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Pointers & Modular Programming

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Comp 230

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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 ."
         // This means that we can store the memory address of a type
        // float variable in p .
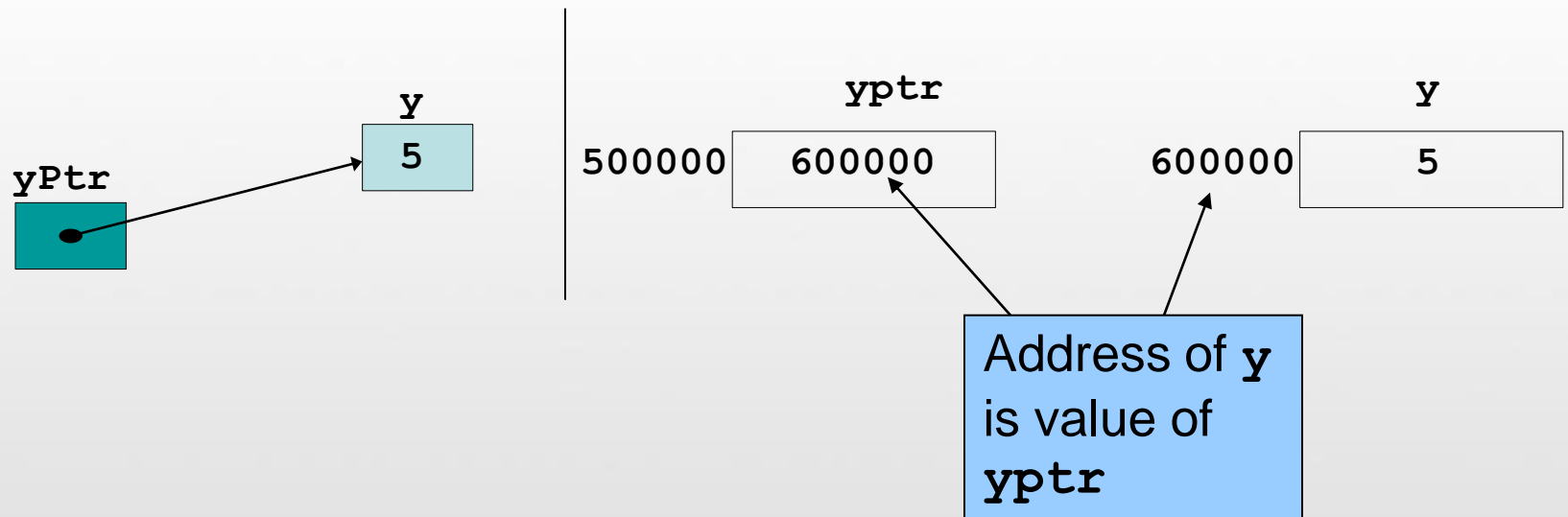
pointer

- **Pointer Type Declaration:**

  SYNTAX: *type   * variable ;*
  EXAMPLE: float   *p;

  The value of the pointer variable p is a memory address

Example (1)

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


Address of **y** is value of **yptr**

Example (2)

```
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
```

Example (3):
What actually *ptr* is?

- **ptr** is a variable storing **an address**
- ptr is **NOT** storing the actual value of i

Address of i= 0022FF18   Address of **ptr=**0022FF1C

```
int i = 5;

int *ptr;

ptr = &i;

printf("i = %d\n", i);

printf("*ptr = %d\n", *ptr);

printf("ptr = %p\n", ptr);

printf("address of i = %p\n", &i);

printf("address of ptr = %p\n", &ptr);
```

ptr	address of i

i	5

Output:

i = 5

*ptr = 5

ptr =0022FF18

address of i = 0022FF18

address of ptr = 0022FF1C

value of ptr = address of i in memory

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Example (4)

```c
#include <stdio.h>
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

Example (5)

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
```

Examples

```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;

}
```

Example (6)

Write function to find the sum and the difference between two numbers.

```c
#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);
}
```

Example (7)

Write a function to :
1. **Find the number of digits in a given number**
2. **Sum of digits**
3. **Reverse a number**

