## 1. Describe Video Basics with its Property

- Video is a sequence of still image representing scenes in motion. Video will be "capturing, recording, processing, storing, transmitting, and reconstructing" all done electrically. Digital video comprise a series of orthogonal digital images displayed in rapid succession at a constant rate.

### Properties of Video

| Properties | Description |
|---|---|
| Frame | Each page or image is called frame |
| Pixel | Pixel is the smallest addressable screen element in image. The size of each frame is measured by digital unit in pixels in horizontal and vertical (width x height) |
| Frame Per Second (FPS) | No of frame per second is measured by frame per second. The minimum frame rate to achieve the illusion of a moving image is about 15 frames per second. Movie film is shot at the frame rate of 24photogrames/s, which complicates slightly the process of transferring a cinematic motion picture to video. |
| Color depth | No of bit used to represent the different color is called color depth, if there is no color, 1 bit is used on or off. With 8 bit can represent 256 different colors. Windows 7 supports up to 48 bit color depth. |
| Bit rate or bit per Second (BPS) | The number of bits that are conveyed or processed per second. BPS is measured by the width x height x Color Dept x FPS. |
| Video size | How bit is the digital video file size. It can measured by width x height x Color Dept x FPS x runtime in second. |

## 2. Explain in detail basic video format.

Most video formats are described by the following characteristics:

- **Standard**
- **Image dimension and aspect ratio**
- **Frame rate**
- **Scanning method**

**Video Standard**

- A number of video standard have emerged over the year.
- Standard definition (SD) video formats have been used for broadcast television from the 1950s to the present.
- These include NTSC, PAL, and SECAM regional video standards, with each used in certain countries and regions of the world.
- **NTSC (National Television System Committee) :**
- The television and video standard used in most of the America. Taiwan, Japan, and Korea.

- **PAL (Phase Alternating Line) :**
- The television and video standard used in most of Europe. Brazil, Algeria, and China.
- **SECAM :**
- A video standard that is based on PAL and used in countries such as France, Poland, Haiti, and Vietnam. SECAM is not supported by final Cut Pro. However, editing work is usually done in PAL and converted to SECAM for broadcasting.
- Originally, all these formatted were analog. More recently, digital SD video formats were introduced. As well as digital high definition (HD) video formats.

**Image Dimensions and Aspect Ratio**

- The horizontal and vertical pixel dimensions of your format determine the frame size and aspect ratio.
- For example, SD NTSC video is 720 pixels wide and 486 pixels tall. HD video is either 1280 x 720 or 1920 x 1080. And is usally referred to by the vertical dimension (for example, 720 or 1080) and the frame rate.
- Digital cinema formats are generally referred to using their horizontal dimension as either 2K, 3K, or 4K. Shorthand for at least 2,000 pixels, 3,000 pixels, or 4,000 pixels wide.

**Aspect Ratio**

- The aspect ratio of a video frame is the width with respect to the height.
- SD video has an aspect ratio of 4:3 while HD video uses 16:9. Digital cinema formats use the 16:9 aspect ratio as well as closely related film-based aspect ratios.
- 1280/720 or 1920/1080 is equivalent to 16:9, while 720/480 is not equivalent to 4:3. This is because SD digital video uses pixels that are rectangular, not square.

**Frame Rate**

- The frame rate of your video determines how quickly frames are recorded and played back.
- The higher the number of frames per second (fps). The less noticeably the image flickers on screen.

**Scanning Method**

- Video frames are composed of individual lines, scanned from the top of the screen to the bottom.
- Lines may be scanned progressively one line at a time.

**A. Interlace Scanning**

- An interlaced scan begins just as you would think, but reaches the bottom after only half number of scan lines has been completed.
- Frame rates lower than 40 fps can cause noticeable flicker.

**B. Progressive Scanning**

- This process scans every other line of the image, first all the odd lines and then the

even lines

## 3. Explain in detail different types of monitor

### Monitors

- The monitor works with a video card, located inside the computer case, to display images and text on the screen.
- Newer monit0rs usually have LCD (Liquid Crystal Display) or LED (light-Emitting Diode) displays.
- These can be made very thin, and they are often called flat-panel displays. Older monitors are much larger and heavier, and they take up more desk space.

### VGA

- Short for video Graphics Array, VGA is a popular display standard developed by IBM and introduced in 1987, VGA provides 640 x 480 resolution color display screens with a refresh rate of 60Hz and 16 colors displayed at a time.
- If the resolution is lowered to 320 x 200, 256 colors are shown. Many revisions of the standard have been introduced.
- The most common is super VGA (SVGA), which allow for resolutions greater than 640 x 480, such as 800 x 600 or 1280 x 760. A standard VGA connection has 15 pins and is shaped like a trapezoid.

