



COMPUTER GRAPHICS

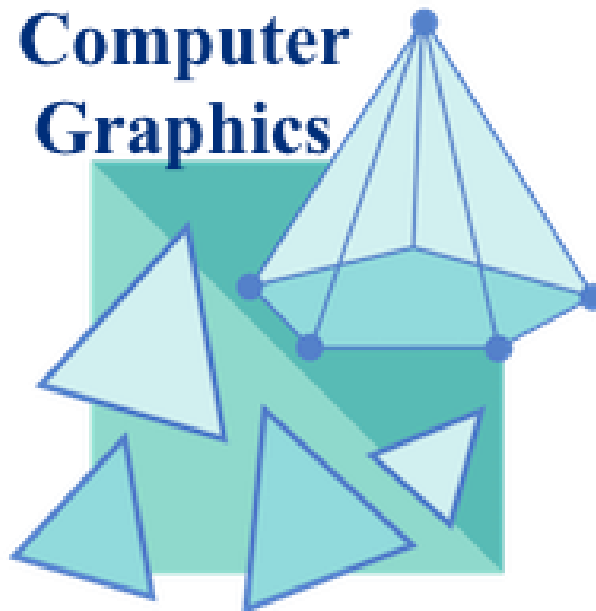
By
Assis. L. Mohamed A. Abdul-Hamed
Computer science & IT collage – Basra – Iraq
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Outline

- **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.

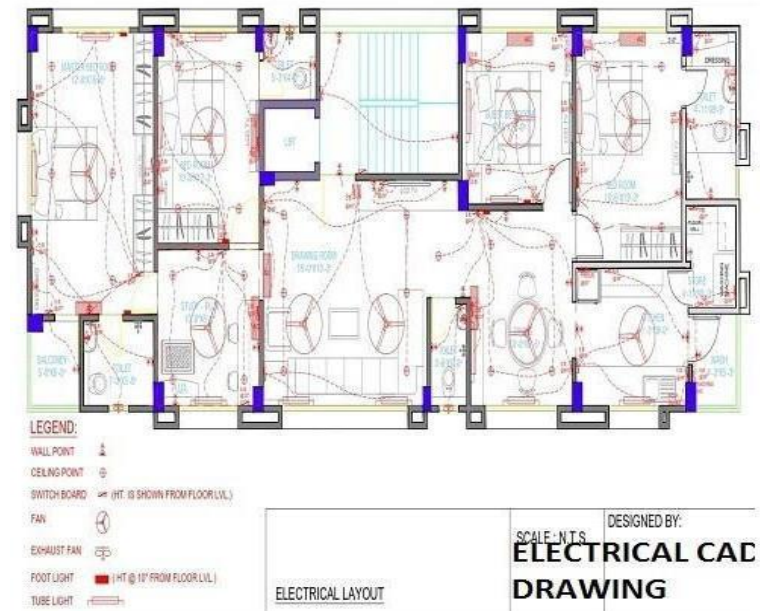
A variety of systems can be profitably simulated such as Virtual reality.



Cont...

5. Computer-Aided Design

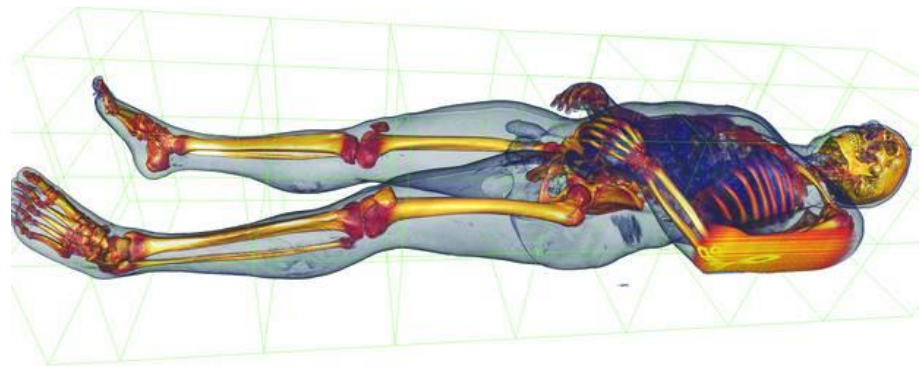
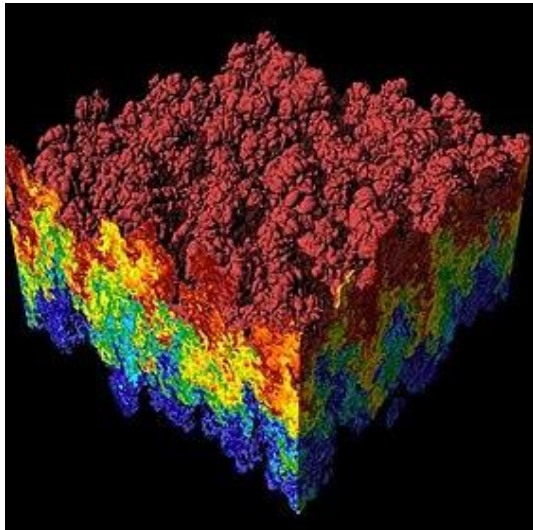
A number of disciplines use computer graphics to facilitate the design of system or product.