Example:
Please enter a number: 123
number of digits = 3
sum of digits=6
reverse=321

Code

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Example (8)

```c
#include<stdio.h>
void interchange(int*,int*);
int main() {

    int num1,num2;
    printf("Enter num1 and num2: ");
    scanf("%d%d",&num1,&num2);
    interchange(&num1,&num2);

    printf("\nNumber 1 : %d",num1);
    printf("\nNumber 2 : %d",num2);

    return(0);
}
void interchange(int *num1,int *num2)
{
    int temp;
    temp  = *num1;
    *num1 = *num2;
    *num2 = temp;
}
```

Exchanges the values of the two integer variables

Example (9)

Identify and correct the errors in the following code fragment, given the correct output (%p is used to print a pointer):

```
int y = 3;

int *yptr;

yptr = &y;

printf("The value of y is %d\n", *yptr);

printf("The address of y is %op\n", *yptr);
```

Change "*yptr" in the above statement to "yptr" or "&y"

Output:

The value of y is 3

The address of y is 2063865468

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Example (10): Output

```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.

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Example (11)

C program to find square and cube of given number

```c
#include <stdio.h>
int square_cube(int,int*);
int main()
{
    int num,square,cube;
    printf("Please enter a number : ");
    scanf("%d",&num);
    square=square_cube(num,&cube);
    printf("square=%d\ncube=%d",square,cube);
    return 0;

}
int square_cube(int num,int*cube)
{

    int square;
    square=num*num;
    *cube=num*num*num;
    return square;

}
```

Please enter a number : 2
square=4
cube=8

Example (12)

```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++;
}
```
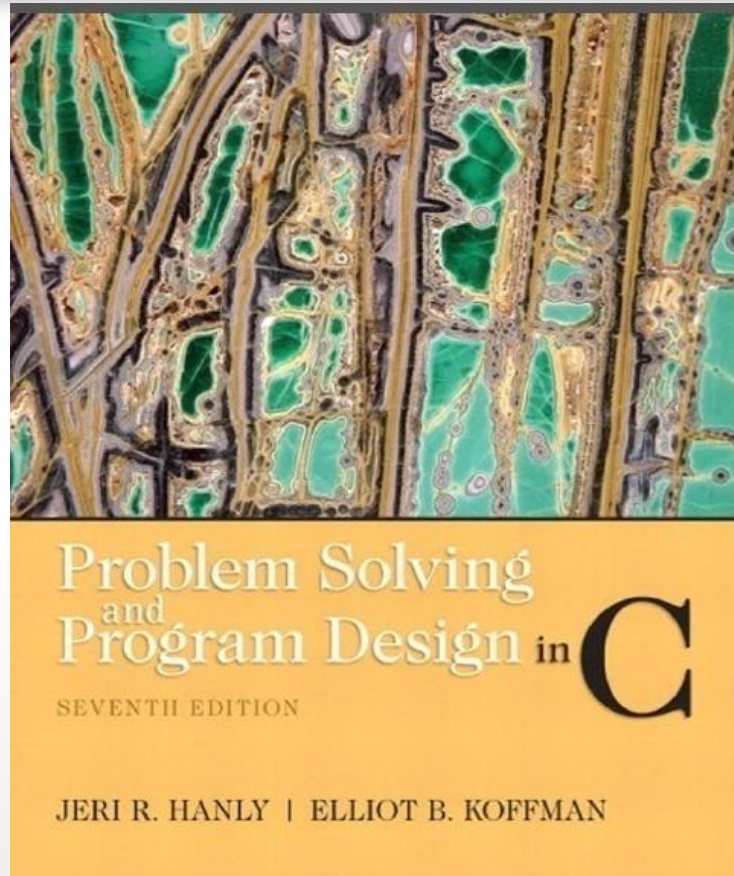
code

Output:

num1=2 num2=3 res=0 x=3

num1=2 num2=3 res=4 x=3

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

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Question?

"Success is the sum of small efforts, repeated day in and day out."
Robert Collier

References:

Problem Solving & Program Design in C (main reference)
http://www.programmingsimplified.com/c-program-print-stars-pyramid

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