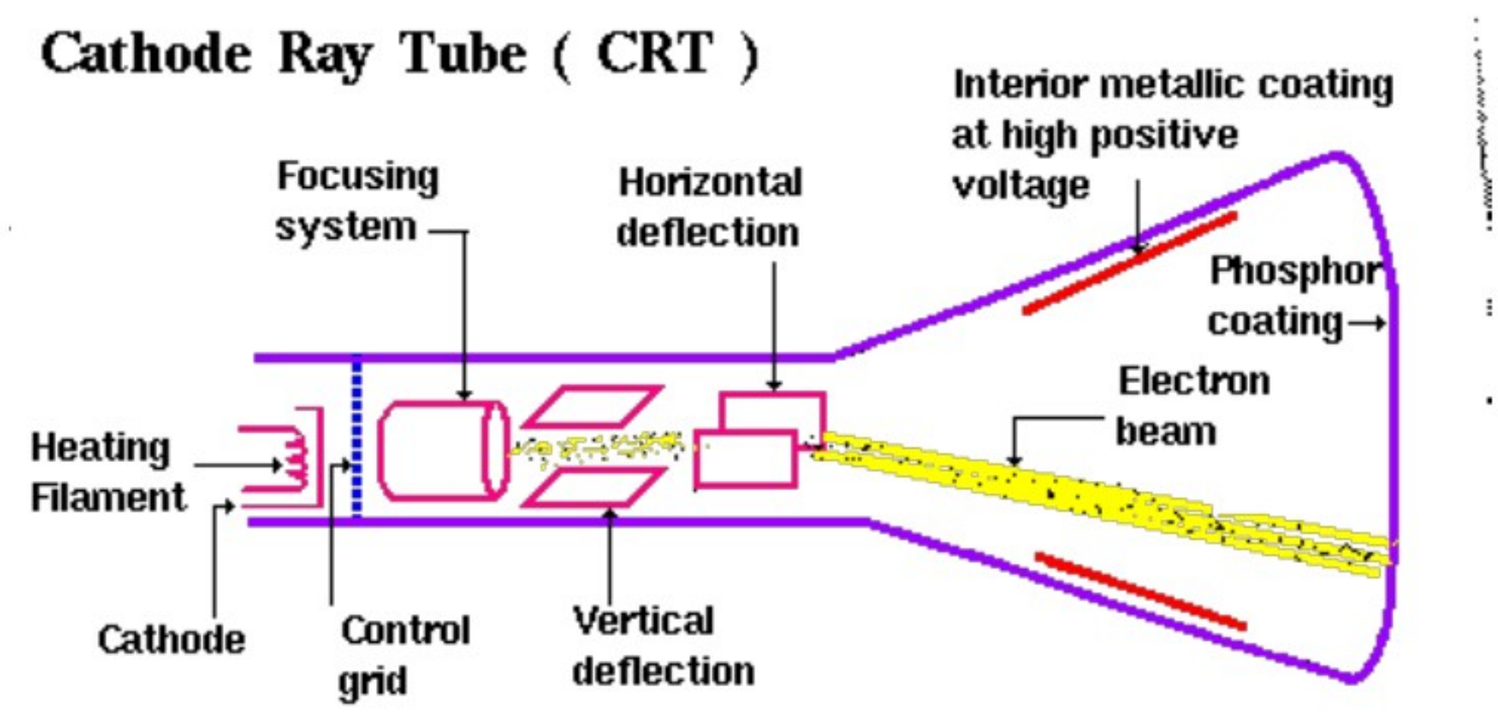
### Monitor Type

The monitor is characterizing by their supported display card standards. There are basically three main type of monitors.

1. **Digital Monitor**
   - The older monitor which uses MDA, CGA and EGA video standards (described in detail following section) are called digital monitors. The data describing the pixel colors are sent from the video adapter to the monitor in a series of digital signals which are stream of data bits. For video cards that and display only a few colors, the digital monitor is preferable and also economical because the circuit is simple than analog system. Monochrome, CGA standard and EGA standard monitors are common digital monitors.
2. **Analog Monitor**
   - The analog type monitors use the VGA standard. The VGA standards allow transfer the color information from the video adapter to the monitor as analog signals. Analog monitor are support 256 different color values for each red, green and blue color which make a total of 16.7 million different color combination.
3. **Multi-Scanning Monitor**
   - These monitors can be connected to a wide variety of video boards and they can be sued with analog or digital video adapters. They can switch automatically or manual for working analog or digital monitor. They contain more sophisticated electronics circuit which gives more flexibility to work on different display standards.