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

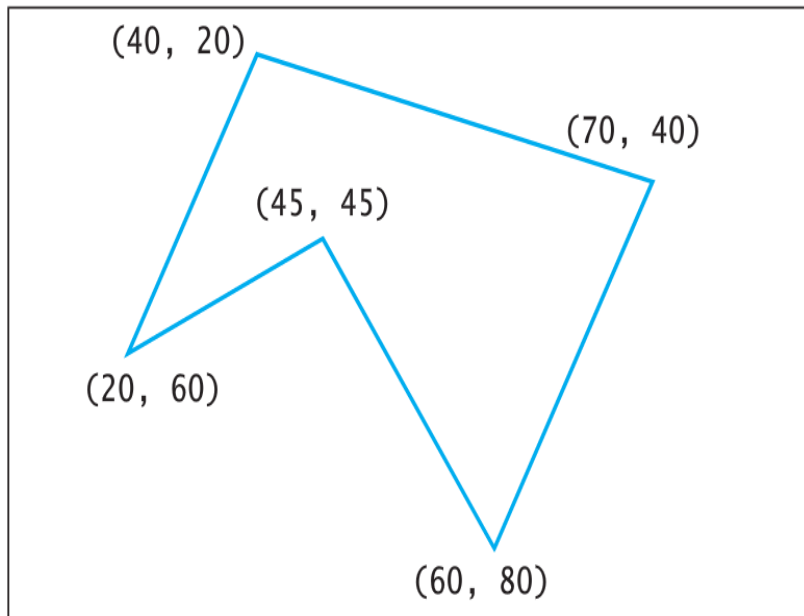
- **Output Primitive** is the basic objects of pictures, such as polylines, text, filled region, raster images and Representation of shades.
- **Attributes** (الخصائص) of a graphic primitive (بدائي) are the characteristics that affect how it appears such as Color and Thickness .
- There are five elements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

Elements of Pictures

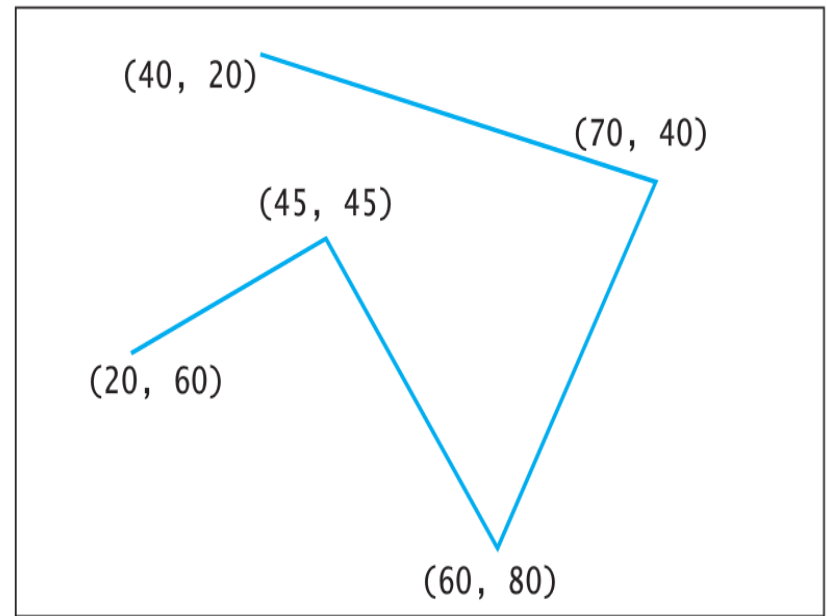
1. **Polylines** is a connected sequence of straight lines.
 - Polyline can appear as a smooth curve
 - The pictures made up (تتكون) of polylines are called line drawing .
 - A polyline with several lines, these lines call an edge .
 - Two adjacent (متجاورة) lines meet (تتجمع) at a vertex .

