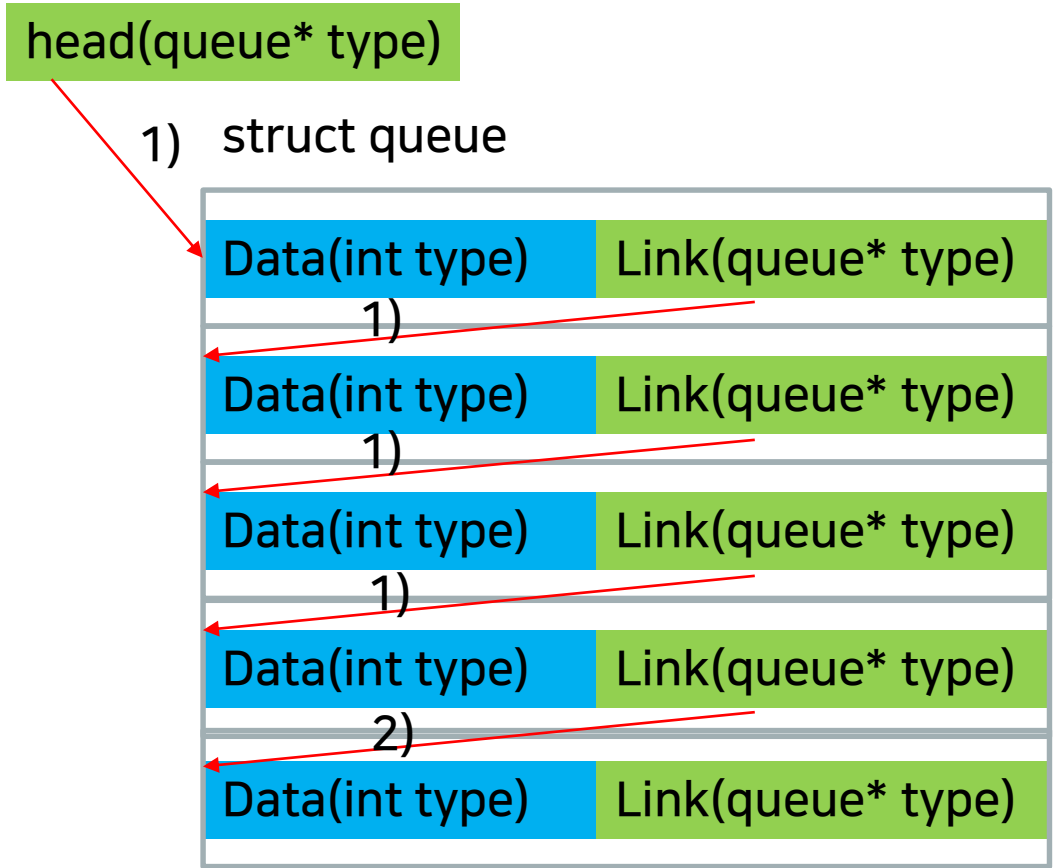
enqueue

```
void enqueue_data(queue **head, int data)
{
    if(!(*head))
    {
        *head = create_queue_node();
        (*head)->data = data;
        return;
    }
    enqueue_data(&(*head)->link,data);
    // TODO
    //
}
#endif
```

1) Recursion을 통해 link가 NULL일 때까지 내려감
2) 마지막 link에 node를 생성하고 data를 넣음



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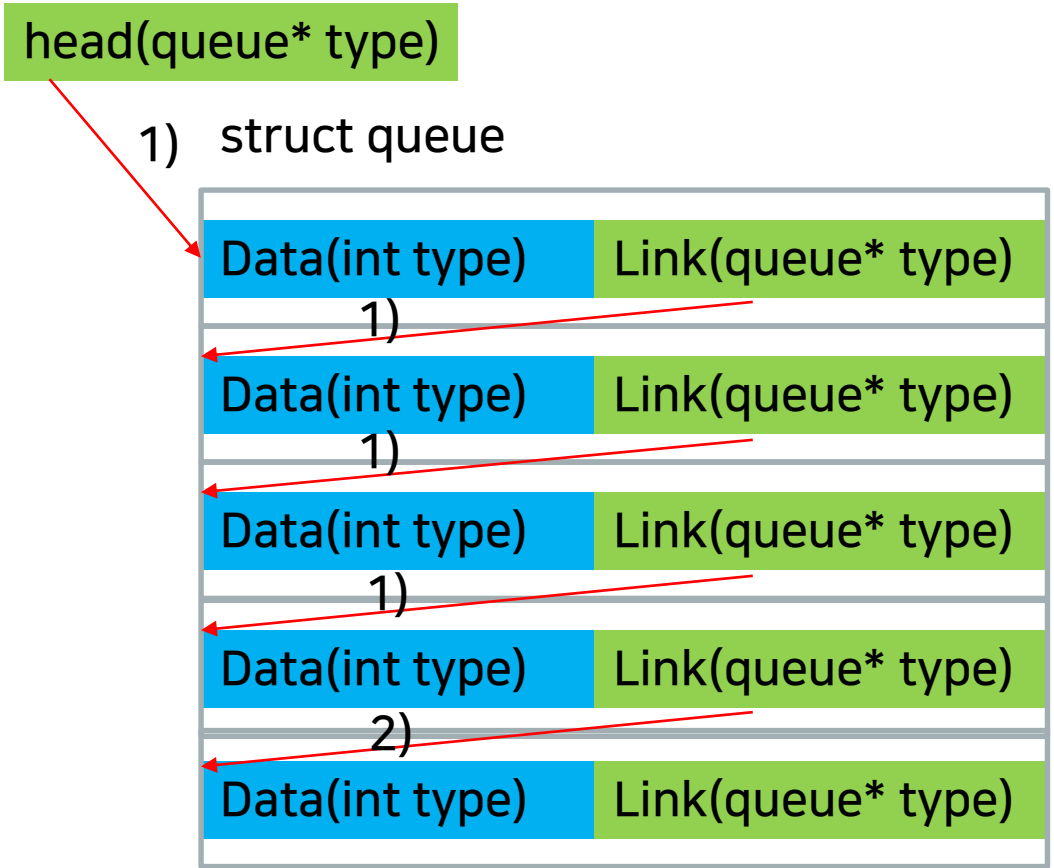
enqueue(not recursion)

```
void enqueue_data(queue **head, int data)
{
    queue* tmp = *head;
    if(!(*head))
    {
        *head = create_queue_node();
        (*head)->data = data;
        return;
    }

    while(tmp->link)
    {
        tmp=tmp->link;
    }
    tmp->link = create_queue_node();
    (tmp->link)->data = data;
}
```

