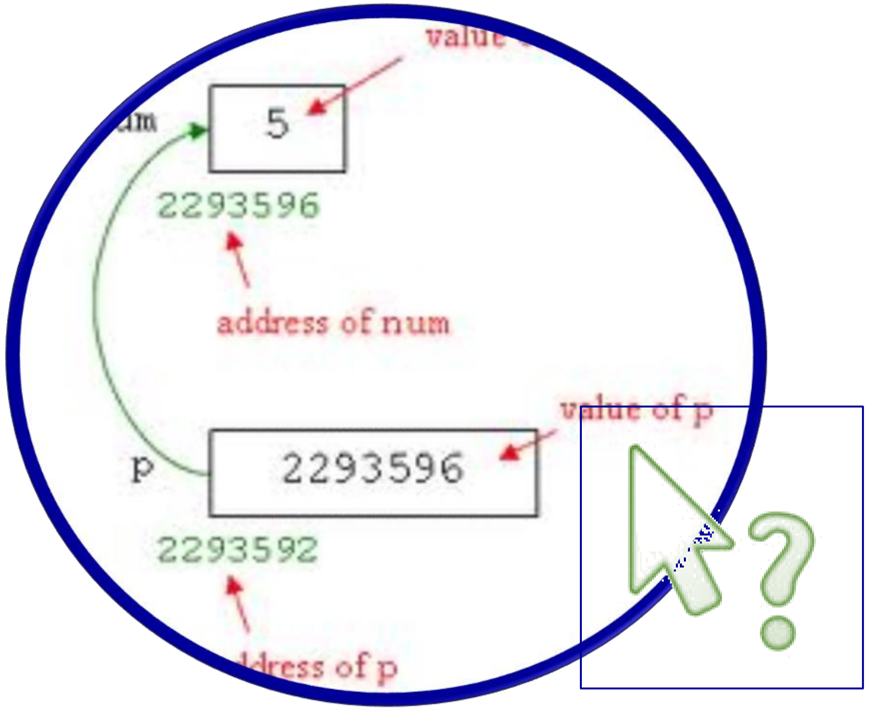
S23_1 Pointers


value
um
5
2293596
address of num
value of p
p
2293596
2293592
ldress of p
?

Pointers

Objectives

To learn and appreciate the following concepts

- Basic operations on pointers
- Pointers and Arrays
- Pointers and Character Strings
- Pointers and 2D
- Array of Pointers

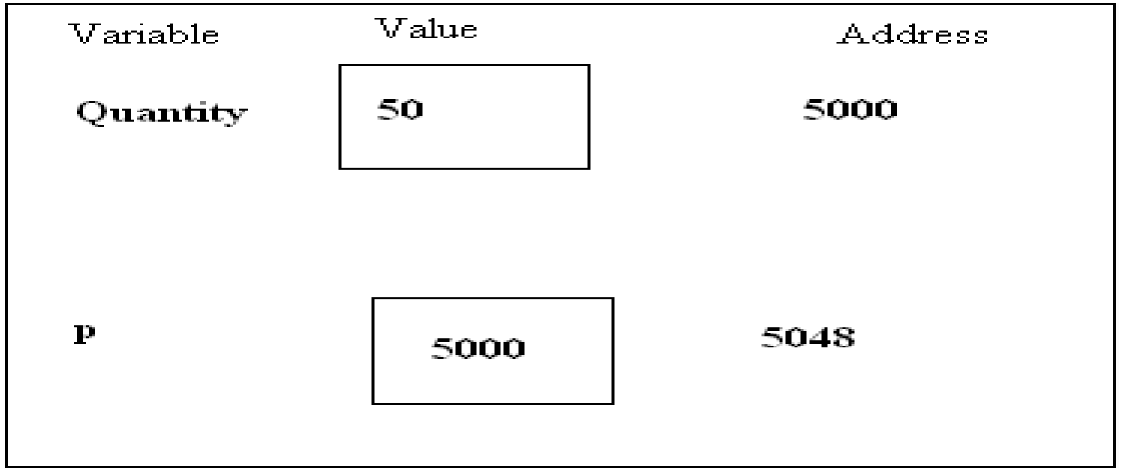
Session outcome

At the end of session one will be able to understand

- Basic operations on pointers
- Pointers and Arrays

Pointers- recap

```
int Quantity;  //defines variable Quantity of type int
int* p;  //defines p as a pointer to int
p = &Quantity; //assigns address of variable Quantity to pointer p
```



Variable	Value	Address
Quantity	50	5000
p	5000	5048

Now…

```
Quantity = 50;//assigns 50 to Quantity
*p = 50; //assigns 50 to Quantity
```

Pointer expressions

- Pointers can be used in most valid C expressions. However, some special rules apply.
- You may need to surround some parts of a pointer expression with parentheses in order to ensure that the outcome is what you desire.
- As with any variable, a pointer may be used on the right side of an assignment operator to assign its value to another pointer.

Pointer Expressions - Example

- Eg: int a=10, b=20,c,d=10;

  int *p1 = &a, *p2 = &b;

Expression	a	b	c
c= *p1**p2; OR *p1 * *p2 OR (*p1) * (*p2)	10	20	200
c= c + *p1;	10	20	210

c=5 * - *p2 / *p1;
OR   (5 * (- (*p2)))/(*p1)
//space between / and * is required
	10	20	-10

*p2 =*p2 +10;	10	30	

Operations on Pointer Variables

- **Assignment** – the value of one pointer variable can be assigned to another pointer variable of the same type
- **Relational operations** - two pointer variables of the same type can be compared for equality, and so on
- **Some limited arithmetic operations**
  - integer values can be added to and subtracted from a pointer variable
  - value of one pointer variable can be subtracted from another pointer variable
  - Shorthand Increment and Decrement Operators

Allowed Pointer Operations - Example

- int a = 10, b = 20, *p1, *p2, *p3, *p4;
- p1 = &a; //assume address of a = 2004
- p2 = &b; //assume address of b = 1008

Assume an integer occupies 4 bytes

Pointer Operations	Example expression	Result
Addition of integers from pointers	p3 = p1 + 2	value of p3 = 2004 + 4*2 = 2012
Subtraction of integers from pointers	p4 = p2 – 2	value of p4 = 1008-4*2 = 1000
Subtraction of one pointer from another	c = p3– p1	Value of c = 2012– 2004= 2
Pointer Increment	p1++	Value of p1 = 2008
Pointer Decrement	--p1	Value of p1 = 2004

Allowed Pointer Operations - Example

```
if (p1<p2)
 printf(“p1 points to lower memory than p2”);

if (p1==p2)
   printf(“p1 and p2 points to same location”);

if (p1!=p2)
Printf(“p1 and p2 NOT pointing to same location”);
```

Invalid Operations:

- Pointers are not used in division and multiplication.

  p1/*p2;

  p1*p2;

  p1/3; are not allowed.

- Two pointers can not be added.

  p1 + p2 is illegal.

Program to exchange two values

```
#include<stdio.h>
int main()
{

int x, y, t, *a, *b;
a=&x; b=&y;
printf(”Enter the values of a and b: \n”);
scanf(”%d %d”, a, b); // equivalent to scanf(”%d %d”, &x, &y);
 t=*a;
*a=*b;
*b=t;

printf(”x = %d \n”, x);
printf(”y = %d”, y);

return 0;
}
```

```
Enter the values of a and b:
10  5
x= 5
y = 10
```

Go to posts/chat box for the link to the question

submit your solution in next 2 minutes

The session will resume in 3 minutes

Summary of pointers

- Basic operations on pointers