C, C++, DSA in depth

Pointers

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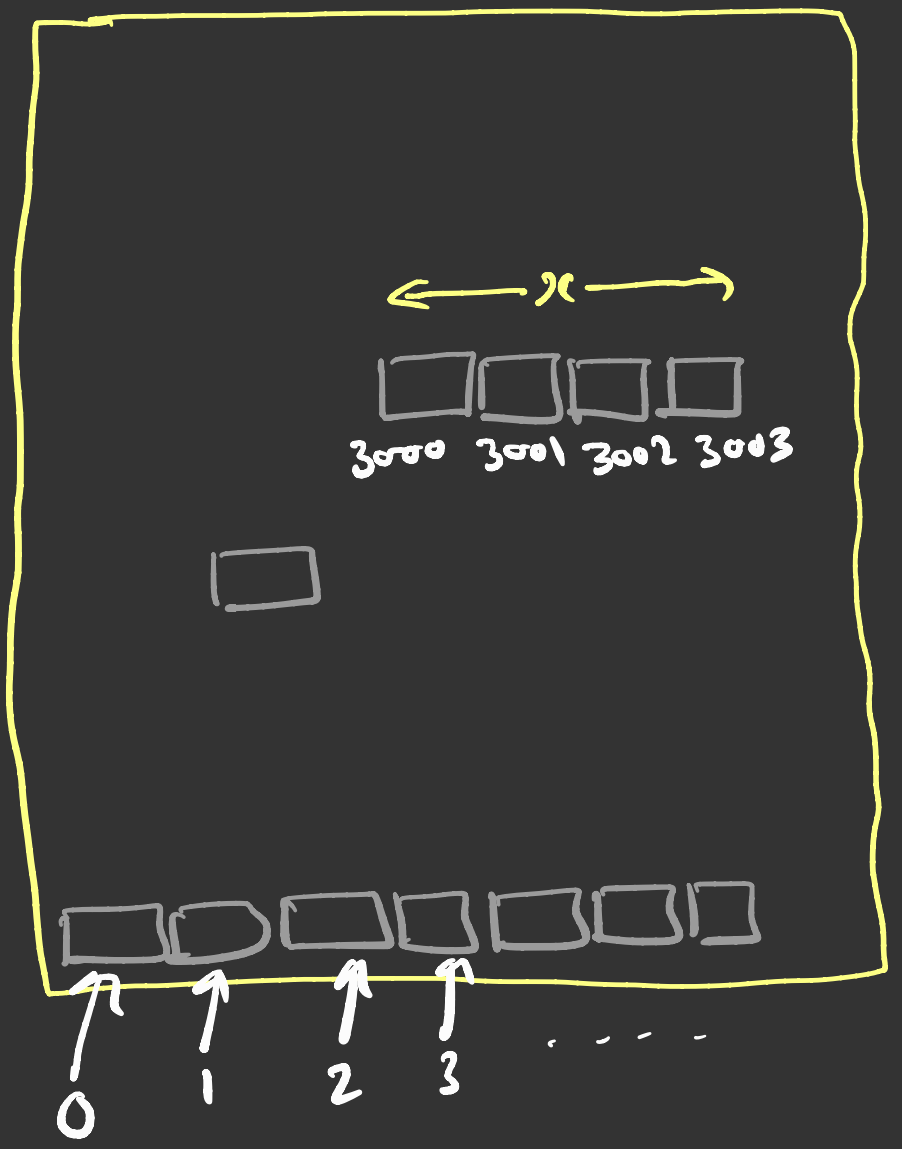
Agenda

1. Introduction to memory address
2. Referencing and Dereferencing operators
3. What is pointer?
4. Size of pointer
5. Base address
6. Data type of pointer
7. Extended concept of pointers

Introduction to Memory Address

Address = Reference
= position number of byte in program's memory

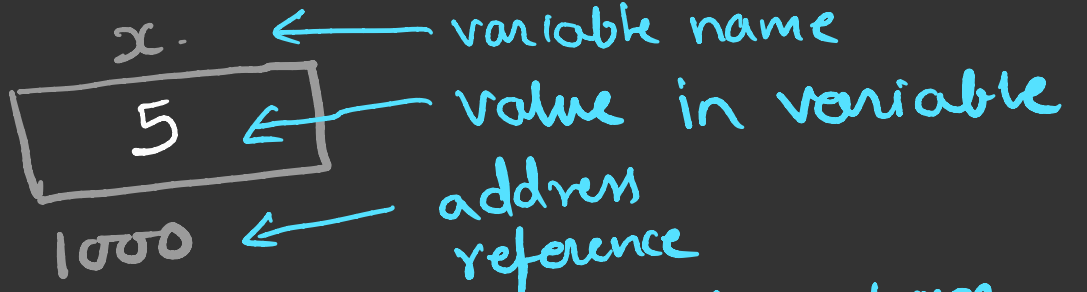


int x;

