COMPETITIVE PROGRAMMING 101

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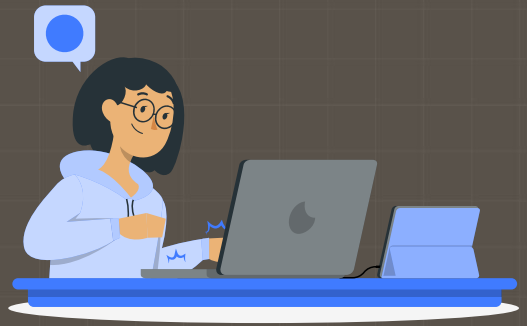

If you have a variable var in your program, &var will give you its address in the memory.

What will we do with the address of a variable?

A very useful concept in data structure where we can link up one object of some type with another object of similar type. Used to build Linked list, Stack, Queue and several other data structures.

```
int *n;
n = new int;
cin >> (*n);
cout << (*n) << "\n";
```

```
int *n;
n = new int;
cin >> (*n);
cout << (*n) << "\n";
```

What will the following code snippet do?

simply takes a input (integer) and shows it as a output.

Pointer In Action

The symbol used to denote a pointer is *

usually int n; means a declaration of a variable named n

But int *n means a pointer pointed to some address which we haven't initialized.

To see which address value we are pointing at using some pointer p, we can simply write cout << p; and get the value. If we want to get the value, which is stored in the address pointed by our pointer we can write *p.

What is addressing?

In your computer when you declare something it allocates some memory seeing the corresponding data type right?

*Emran vaiya had already told you about data types like int takes four bytes of memory where long takes 8 bytes.

Where are those memory being allocated?

Computer memory like RAM, SSD etc….

Suppose a memory address be 0x9A

and when you declare some variable **a** it goes to the address named 0x9A

Suppose each of those address holds 1 byte of data then the next integer you declare will go to (0x9A + 4) address

That means (0x9A), (0x9A + 1) … 0x9A + 3

this four addresses are used to hold a integer

type variable **a.**

How can we see the address of some variable.

```
int n;
cin >> n;
cout << (&n);
```

using & before n gives us the address of the variable n.

A pointer can be used to save the reference of **&n.**

An example to understand pointer

Say you are to eat a burger

The burger is in a box

Say burger is your variable

Then the box is &burger which means it's address

And your eyes looking at the box is a pointer to the address.

Made some sense ????

Some tricks to use pointer:

Say what will this code do?

```
int n;
cin >> n;
int *p;
p = &n;
cout << p << "\n";
cout << *p << "\n";
```

```
int n; // it is a simple code for declaration of a variable named n
cin >> n; // in this line we can take input which will be stored in n
int *p; // we are declaring a pointer named p which is now pointing to an invalid address;
p = &n; // accessing with & we get the address
 of variable n, and using = we are pointing at its address
 by p
cout << p << "\n"; // this line simply prints the value of the address
we are pointing at
cout << (*p) << "\n"; // this line simply prints the value, which is
stored in address &n pointed by our pointer p.
```

Use of new

In c++ you can use new to declare memory for some specific data type and assign the allocated memory to some pointer making the pointer act like an independent variable

```
int *n;

n = new int;

cin >> (*n);

cout << (*n);
```

Some complex pointer:

C++ has the chance to use pointer of pointer

int **a;

what is this???

```cpp
#include<bits/stdc++.h>
using namespace std;

int main() {
    int **a;
    a = new int*[10];
    for(int i = 0; i < 10; i++) {
        a[i] = new int;
    }
    for(int i = 0; i < 10; i++) cin >> *a[i];
    for(int i = 0; i < 10; i++) cout << *a[i] << " ";
    cout << "\n";
}
```

int **a;

Here **a** is a pointer which is pointing to some pointers.

Seems confusing????

**********ASK ME IN CLASS*******

Value changing of a variable using pointer

```
#include<bits/stdc++.h>
using namespace std;

int main() {
    int a;
    cin >> a;
    int *p = &a;
    cout << *p << "\n";
    a = 2;
    cout << *p << "\n";
}
```

Swap implementation using pointer

```
#include<bits/stdc++.h>
using namespace std;
void Swap(int *a, int *b) {
    int *p = new int;
    *p = *a;
    *a = *b;
    *b = *p;
}
int main() {
    int a, b;
    cin >> a >> b;
    cout << a << " " << b << "\n";
    int *p = &a;
    int *q = &b;
    Swap(p, q);
    cout << a << " " << b << "\n";
}
```

```
int **a; /// a is a pointer and he carries a list of pointer variables


a = new int*[2];

for(int i = 0; i < 2; i++) {
  a[i] = new int[2];
}

for(int i = 0; i < 2; i++) {
  for(int j = 0; j < 2; j++) cin >> a[i][j];

}

for(int i = 0; i < 2; i++) {
  for(int j = 0; j < 2; j++) cout << a[i][j] << " ";
  cout << "\n";
}
```

Details in class

Thank you for reading the whole slide!!!