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:

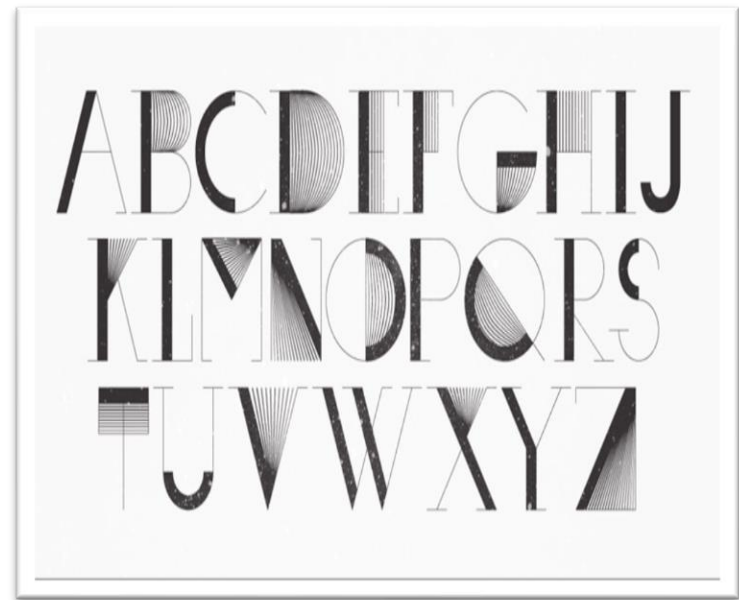
- **Text mode** : used for simple input output of characters, A built-in character generating alphabetic, numeric, and punctuation (ترقيم) characters.
- **Graphics mode** : offers a richer set of character shapes than text mode.

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

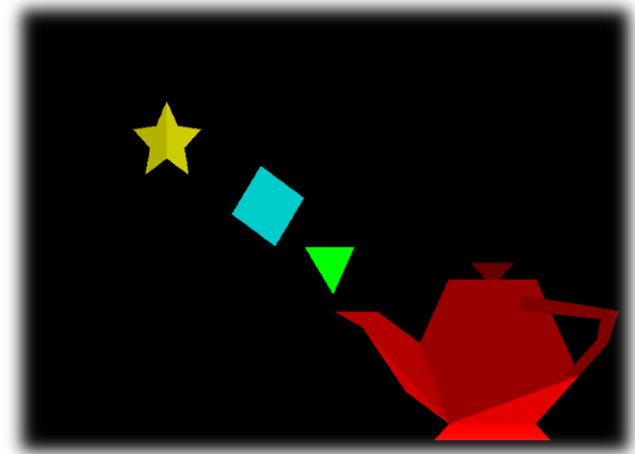
Elements of Pictures

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.

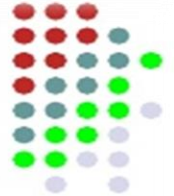


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4- Raster Image

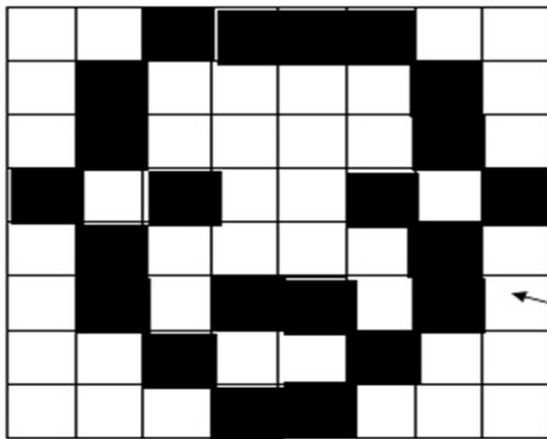
- The image is made up of many small “cell” in different shades of gray.
- The individual cells are often called **Pixel**.
- A raster image is stored in computer as an **array** of numerical values.
- Each value of the pixel stored in array that called a “**pixel map**” or “**bitmab**”.

Pixels Map



BIT Map Graphics

SCREEN



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



PIXEL

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:

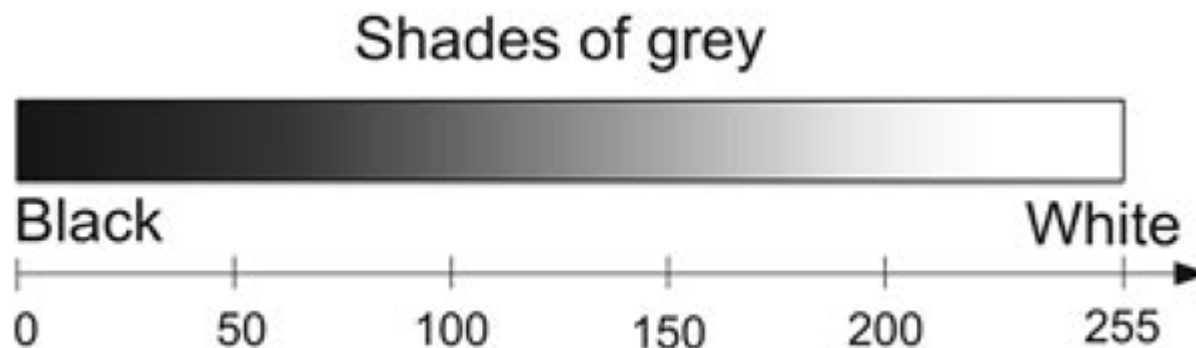
- 1- Gray-scale raster images**
- 2- Color raster images**

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!