CS 240 Programming in C

Memory Allocation

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Enumeration

Enumeration (or enum) is a user defined data type in C. It is mainly used to assign names to integral constants, the names make a program easy to read and maintain.
Syntax:

```
enum State {Working = 1, Failed = 0};
```

Enumeration

Variables of type enum can also be defined. They can be defined in two ways:
Syntax:

```
// In both of the below cases, "day" is
// defined as the variable of type week.

enum week{Mon, Tue, Wed};
enum week day;

// Or

enum week{Mon, Tue, Wed}day;
```

Memory allocation functions

- C provides two memory allocation functions: malloc() and calloc().
- malloc() function allocates memory blocks of specified size.
- calloc() function allocates memory blocks and initializes all bytes to zero.
- These functions are used to allocate memory dynamically during runtime.

Memory deallocation functions

- C provides two memory deallocation functions: free() and realloc().
- free() function deallocates the previously allocated memory block.
- realloc() function changes the size of the previously allocated memory block.
- These functions are used to release memory blocks that are no longer needed.

Best Practices for Memory Management

- Always initialize pointers to NULL to avoid referencing uninitialized memory.
- Always check for errors when allocating or deallocating memory.
- Avoid using uninitialized memory.
- Always release memory that is no longer needed to prevent memory leaks.
- Use appropriate memory allocation functions based on the type of data being stored.

Dynamic Memory Allocation

- void *malloc(size_t size)

  malloc returns a pointer to space for an object of size size , or NULL if the request cannot be satisfied. The space is uninitialized.

- ptr = (cast-type*) malloc(byte-size)
  Example:
  int *ptr;
  ptr = (int*) malloc(100 * sizeof(int));
  Since the size of int is 4 bytes, this statement will allocate 400 bytes of memory. And, the pointer ptr holds the address of the first byte in the allocated memory.

- If space is insufficient, allocation fails and returns a NULL pointer.

Dynamic Memory Allocation

- “calloc” or “contiguous allocation” method in C is used to dynamically allocate the specified number of blocks of memory of the specified type. it is very much similar to malloc() but has two different points and these are:
- It initializes each block with a default value ‘0’.
- It has two parameters or arguments as compare to malloc().
- void *calloc(size_t nobj, size_t size)
  calloc returns a pointer to space for an array of nobj objects, each of size size , or NULL if the request cannot be satisfied. The space is initialized to zero bytes.

Dynamic Memory Allocation

- void *realloc(void *p, size_t size)
  realloc changes the size of the object pointed to by p to size . The contents will be unchanged up to the minimum of the old and new sizes. If the new size is larger, the new space is uninitialized. realloc returns a pointer to the new space, or NULL if the request cannot be satisfied, in which case *p is unchanged.

Dynamic Memory Allocation

- void free(void *p) free deallocates the space pointed to by p; it does nothing if p is NULL . p must be a pointer to space previously allocated by calloc , malloc , or realloc.