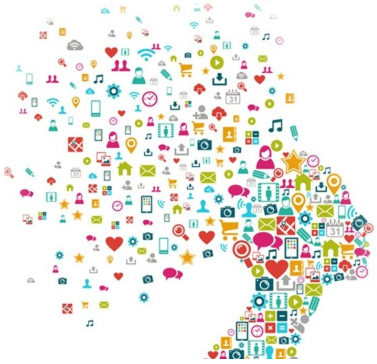

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Dynamic Memory Allocation

Vepuri Vinay Kumar

Contents

- Types of memory allocation.
- Need for dynamic memory allocation.
- Ways of allocating dynamic memory.
- Validating and freeing the memory allocated.
- Types of errors.
- Memory leak.

Types of memory allocation

- Static memory allocation
  - Storage space is given at built time.
  - Allocation and freeing of memory is done implicitly at runtime.
- Dynamic memory allocation
  - Requests memory management subsystem of operating system, to allocate memory at runtime and which returns an address to the allocated memory space.
  - Freeing of memory allocated is to be done explicitly.

Need for dynamic memory allocation

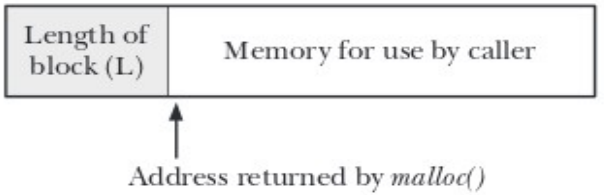
- Can you add more elements into an array?
- What about the unused memory?

```
int main()
{
  int marks[4];
  for(i = 0; i < 4; i++)
   scanf(“%d”, &marks[i]);
}`
```

```
int main()
{
  int marks[10];
  for(i = 0; i < 10; i++)
   scanf(“%d”, &marks[i]);
}
```

Ways of allocating dynamic memory

- Using malloc()
  - Syntax: `void *malloc(size_t size);`
  - Ex: `char *str = (char *) malloc ( sizeof(char) * SIZE);`



Ways of allocating dynamic memory(contd...)

- Using realloc()
  - Syntax: `void *realloc(char *ptr, size_t size);`
  - Ex: `str = realloc(str, sizeof(char) * SIZE);`

- `Using calloc()`
  - `Syntax: void *calloc(size_t nmemb, size_t size);`
  - `Ex: char *name = (char *)calloc(NUM_ELEMENTS, sizeof(char));`

Validation and free

- Validation:
  - ```
    main(){

    int *marks = NULL;

    marks = malloc(sizeof(int));

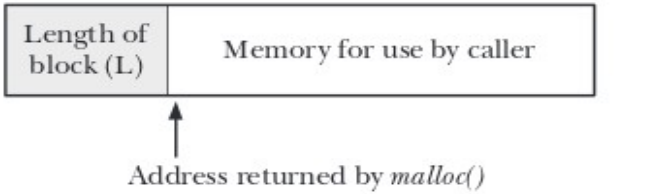
    *marks = 35;

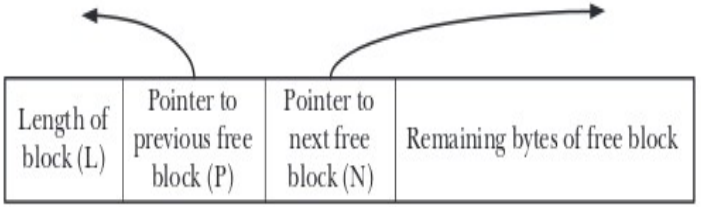
    }
    ```

```
main(){
int *marks = NULL;
marks = malloc(sizeof(int));
if(marks == NULL){
   /*error handling*/
}
}
```
```

Validation and free(contd...)

- Freeing of memory allocated.
  - Syntax: void free(void *ptr);





Types of errors in dynamic memory allocation

- Forget to check return value of malloc.
- Referring to dangling pointer.
- Double free.

Memory leak

- What happens when we allocate space for a variable and lost the pointer to it, without freeing it?
- This leads to memory leak.
- This may exhaust the memory space.

Summary

- Types of memory allocation i.e., static and dynamic.
- Need for dynamic memory allocation.
- Ways of dynamic memory allocating i.e., malloc(), realloc(), calloc().
- Validation and freeing.
- Errors that may be encountered.
- Memory leak.

Any queries?

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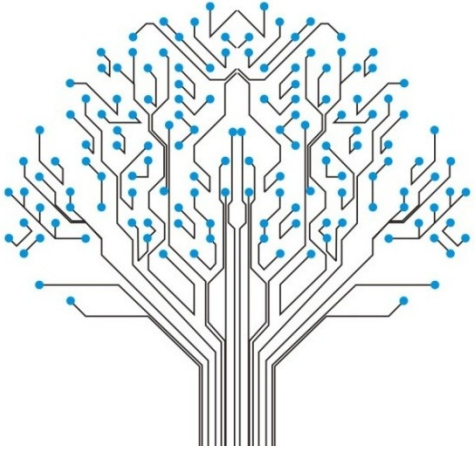
Thank you



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