1) While문을 이용해 link가 null일때까지 내려감
2) 마지막 link에 node를 생성하고 data를 넣음



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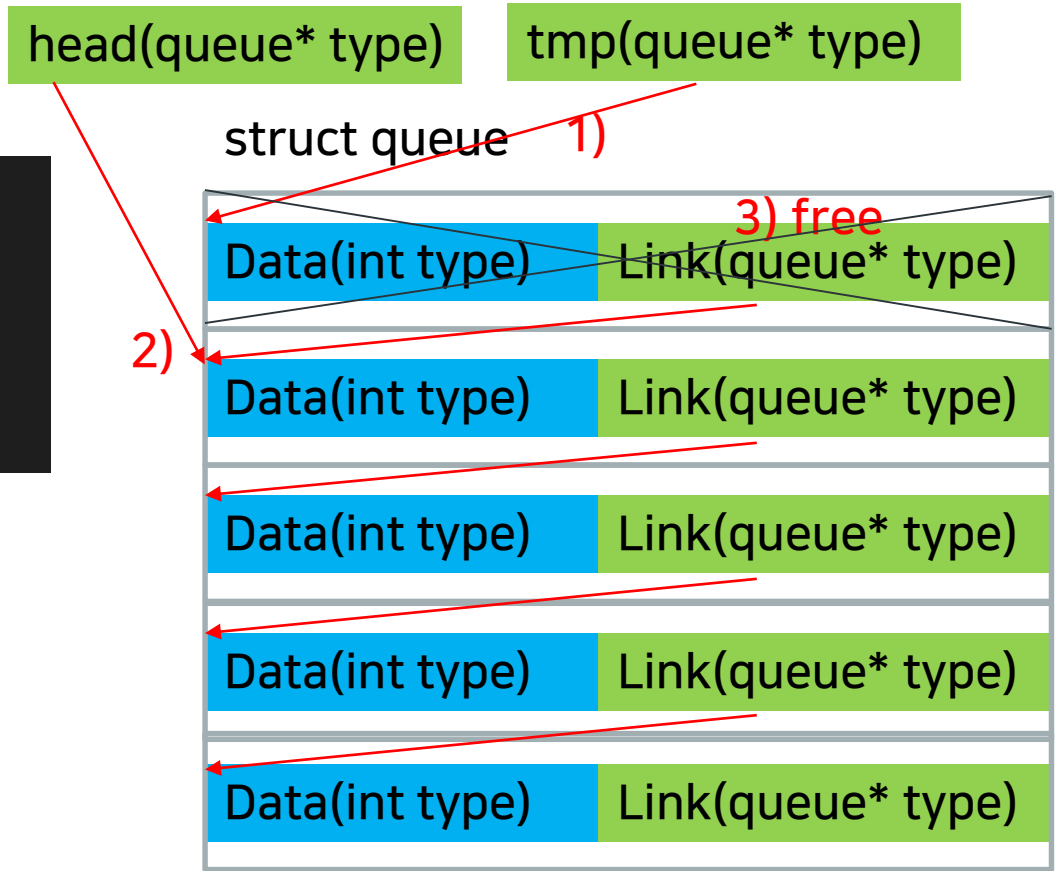
dequeue

```
void dequeue_data(queue** head)
{
    if(*head)
    {
    1) queue* tmp = *head;
    2) *head=(*head)->link;
    3) free(tmp);
    }
    else
        printf("Cannot dequeue - Already Empty queue\n");
}
```



