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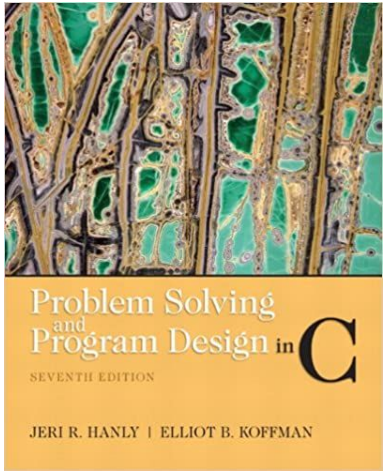


Faculty of Engineering and Technology
Department of Computer Science

Introduction to Computers and Programming (Comp 133)

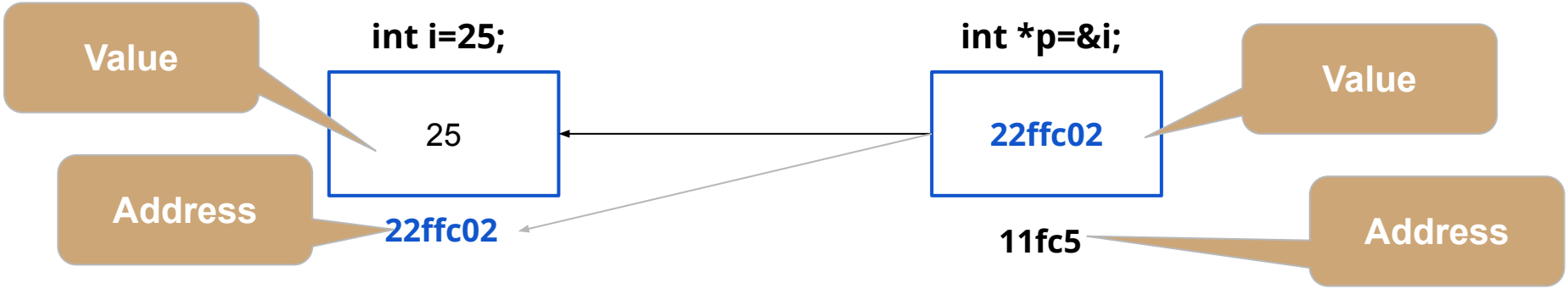
References :
Book : Problem Solving and Program Design in C (7th Edition) 7th Edition
Slides : Dr. Radi Jarrar , Dr. Abdallah Karakra , Dr. Majdi Mafarja.

Pointers and Modular Programming

Chapter 6

Pointer

- Pointer or pointer variable: A memory cell that stores the address of a data item.
- The declaration:
  - **float *p;**
  - Identifies **p** as a pointer variable of type "**pointer to float** ."
  - We can store the memory address of a type float variable in **p.**



Chapter 6

- Pointer variable

Pointer variable

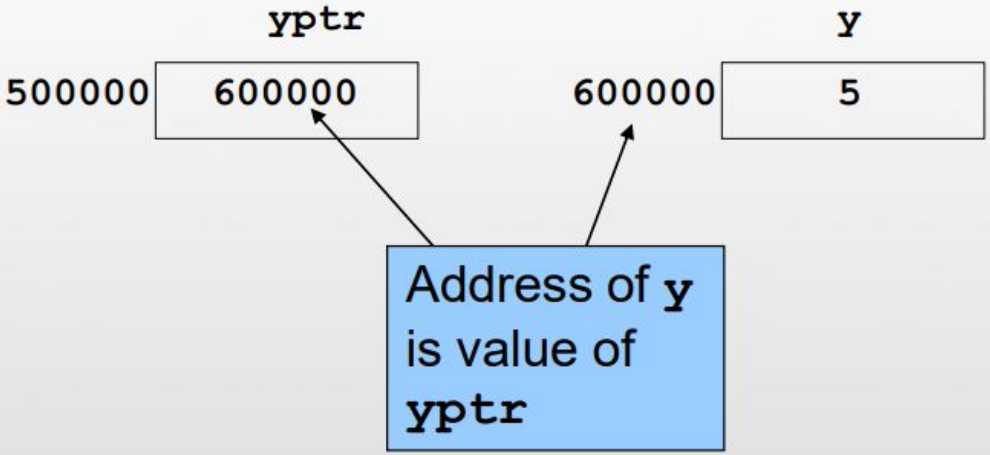
- Syntax : **type** ***ptr_name** ;

- **int *ptr** ; declares a pointer **ptr** to variables of type int.
- **char *ch** ; declares a pointer **ch** to variables of type char.
- **double *dblPtr**; declares a pointer **dblPtr** to variables of type double.

