

## malloc and free

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For example, let's assume we need a block of memory to hold a string of say 100,000,000 ints.

```
int *p;
p = malloc(100000000 * sizeof (int));
if (p == NULL) {
    printf("Error: array could not be allocated.\n");
    exit(1);
}

        // we can now use the pointer
        // ... lots of things to do

free(p); // free up the memory that was used
```

## sizeof

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- **sizeof** - C operator yields bytes needed for type or variable
- **sizeof (type)** or **sizeof variable**
- note unusual (badly designed) syntax - brackets indicate argument is a type
- use sizeof for every malloc call

```
printf("%ld", sizeof (char)); // 1
printf("%ld", sizeof (int)); // 4 commonly
printf("%ld", sizeof (double)); // 8 commonly
printf("%ld", sizeof (int[10])); // 40 commonly
printf("%ld", sizeof (int *)); // 4 or 8 commonly
printf("%ld", sizeof "hello"); // 6
```

## malloc and sizeof

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- **sizeof** - C operator yields bytes needed for type or variable
- note unusual syntax **sizeof (type)** or **sizeof variable**
- use sizeof for every malloc call
- malloc() returns pointer to block of memory
- malloc() returns a (void \*) pointer - can be assigned to any pointer type
- malloc() returns NULL if insufficient memory available - check for this

## free

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- `free()` indicates you've finished using the block of memory
- Continuing to use memory after `free()` results in very nasty bugs.
- `free()` memory block twice also cause bad bugs.
- if program keeps calling `malloc()` without corresponding `free()` calls program's memory will grow steadily larger called a **memory leak**.
- Memory leaks major issue for long running programs.
- Operating system recovers memory when program exists.