



# COMPUTER GRAPHICS

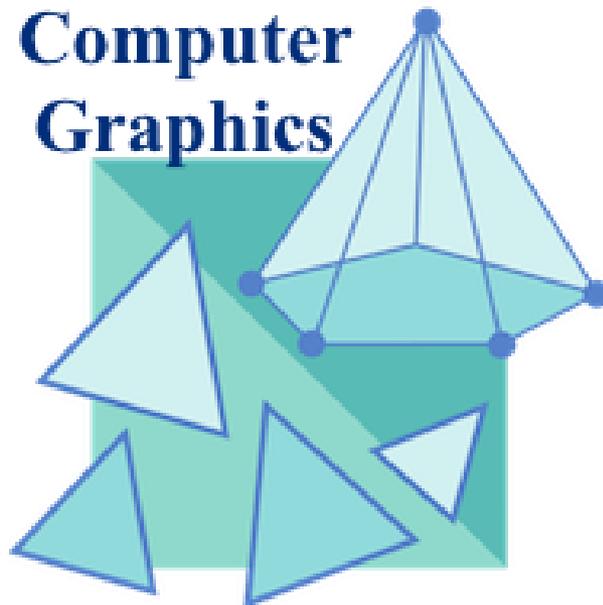
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# Outline

- **Introduction.**
- **Computer Graphics Definition.**
- **Computer Graphics Uses.**
- **Elements of Pictures.**

# Introduction

- To display a picture of any size on a computer screen is a difficult process. Computer graphics are used to simplify this process.



# WHAT IS COMPUTER GRAPHICS (CS)?

C.G. is pictures that generated by a computer.

- Usually, the term refers to computer-generated image data created with the help of specialized graphical hardware and software.
- Hardware tools include :
- **Display Devices** such as video monitors, printers, ... to **display graphics** , **Input Devices such as** mouse, trackball, ... **the user point to items and draw figures**

# Computer-Generated Picture Uses

## 1. Art, Entertainment, and Publishing

- **Movie, Production, Animation, and Special Effects**  
**Computer animations are seen on T.V. Computer Games, Browsing on the World Wide Web, Side Book, and Magazine Design.**



# Cont...

## 2. Computer Graphics and Image processing.

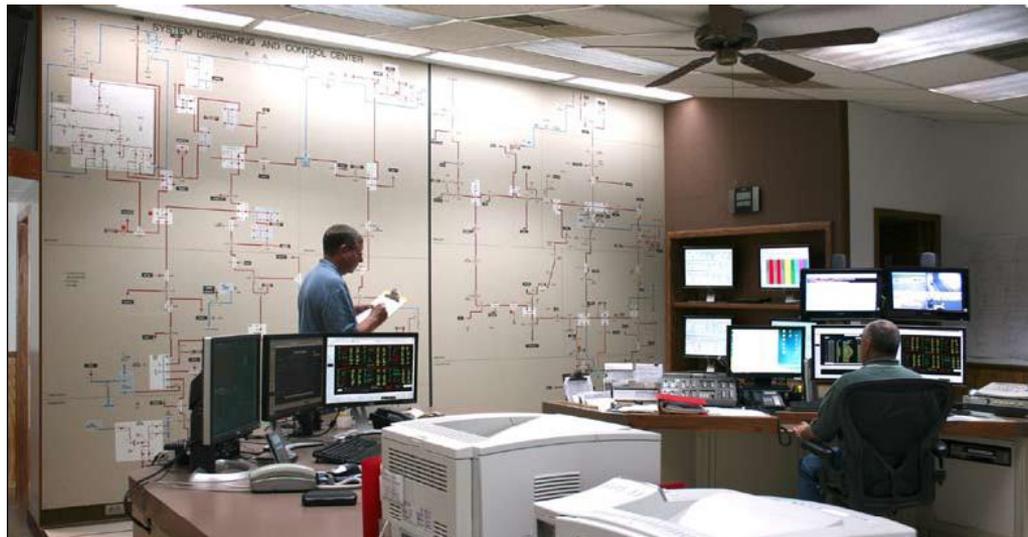
C.G. task is to create pictures and image in a computer.