Pointer variable

```
int y = 5;
int *yPtr;
yPtr = &y;   //yPtr gets address of y
```

yPtr "points to" y



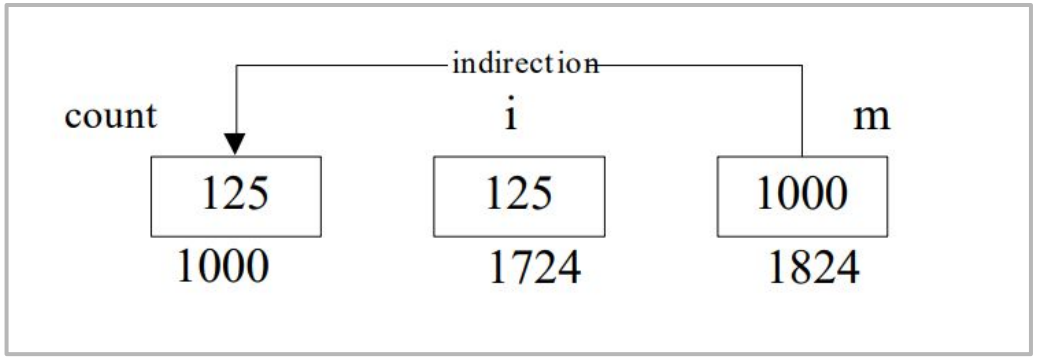
Pointer Operators * and &

- **&** is a unary operator that returns the **address** a variable.
- ***** unary operator and it returns the **value** of the variable located at the address.

```
int *m ;
int count=125, i ;

m = &count ;

i = *m ;
```



Pointers to Files

- FILE *inp; /* pointer to input file */
  - inp = fopen("distance.txt", "r");
  - fscanf(inp, "%lf", &item);
  - fclose(inp);
- FILE *outp; /* pointer to ouput file */
  - outp = fopen("distout.txt", "w");
  - fprintf(outp, "%.2f\n", item)
  - fclose(outp);

Pointers to Files

```
int
main(void)
{
    FILE *inp;          /* pointer to input file */
    FILE *outp;         /* pointer to ouput file */
    double item;
    int input_status;   /* status value returned by fscanf */

    /* Prepare files for input or output */
    inp = fopen("indata.txt", "r");
    outp = fopen("outdata.txt", "w");

    /* Read each item, format it, and write it */
    input_status = fscanf(inp, "%lf", &item);
    while (input_status == 1) {
        fprintf(outp, "%.2f\n", item);
        input_status = fscanf(inp, "%lf", &item);
    }

    /* Close the files */
    fclose(inp);
    fclose(outp);

    return (0);
}
```

File indata.txt

```
344 55 6.3556 9.4
43.123 47.596
```

File outdata.txt

```
344.00
55.00
6.36
9.40
43.12
47.60
```

Pointer Example

```c
int main() {
int y=2;
int *p;
p = &y;
printf ("y address is %p \n",&y);
printf ("y address is %p \n",p);
printf ("y value is %d \n",y);
printf ("y value is %d \n",*p);
return 0;
}
```

```
y address is 0x7fffedb66e3c
y address is 0x7fffedb66e3c
y value is 2
y value is 2
```

Pointer Example

```
int i = 5;
int *ptr;                          /* declare a pointer variable */
ptr = &i;                          /* store address-of i to ptr */
printf("*ptr = %d\n", *ptr);       /* refer to referee of ptr */
```

output
*ptr = 5

initialize pointers

```
int main()
{
 int x;
 int *p;
 scanf("%d",p); /*Incorrect … the pointer is not initialized*/
 p = &x;
 scanf("%d",p); /* Correct */

printf("%d",x);
}
```

Pointer Example

```
int m= 3, n=100, *p;
p= &m;
printf("m is %d\n",*p);
m++;
printf("now m is %d\n ",*p);
p= &n;
printf("n is %d\n",*p);
*p= 500; /* *p is at the left of "= " */
printf ("now n is %d\n ", n);
```

```
m is 3
now m is 4
 n is 100
now n is 500
```

Pointer Example

```
int main()
{
    int x, *p;
    p = &x;
    *p = 0;
    printf("x is %d\n", x);
    printf("*p is %d\n", *p);
    *p += 1;
    printf("x is %d\n", x);
    (*p)++;
    printf("x is %d\n", x);
    return 0;
}
```

Output:

```
x is 0
*p is 0
x is 1
x is 2
```

Pointer Example

Trace the execution of the following fragment

```
int m = 10, n = 5;
int *mp, *np;
mp = &m;
np = &n;
*mp = *mp + *np;
*np = *mp – *np;
printf("%d %d\n%d %d\n", m, *mp, n, *np);
```

Output:

```
15 15
10 10
```

Chapter 6

- Pointers as Function Parameters (Call by Reference)

Pointers as Function Parameters

- Write a function to exchange the values of two integer variables.

```
#include <stdio.h>
void swap( int*, int*);
void main( )
{
int a, b ;
printf( "Enter two numbers" ) ;
scanf( " %d %d ", &a, &b ) ;
printf( "a = %d ; b = %d \n", a, b ) ;
swap( &a, &b ) ;
printf( "a = %d ; b = %d \n", a, b ) ;
}

void swap ( int *ptr1, int *ptr2 )
{
int temp ;
temp = *ptr2 ;
*ptr2 = *ptr1 ;
*ptr1 = temp ;
}
```