Address is a logical number which is non negative Integer

Referencing and Dereferencing operators

```
int x=5;
```




```
printf("%d", x); 5
printf("%d", &x); 1000
printf("%d", *&x ); 5
```

we cannot decide or change address of any variable

*&x ≃ x (imp)

&

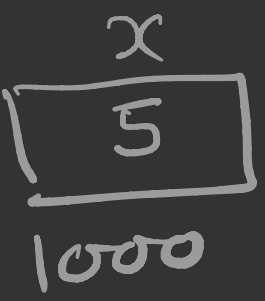
- Address of operator
- Referencing operator
- Unary operator
- & ← variable
  variable → & → address

*

- Indirection operator
- Dereferencing operator
- Unary operator
- * ← Address
  Address → * → variable

```
int x = 5;
&x = 7;
```

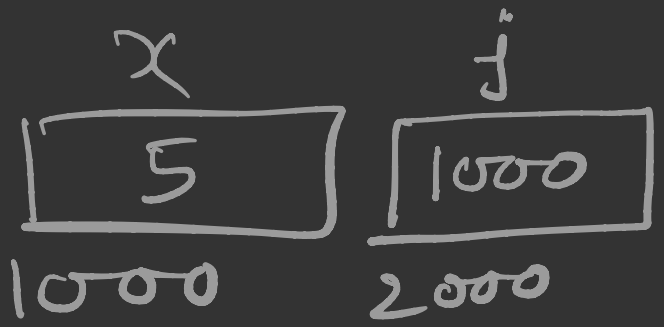
Error



&x is not a variable, it is just a way to represent address of variable x. Address number is a constant value.

We cannot have constant in the left hand side of assignment (=) operator.

```
int x = 5;
int *j;
j = &x;
```




```
printf("%d %d %d", &x, j, *&x);
```
1000 1000 5

```
printf("%d %d %d", &j, x, *j);
```
2000 5 5

$$*j = x$$

j is a pointer variable, which contains address of another variable.

प्रधानमंत्री (Pointer)

What is a Pointer?

Pointer is variable, which contains address of another variable.