# Cont...

## 3. Monitoring a process

Complex systems (factories, power plants,..) must be monitored to watch out (by human) for impending trouble.



# Cont...

## 4. Displaying Simulations.

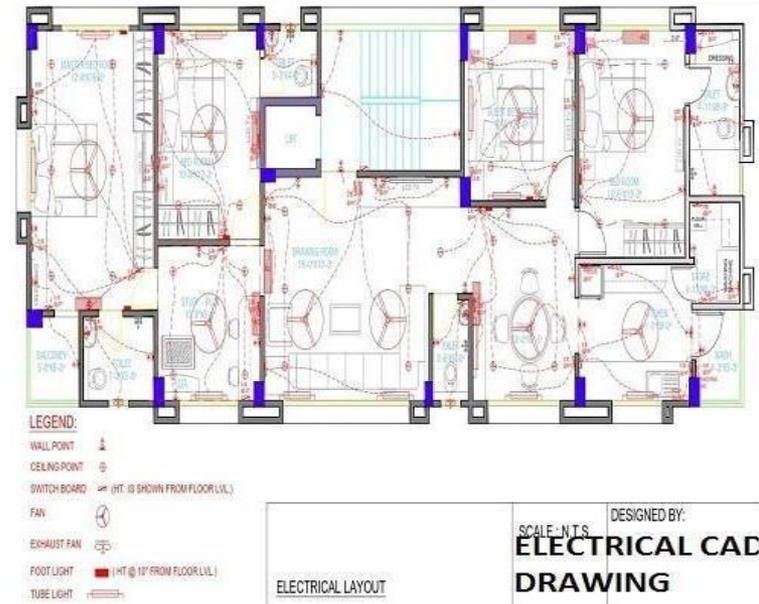
A variety of systems can be profitably simulated such as Virtual reality.



# Cont...

## 5. Computer-Aided Design

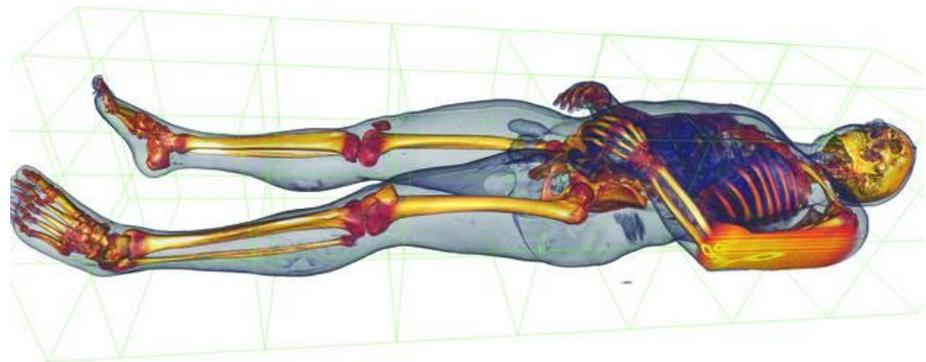
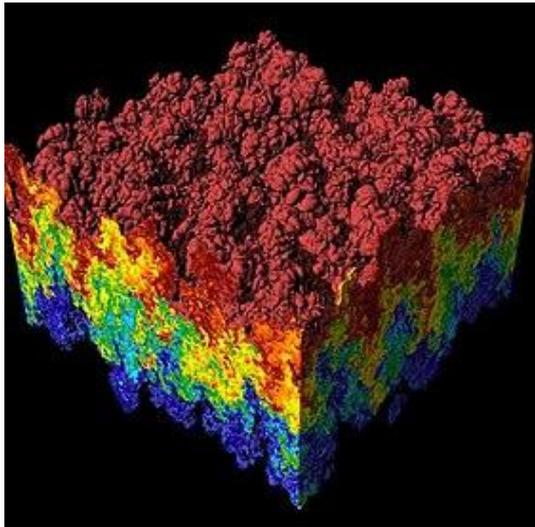
A number of disciplines use computer graphics to facilitate the design of system or product.



