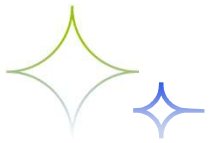

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Programming with C I

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Previous uses of pointers…

- Reference to data
- Output parameters
- Arrays and strings
- File pointers

What happens when we run our executable file?

```
int func1(int x) {
    x += 1;
    return x;
}

int main(void) {
    int n = 10;
    n = func1(n);
    return 0;
}
```

Stack memory

What happens when we run our executable file?

```
int main(void) {
    int* nump;
    nump = malloc(sizeof(int));
    *nump = 10;
    free(nump);
}
```

Stack memory

main
int* nump:

Heap memory

What happens when we run our executable file?

```
int main(void) {
    int* nump;
    nump = malloc(sizeof(int));
    *nump = 10;
    free(nump);
}
```

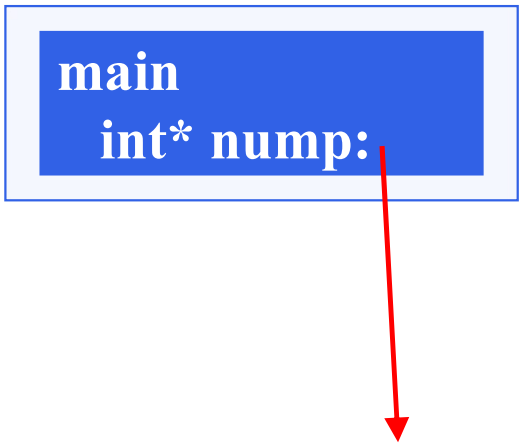
Stack memory

Heap memory

What happens when we run our executable file?

```
int main(void) {
    int* nump;
    nump = malloc(sizeof(int));
    *nump = 10;
    free(nump);
    *nump++;
}
```

Stack memory



undefined behavior!

Heap memory

Dynamic Memory Allocation

- **heap**
  - region of memory in which function **malloc** dynamically allocates blocks of storage

- **stack**
  - region of memory in which function data areas are allocated and reclaimed

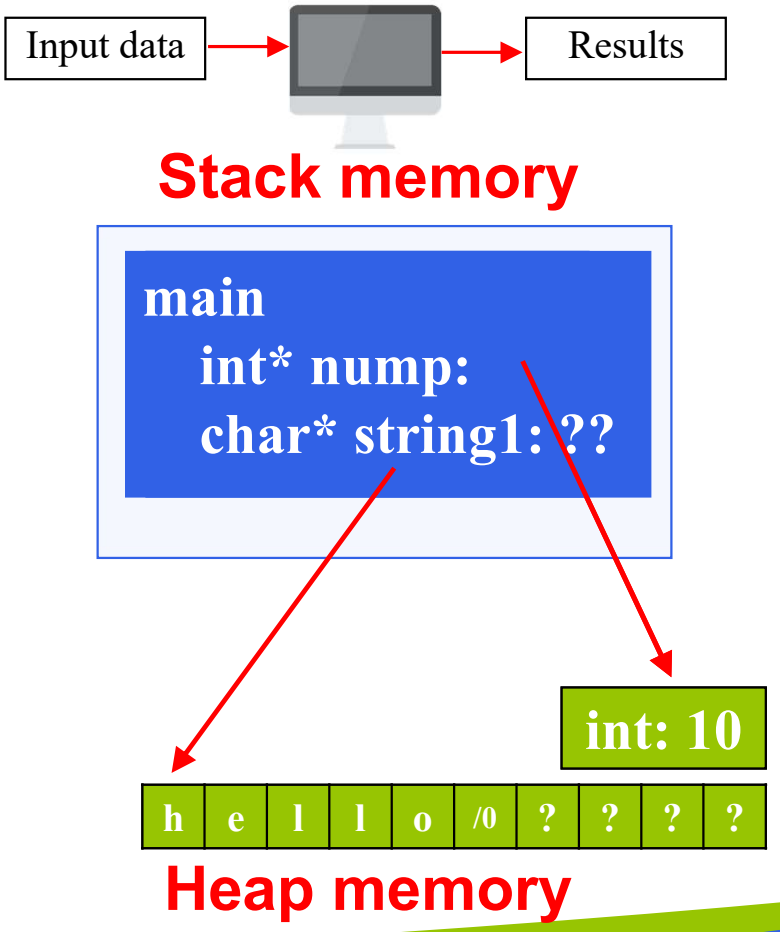
Important functions

- malloc(<amnt of memory to reserve>)
- calloc(<num>, <amnt of memory to reserve>)
- free(pointer)

These are all from stdlib.h.