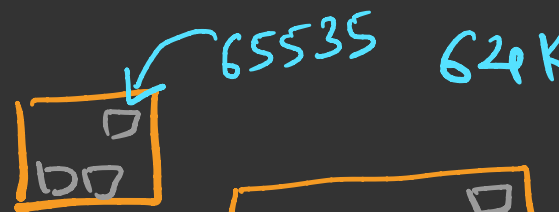
OS

16-bit → DOS

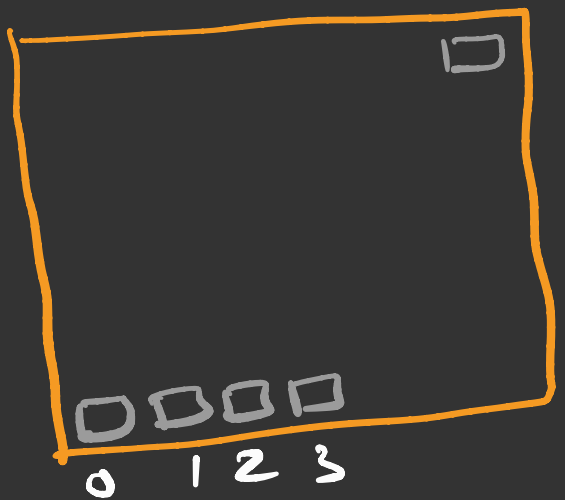
32 bit → windows XP

64 bit → windows 10

65535 → 2 bytes



64 Kb = 64 x 1024 bytes
= 65536 bytes
0 to 65535



Size of Pointer

ordinary variable

Pointer variable

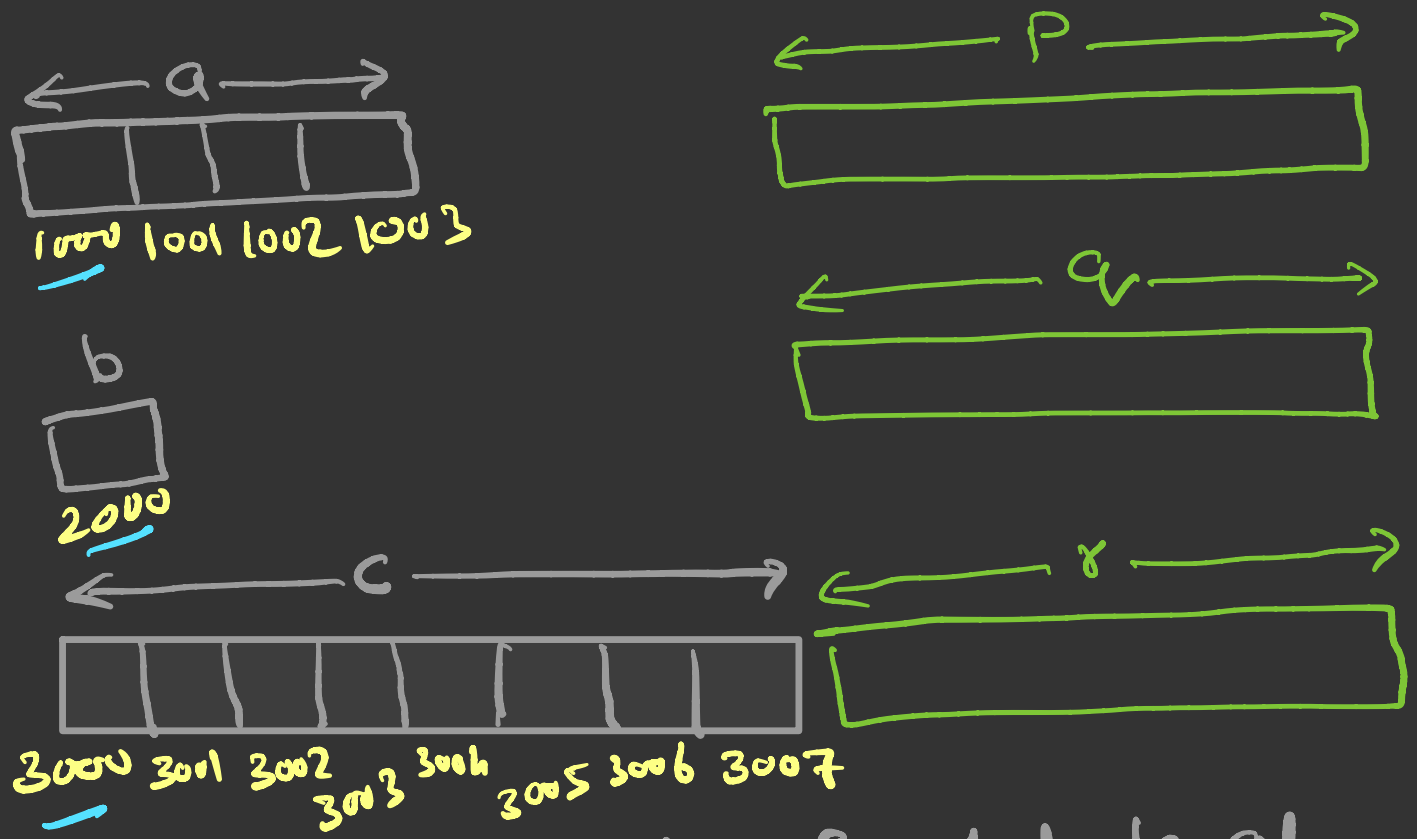
```
int a, *p;
char b, *q;
double c, *r;
```