# Cont...

## 6. Scientific Analysis and Visualization

Although the Scientific data can be difficult to **visualize** but the graphics is a good tool to represent scientific information.



# Elements of Pictures created in computer graphics

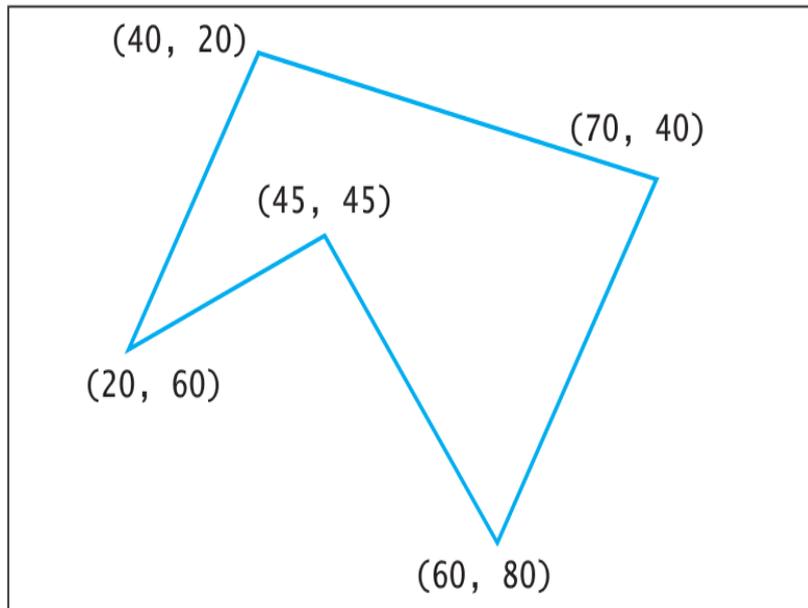
- **Output Primitive** is the basic objects of pictures, such as polylines, text, filled region, raster images and Representation of shades.
- **Attributes** (الخصائص) of a graphic primitive (بدائي) are the characteristics that affect how it appears such as Color and Thickness .
- There are five elements of pictures (Output Primitive) :

# Elements of Pictures

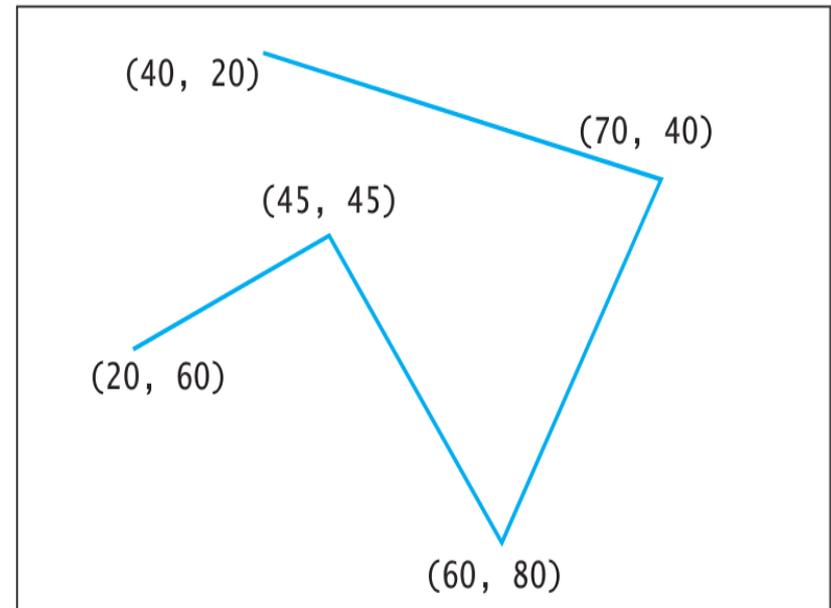
1. **Polylines** is a connected sequence of straight lines.
  - Polylines can appear as a smooth curve
  - The pictures made up (تتكون) of polylines are called line drawing .
  - A polyline with several lines, these lines call an edge .
  - Two adjacent (متجاورة) lines meet (تتجمع) at a vertex .