What happens when we run our executable file?

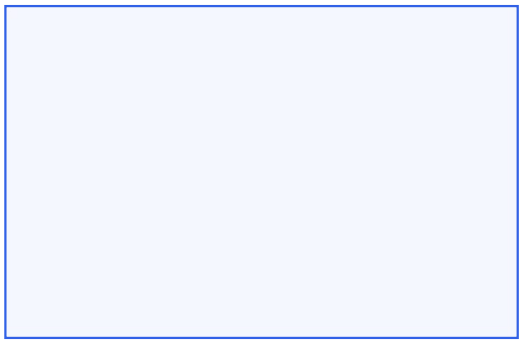
```
int main(void) {
    int* nump;
    nump = malloc(sizeof(int));
    *nump = 10;
    char* string1;
    string1 = calloc(10, sizeof(char));
    strcpy(string1, “hello”);
    free(nump);
}
```



What happens when we run our executable file?


```
int main(void) {
    int* nump;
    nump = malloc(sizeof(int));
    *nump = 10;
    char* string1;
    string1 = calloc(10, sizeof(char));
    strcpy(string1, “hello”);
    free(nump);
}
```

Stack memory

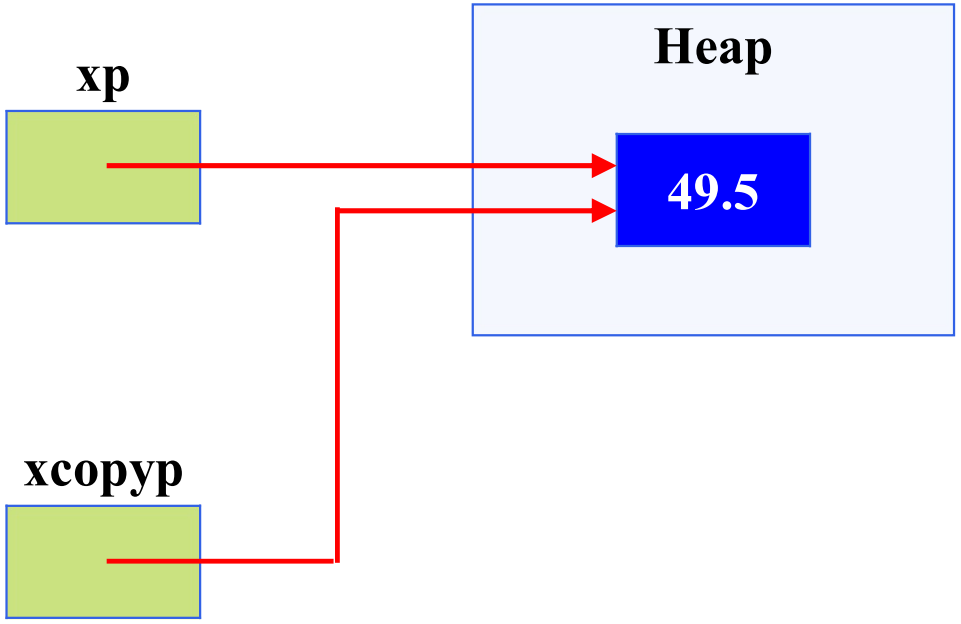


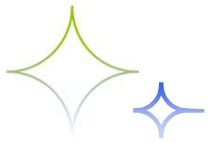
Heap memory

Figure Multiple Pointers to a Cell in the Heap

```
double *xp,  *xcopyp;

xp = (double *)malloc(sizeof (double));
*xp = 49.5;
xcopyp = xp;
free(xp);
. . .
```





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THE END

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