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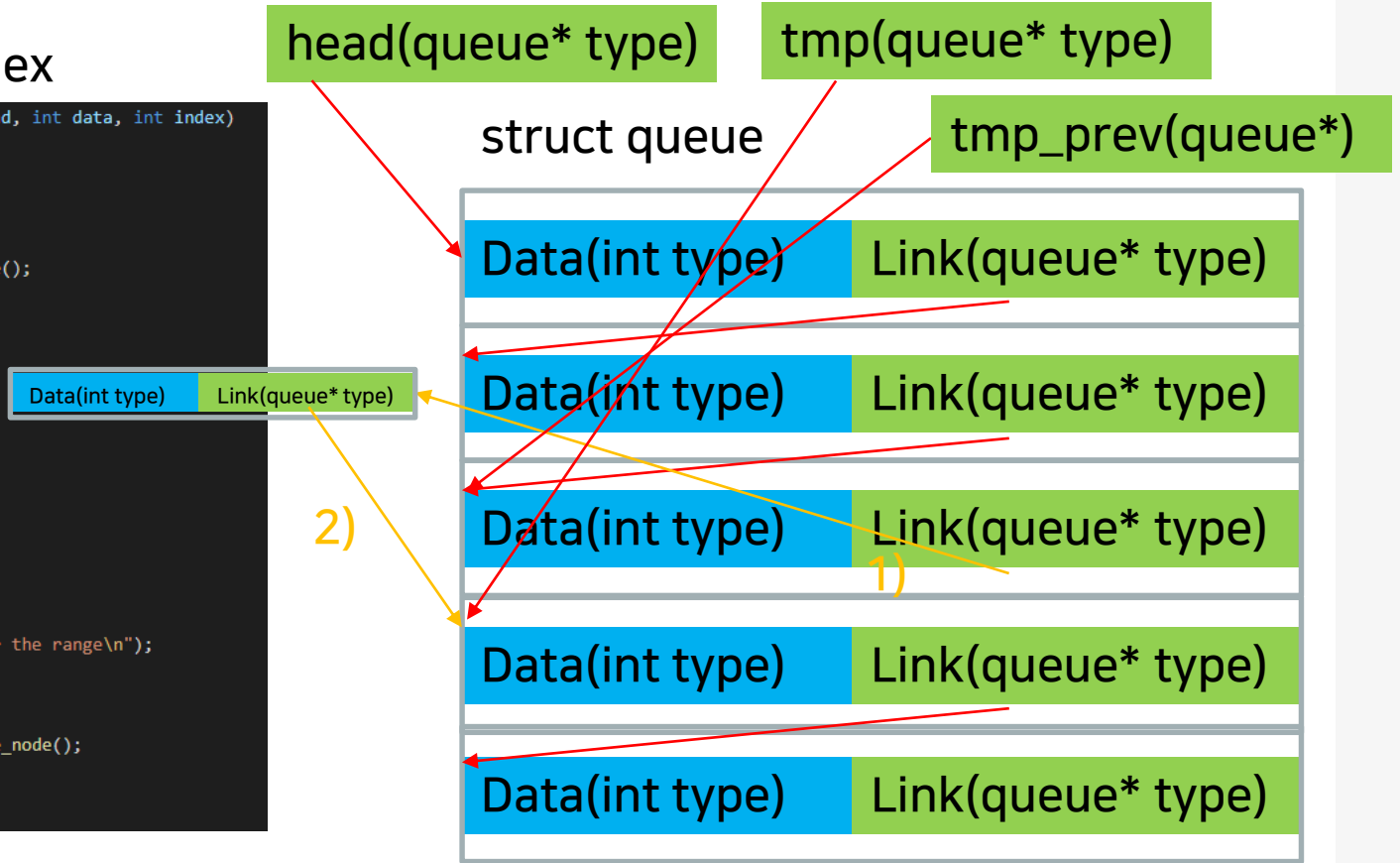
enqueue at index

```
void enqueue_data_idx(queue** head, int data, int index)
{
    queue* tmp = *head;
    queue* tmp_prev = NULL;
    if(!index)
    {
        *head = create_queue_node();
        (*head)->data = data;
        (*head)->link = tmp;
        return;
    }
    while(index)
    {
        if(tmp)
        {
            tmp_prev = tmp;
            tmp=tmp->link;
            index--;
        }
        else
        {
            printf("index is over the range\n");
            return;
        }
    }
 1) tmp_prev->link = create_queue_node();
    tmp_prev->link->data = data;
 2) tmp_prev->link->link = tmp;
}
```



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dequeue at index

```
void dequeue_data_idx(queue** head, int index)
{
    queue* tmp = *head;
    queue* tmp_prev = NULL;
    if(!index)
    {
        *head = (*head)->link;
        free(tmp);
        return;
    }
    while(index)
    {
        if(tmp)
        {
            tmp_prev=tmp;
            tmp=tmp->link;
            index--;
        }
        else
        {
            printf("index is over the range\n");
            return;
        }
    }
  1) tmp_prev->link = tmp_prev->link->link;
  2) free(tmp);
}
```