# Cont...

- if the first and last points are connected by an edge, the polylines is a **Polygon**.



(a) Polygon



(b) Polyline

# The attribute of lines and polylines

- Polyline attributes are the Color and Thickness of its edges.
- The drawing routine (Programmatically):
  - a- Point (Dot): drawDot (X,Y);
  - b- Polylines : drawPolyline (poly);  
where poly is a list of endpoints (Xi,Yi).

# Elements of Pictures

## 2- Text

There are Two display modes:

- **Text mode** : used for simple input output of characters, A built-in character generating alphabetic, numeric, and punctuation (ترقيم) characters.
- **Graphics mode** : offers a richer set of character shapes than text mode.

# Text Attributes

- Text font, color, size, spacing and orientation.
- The shape of character can be defined by a polylines or by an arrangement of dots.



Text mode

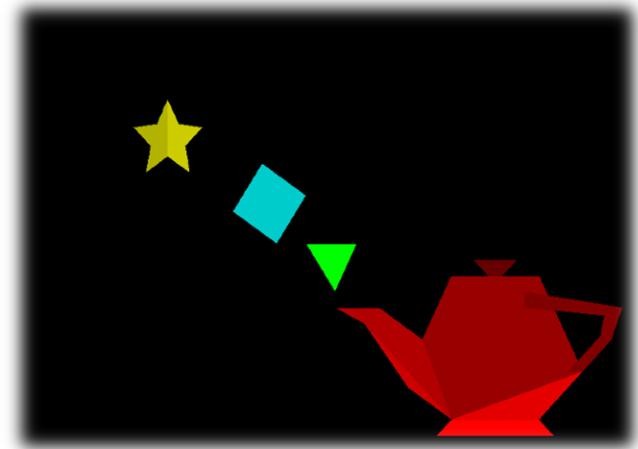


Graphics mode

# Elements of Pictures

**3- Filled Regions (fill area)** is a shape filled (يملئ) with some color or pattern, the boundary is a polygon.

- The routine for this primitive is:  
`fillPolygon (poly, pattern);`



Where the **poly** is a variable hold the data for the polygon while **pattern** used for filling.

# Conti...

## 4- Raster Image

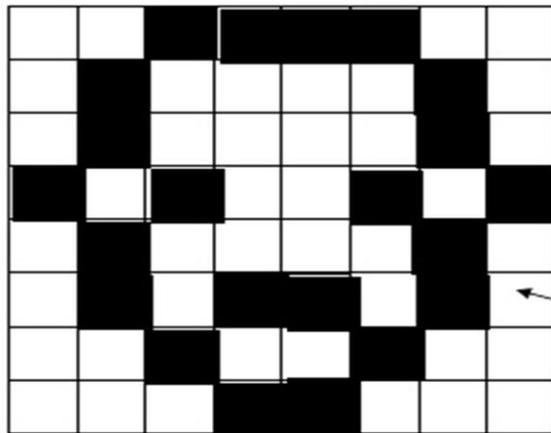
- The image is made up of many small “cell” in different shades of gray.
- The individual cells are often called Pixel.
- A raster image is stored in computer as an **array** of numerical values.
- Each value of the pixel stored in array that called a “**pixel map**” or “**bitmab**”.