→ ordinary variable ka size uske data type par depend karta hai

→ Pointer variable ka size uske data type par depend nahi karta hai

Base Address

```
int a, *p;
char b, *q;
double c, *r;
```

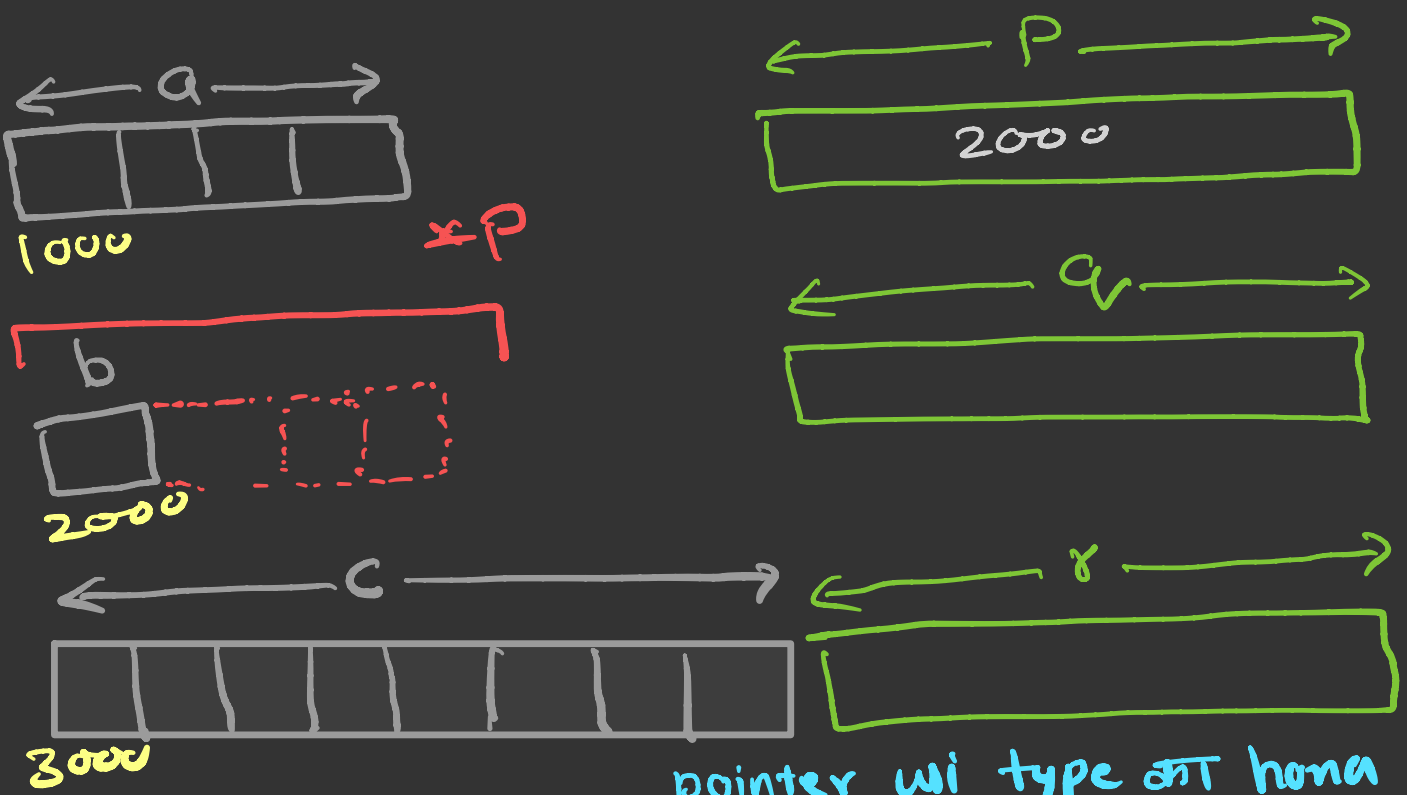


Base address = address of the first byte of any variable.

Pointer always contains base address

Data Type of Pointer

```
int a, *p;
char b, *q;
double c, *r;
```



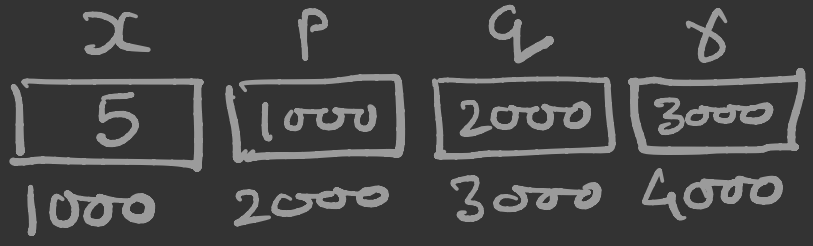
`p = &b;` `*p ≃ b`

pointer wi type of hona chahiye jis type ka variable ka address use rakhna hai

`char *q;` q is not going to store character constant, but it is going to store address of char variable.

Extended Concept of Pointers

```
int x=5, *p, **q, ***r;
p=&x;
q=&p;
r=&q;
```



Pointer khud jitne level ka hota hai us se exactly ek kam level wale ka address rakhta hai

```
printf("%d %d %d %d", q, *r, &p, &x);
```
2000 2000 2000 1000

```
printf("%d %d %d %d", **r, &q, **&q, p);
```
1000 3000 1000 1000

```
printf("%d %d %d %d", &r, **q, *p, ***r);
```
4000 5 5 5