Call by Reference

Pointers as Function Parameters

```c
#include <stdio.h>
int sum(int,int);
int main()
{
    int num1=4,num2=5;
    int result;
    result=sum(num1,num2);
    printf("The result is %d",result);

    return 0;
}
int sum(int x,int y)
{
    return (x+y);
}
```

```c
#include <stdio.h>
void sum(int*,int,int);
int main()
{
    int num1=4,num2=5;
    int result;
    sum(&result,num1,num2);
    printf("The result is %d",result);

    return 0;
}
void sum(int*res,int x,int y)
{
    *res=x+y;
}
```

Pointers as Function Parameters

```
#include <stdio.h>
void min_max(int, int, int*, int*);
int main()
{
int x,y;
int small,big;
printf("Two integers: ");
scan f (" %d %d" , &x , &y);
min_max(x,y,&small,&big);
printf("%d < = %d", small, big);
return 0;
}
void min_max(int a, int b, int *min, int *max)
{
if (a> b){
*max= a;
*min= b;
}
else{
*max=b;
*min=a;
}
}
```

Function to find Max and Min for two numbers.

Pointers as Function Parameters

Function to find the sum and the difference between two numbers

```
#include <stdio.h>
int sum_difference (int,int,int*);
int main()
{
    int num1,num2,sum,diff;
    printf("Please enter two numbers: ");
    scanf("%d%d",&num1,&num2);
    diff=sum_difference (num1,num2,&sum);
    printf("Sum= %d and difference=%d",sum,diff);
    return 0;
}

int sum_difference (int x,int y,int* sum)
{
    *sum=x+y;
    return (x-y);
}
```

Pointers as Function Parameters

```c
#include <stdio.h>
int main()
{
    int i = 0, j = 5;
    int *y;
    y=&j;
    for( i = 0; i <= 4; i++ )
    {
        *y  = *y + i;
    }
    printf( "The final value of j is %d.\n", j );
    return 0;
}
```

The final value of j is 15.

Pointers as Function Parameters

```c
#include <stdio.h>
int x=2;
void fun1(int,int*,int);
void fun2(int,int*);
int main()
{
    int num1=2,num2=3,res=0;
    x=num1+1;
    printf("num1=%d num2=%d res=%d x=%d\n",num1,num2,res,x);
    fun1(num1,&res,num2);
    printf("num1=%d num2=%d res=%d x=%d\n",num1,num2,res,x);
    fun2(num2,&res);
    printf("num1=%d num2=%d res=%d x=%d\n",num1,num2,res,x);
 return 0;
}
void fun1(int x,int* y, int z)
{
    *y=x+z;
    *y=x+2;
}
void fun2(int y, int* z)
{
    *z=x+2;
    *z=y+3;
    x++;
}
```

```
num1=2 num2=3 res=0 x=3
num1=2 num2=3 res=4 x=3
num1=2 num2=3 res=6 x=4
```

Pointers as Function Parameters

```c
#include <stdio.h>
void sum(int a, int b, int *cp);
int main(void)
{
 int x, y, z;
 x = 5; y = 3;
 printf("   x   y   z \n\n");
 sum(x, y, &z);
 printf("%4d%4d%4d\n", x, y, z);
 sum(y, x, &z);
 printf("%4d%4d%4d\n", x, y, z);
 sum(z,y, &x);
 printf("%4d%4d%4d\n", x, y, z);
 sum(z, z, &x);
 printf("%4d%4d%4d\n", x, y, z);
 sum(y, y, &y);
 printf("%4d%4d%4d\n", x, y, z);
 return (0);
}
void sum(int a, int b, int *cp)
{
 *cp = a + b;
}
```

```
   x   y   z

   5   3   8
   5   3   8
  11   3   8
  16   3   8
  16   6   8
```

Scope Rules

- **Local Variable** Inside a function or block
  - Can be accessed only in the scope of block.
  - **Void sum() { int result } ;**
- **Global variable** Outside of all function
  - Can be accessed from anywhere
- **Formal Parameters** In the function parameters
  - Can be accessed only in the scope of function.
  - **Void sum(int x , int y) { return x=y; }**

Scope Rules

- **Local Variable** Inside a function or block

```
int main()
{
  /* Declaration of local variable  */
  int a;

  /* initialization */
   a = 7;

 printf ("value of a = %d\n", a);
  return 0;
}
```

Scope Rules

- **Global variable** Outside of all function

```
/* Declaration of global variable  */
int a;
int main()
{

  /* initialization */
   a = 7;

 printf ("value of a = %d\n", a);
  return 0;
}
```

Thank You.

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