# Pixels Map



## BIT Map Graphics

SCREEN



PIXEL

Bit Map = the graphic is made up from a series of pixels

MEMORY

0	0	1	1	1	1	0	0
0	1	0	0	0	0	1	0
0	1	0	0	0	0	1	0
1	0	1	0	0	1	0	1
0	1	0	0	0	0	1	0
0	1	0	1	1	0	1	0
0	0	1	0	0	1	0	0
0	0	0	1	1	0	0	0

MEMORY REQUIRED

8 BITS X 8 BITS = 64 BITS  
= 8 BYTES

# Q\ How are raster image created?

## **A. Hand-designed images**

A designer figures out what values are needed for each cell and types them into memory.

## **B. Computed image**

An algorithm is used to render a scene (مشهد), which might be modeled abstractly in computer memory.

## **C. Scanned image**

A photograph or television image can be digitized  
And attach them to a computer.

# Elements of Pictures

**5- Representation of shades of gray and color in raster images** is the manner (اسلوب) in which the various shades of gray or color are represented in the bitmap.

The most common methods for representation of shades:

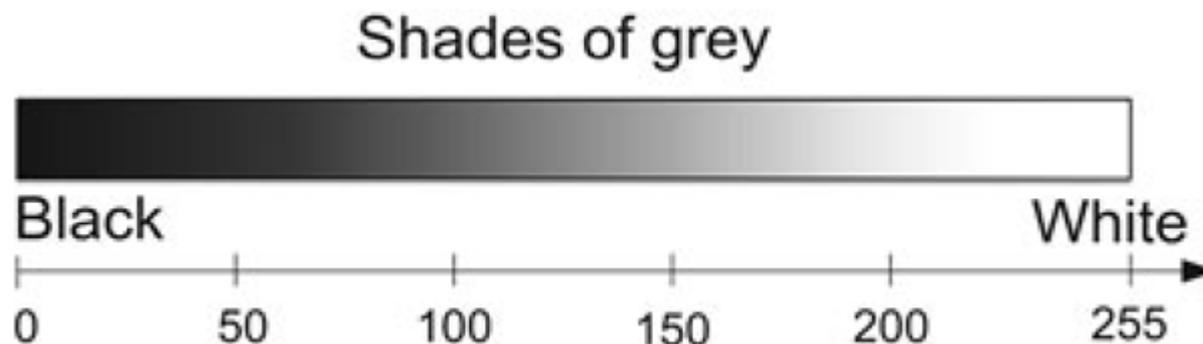
- 1- Gray-scale raster images**
- 2- Color raster images**

# 1- Gray-scale raster images

- If there are only two pixel values in a raster image, it is called bi-level or “One-bit-per-pixel” image.
- When the pixels in a gray-scale image take on more than two values. Gray-scale are called **pixel depth** (the number of bits needed to represent their gray levels).

# Conti...

- There are  $2^n$  gray-levels in an image with pixel depth n. the common values:
  - ❖ Two bits per pixel produce 4 gray levels.
  - ❖ Four bits per pixel produce 16 gray levels.
  - ❖ Eight bits per pixel produce 256 gray levels.



# Conti...

- The effect of pixel depth in gray-scale level is (Quantization(التكميم))
- When an image uses eight bits per pixel is altered (تغير) so that fewer bits per pixel are utilized, this caused to loss a significant (ملحوظ) in quantity, this effect is called **banding**.



## 2- Shades of color raster image

- Each pixel in color image has a “**color value**”.
- The common way is to describe a color as a combination of amount of red, green and blue components.
- The number of bits used to represent the color of each pixel is called the **color depth** of the pixel.
- **True color** is a highest quality images that have 24 a color depth so that use a byte for each component.

# Color value and perceived color

Color value	displayed
0,0,0	black
0,0,1	blue
0,1,0	green
0,1,1	cyan
1,0,0	red
1,0,1	magenta
1,1,0	yellow
1,1,1	white

*Thanks!*