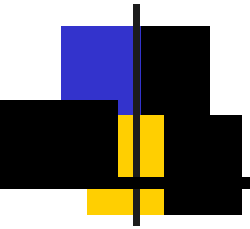
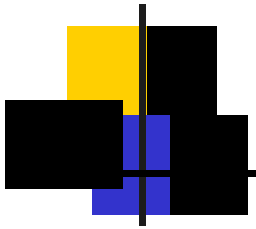


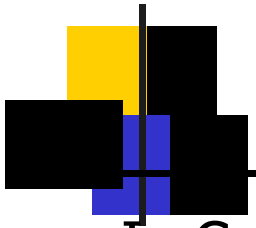
Input and Output in 'C'

Session 4



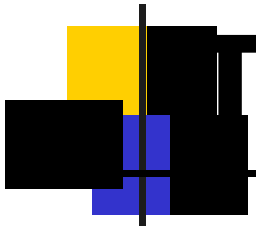
Objectives

- To understand formatted I/O functions - scanf() and printf()
- To use character I/O functions - getchar() and putchar()



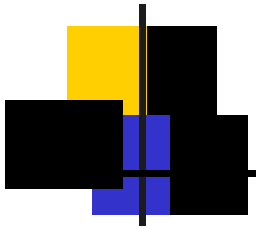
Standard Input/Output

- In C, the standard library provides routines for input and output
- The standard library has functions for I/O that handle input, output, and character and string manipulation
- Standard input is usually the keyboard
- Standard output is usually the monitor (also called the console)
- Input and Output can be rerouted from or to files instead of the standard devices



The Header File <stdio.h>

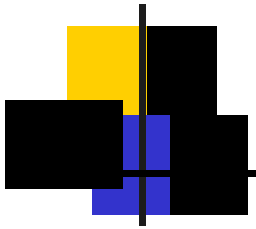
- #include <stdio.h>
  - This is a preprocessor command
- stdio.h is a file and is called the header file
- contains the macros for many of the input/output functions used in 'C'
- printf(), scanf(), putchar(), getchar() functions are designed such that, they require the macros in stdio.h for proper execution



Formatted Input/Output

- printf() – for formatted output
- scanf() – for formatted input

- ***Format specifiers*** **specify the format in which the values of the variables are to be input and printed**

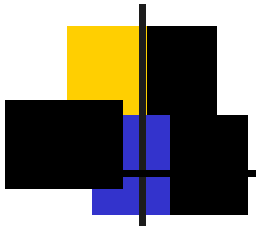


printf ()-1

- used to display data on the standard output – console

Syntax→ printf ("control string", argument list);

- The argument list consists of constants, variables, expressions or functions separated by commas
- There must be one format command in the control string for each argument in the list
- The format commands must match the argument list in number, type and order
- The control string must always be enclosed within double quotes, which are its delimiters



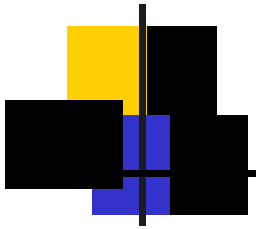
printf ()-2

The control string consists of one or more of three types of items:

1. **Text** characters:
   consists of printable characters

2. **Format Commands**:
   begins with a % sign and is followed by a format code - appropriate for the data item

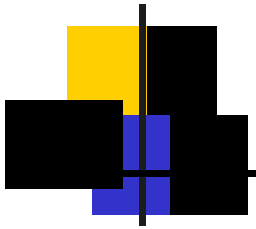
3. **Nonprinting Characters:**
   Includes tabs, blanks and new lines



Format codes-1

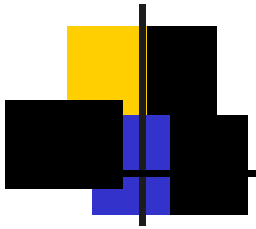
Format	printf()	scanf()
Single Character	%c	%c
String	%s	%s
Signed decimal integer	%d	%d
Floating point (decimal notation)	%f	%f or %e
Floating point (decimal notation)	%lf	%lf
Floating point (exponential notation)	%e	%f or %e
Floating point (%f or %e , whichever is shorter)	%g	
Unsigned decimal integer	%u	%u
Unsigned hexadecimal integer (uses "ABCDEF")	%x	%x
Unsigned octal integer	%o	%o

In the above table c, d, f, lf, e, g, u, s, o and x are the type specifiers



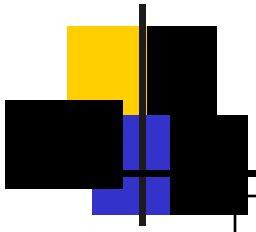
Format codes-2

Format Code	Printing Conventions
%d	The number of digits in the integer
%f	The integer part of the number will be printed as such. The decimal part will consist of 6 digits. If the decimal part of the number is smaller than 6, it will be padded with trailing zeroes at the right, else it will be rounded at the right.
%e	One digit to the left of the decimal point and 6 places to the right , as in %f above



