

Stacks

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Outline

1 Definition

2 Implementation

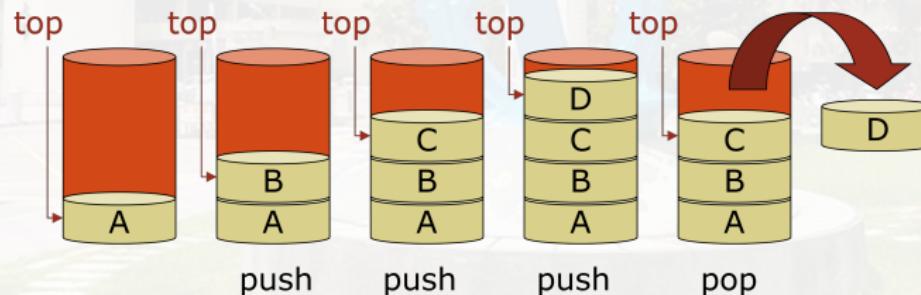
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Definition

- A stack is an ordered list in which **insertions** and deletions are made at the end “top”.
 - insertions: push/add
 - deletions: pop/remove
- Last-In-First-Out (LIFO).



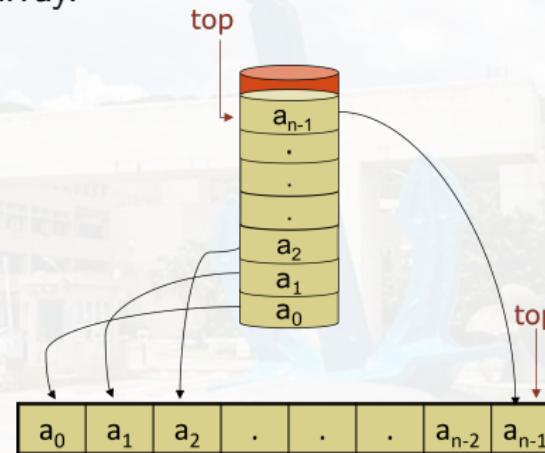
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Stack Implementation: Array

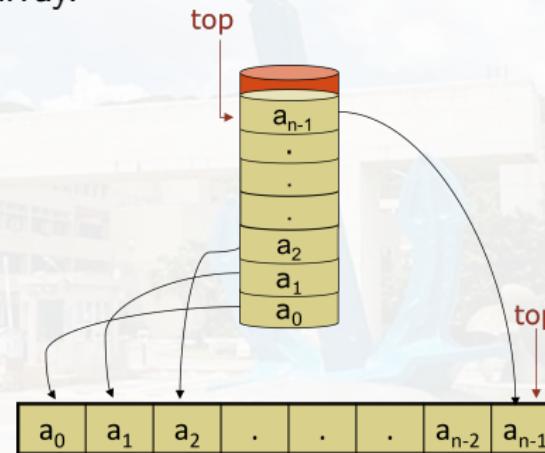
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- An example in C++

Stack Implementation: Array

- The easiest way to implement the stack ADT is using one-dimensional array.



- An example in C++ (another way: using a linked list; will be introduced in the future).

Functions for Stacks

- Create a stack.
 - Create an empty stack with maximum size MAX_STACK_SIZE.

```
#define MAX_STACK_SIZE 101

typedef struct {
    int key; // can be of other types...
    /* other fields? */
} element;

element stack a[MAX_STACK_SIZE];
int top = -1; // initially no element
```

Functions for Stacks (2/2)

- IsEmpty
 - Return true if the stack is empty and false otherwise.



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 $\text{top} < 0$
- IsFull
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`top < 0`
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`top >= MAX_STACK_SIZE-1;`
- Push (or Add)
 - Insert the element into the `top` of the stack.

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`stack[++top] = element;`
- Pop (or Delete)
 - Remove and return the item on the top of the stack.

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- Push (or Add)
 - Insert the element into the `top` of the stack.
`stack[++top] = element;`
- Pop (or Delete)
 - Remove and return the item on the top of the stack.
`return stack[top--];`

push

```
void push(element item) {
    // add an item to the global stack
    if (top >= MAX_STACK_SIZE - 1) {
        stackFull();
    }
    stack[++top] = item;
}

void stackFull() {
    fprintf(stderr, "Stack is FULL!!!");
    exit(EXIT_FAILURE);
}
```

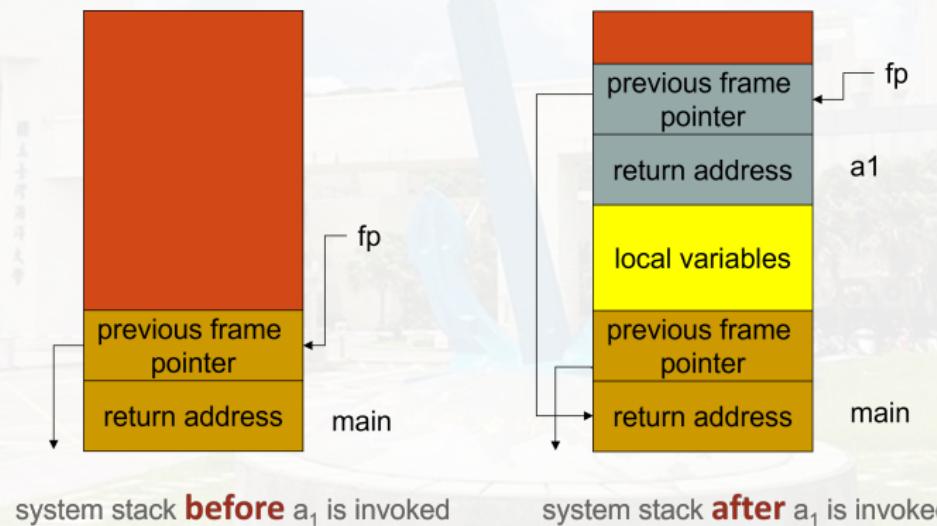
pop

```
element pop() { // no argument is required!
    // return the top element from the stack
    if (top == - 1) {
        return stackEmpty(); // return an error key
    }
    return stack[top--];
}

void stackEmpty() {
    fprintf(stderr, "Stack is EMPTY!!!");
    exit(EXIT_FAILURE);
}
```

Supplementary: System Stack

- Stack frame of a function call



Discussions