Control String Special Characters

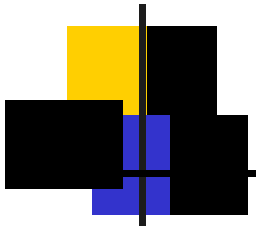
\\	to print \ character
\ "	to print " character
%%	to print % character



control strings & format codes

No	Statements	Control String	What the control string contains	Argument List	Explanation of the argument list	Screen Display
1.	printf("%d",300);	%d	Consists of format command only	300	Constant	300
2.	printf("%d",10+5);	%d	Consists of format command only	10 + 5	Expression	15
3.	printf("Good Morning Mr. Lee.");	Good Morning Mr. Lee.	Consists of text characters only	Nil	Nil	Good Morning Mr. Lee.
4.	int count = 100; printf("%d",count);	%d	Consists of format command only	count	variable	100
5.	printf("\nhello");	\nhello	Consists of nonprinting character & text characters	Nil	Nil	hello on a new line
6.	#define str "Good Apple " …….. printf("%s",str);	%s	Consists of format command only	Str	Symbolic constant	Good Apple

7.	……..
	int count,stud_num;
	count=0;
	stud_nim=100;
	printf("%d %d\n",count, stud_num);
		%d %d	Consists of format command and escape sequence	count, stud_num	two variables	0 , 100

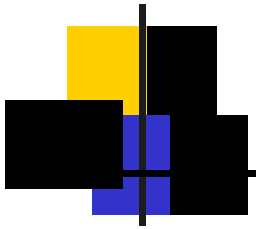


Example for printf()

Program to display integer, float , character and string

```
#include <stdio.h>
   void main()
   {
                int a = 10;
                float b = 24.67892345;
                char ch = 'A';

                printf("Integer data = %d", a);
                printf("Float Data = %f",b);
                printf("Character = %c",ch);
                printf("This prints the string");
                printf("%s","This also prints a string");
    }
```



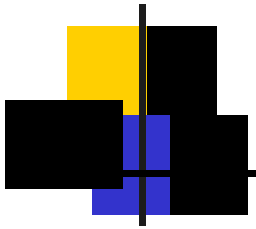
Modifiers in printf()-1

1. '-' Modifier

The data item will be *left-justified* within its field, the item will be printed beginning from the leftmost position of its field .

2. Field Width Modifier

Can be used with type float, double or char array (string).
The field width modifier, which is an integer, defines , defines the *minimum* field width for the data item.



Modifiers in printf()-2

3. Precision Modifier

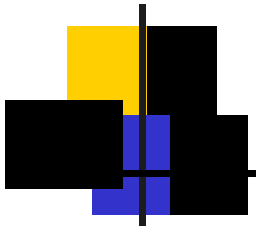
This modifier can be used with type float, double or char array (string). If used with data type float or double, the digit string indicates the *maximum* number of digits to be printed to the right of the decimal.

4. '0' Modifier

The default padding in a field is done with spaces. If the user wishes to pad a field with zeroes this modifier must be used

5. 'l' Modifier

This modifier can be used to display integers as long int or a double precision argument. The corresponding format code is %ld



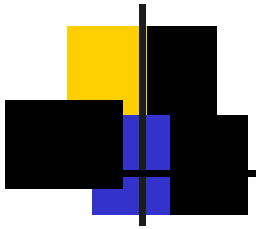
Modifiers in printf()-3

6. 'h' Modifier

This modifier is used to display short integers.
The corresponding format code is %hd

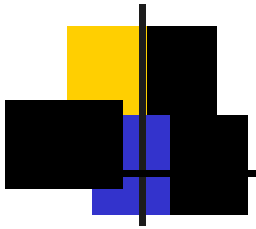
7. '*' Modifier

If the user does not want to specify the field width in advance,
but wants the program to specify it, this modifier is used



Example for modifiers

```
/* This program demonstrate the use of Modifiers in printf() */
#include <stdio.h>
void main()
{
     printf("The number 555 in various forms:\n");
     printf("Without any modifier: \n");
     printf("[%d]\n",555);
     printf("With - modifier :\n");
     printf("[%-d]\n",555);
     printf("With digit string 10 as modifier :\n");
     printf("[%10d]\n",555);
     printf("With 0 as modifier : \n");
     printf("[%0d]\n",555);
     printf("With 0 and digit string 10 as modifiers :\n");
     printf("[%010d]\n",555);
     printf("With -, 0 and digit string 10 as modifiers: \n");
     printf("[%-010d]\n",555);
}
```



scanf()

- Is used to accept data

The general format of scanf() function

scanf("control string", argument list);

- The format used in the printf() statement are used with the same syntax in the scanf() statements too

Differences in argument list of between printf() and scanf()

- printf() uses variable names, constants , symbolic constants and expressions

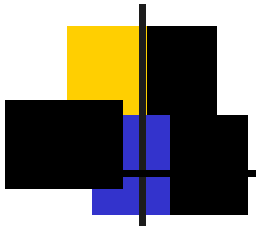
- scanf() uses pointers to variables

When using scanf() follow these rules, for the argument list:

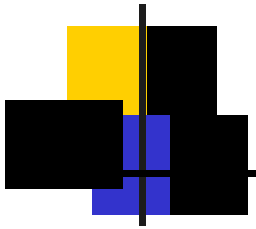
- If you wish to read in the value of a variable of basic data type, precede the variable name with a **&** symbol

- When reading in the value of a variable of derived data type, do not use a **&** before the variable name

Differences in the format commands of the printf() and scanf()



- There is no %g option
- The %f and %e format codes are in effect the same

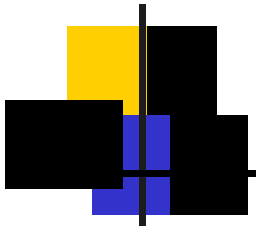


Example for scanf()

```
#include <stdio.h>
   void main()
   {
       int a;
       float d;
       char ch, name[40];

    printf("Please enter the data\n");
    scanf("%d %f %c %s", &a, &d, &ch, name);

    printf("\n The values accepted are :
       %d, %f, %c, %s", a, d, ch, name);
   }
```



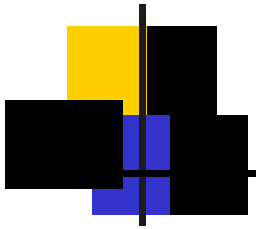
Buffered I/O

- used to read and write ASCII characters

A buffer is a temporary storage area, either in the memory, or on the controller card for the device

Buffered I/O can be further subdivided into:

- Console I/O
- Buffered File I/O

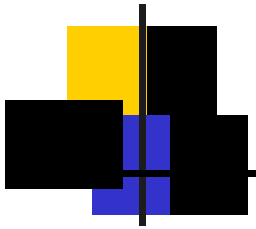


Console I/O

- Console I/O functions direct their operations to the standard input and output of the system

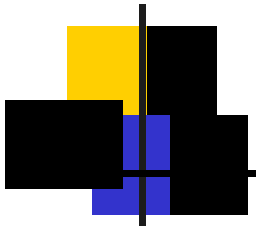
In 'C' the simplest console I/O functions are:

- **getchar()** – which reads one (and only one) character from the keyboard
- **putchar()** – which outputs a single character on the screen



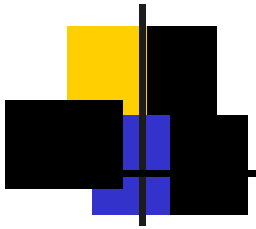
getchar()

- Used to read input data, a character at a time from the keyboard
- Buffers characters until the user types a carriage return
- getchar() function has no argument, but the parentheses - must still be present



Example for getchar()

```
/* Program to demonstrate the use of getchar() */
#include <stdio.h>
void main()
{
   char letter;
   printf("\nPlease enter any character : ");
   letter = getchar();
   printf("\nThe character entered by you is %c", letter);
}
```

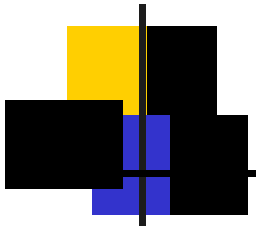


putchar()

- Character output function in ‘C’
- requires an argument

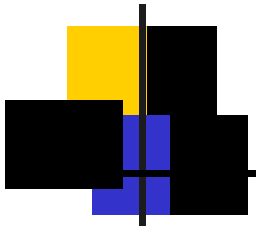
Argument of a putchar() function can be :

- A single character constant
- An escape sequence
- A character variable



putchar() options & effects

Argument	Function	Effect
character variable	putchar(c)	Displays the contents of character variable c
character constant	putchar('A')	Displays the letter A
numeric constant	putchar('5')	Displays the digit 5
escape sequence	putchar('\t')	Inserts a tab space character at the cursor position
escape sequence	putchar('\n')	Inserts a carriage return at the cursor position



putchar()

```
/* This program demonstrates the use of constants and escape
sequences in putchar() */

#include <stdio.h>
void main()
{
   putchar('H'); putchar('\n');
   putchar('\t');
   putchar('E'); putchar('\n');
   putchar('\t'); putchar('\t');
   putchar('L'); putchar('\n');
   putchar('\t'); putchar('\t'); putchar('\t');
   putchar('L'); putchar('\n');
   putchar('\t'); putchar('\t'); putchar('\t');
   putchar('\t');
   putchar('O');
}
```

Example