## CRT Monitor

- The PC Monitor is primary output devices which can display text and graphics on its CRT screen.
- The monitor contains a large vacuum tube that is similar to one found in a television's.
- The front part is tube where we seen the text and/or graphics and rear part contains electron guns which is surrounded by control circuit.
- The monochrome monitor contains single gun while color monitor contain three guns for emission of electron.




## Construction:

The cross-section view of a general purpose electrostatic CRT its four major Sections are:

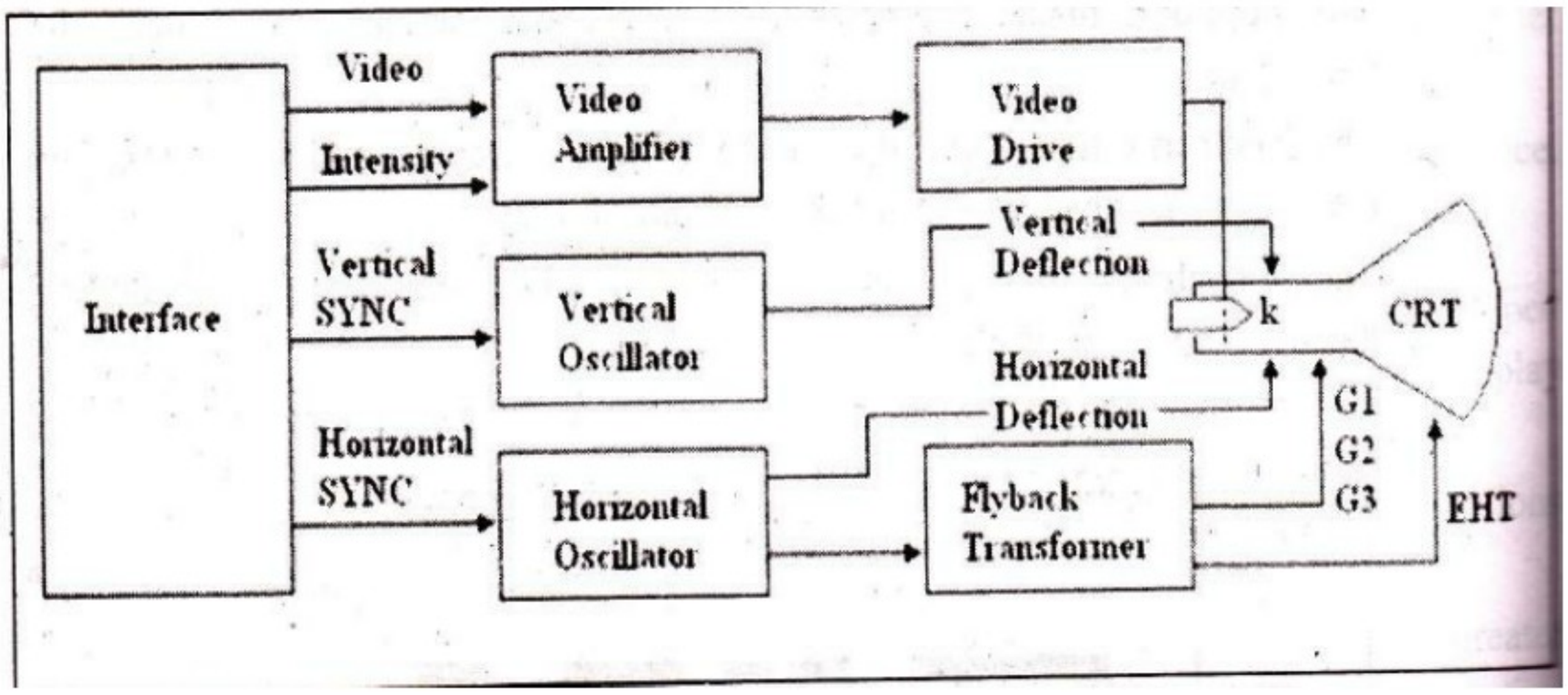
1. An Electron Gun: for producing a stream of electrons.
2. Focusing and Accelerating anodes (G3): for producing a narrow and sharply-focused beam of electrons.
3. Horizontal and Vertical deflecting plates: for moving beam horizontally and vertically for controlling the path.
4. Screen: a glass envelops having a phosphor coated screen at its flares end which produced a bright spot when struck by a high velocity electron beam. This phosphors material is arranged into an array of millions of tiny cells, called dots.

## Working:

- The main unit in the CRT is CRT itself. It is some time refers as a picture tube.
- The CRT is an evacuated glass tube with a fluorescent coating on the inner front surface, which is called screen.
- An electron gun at one end emits an electron beam.
- This beam is directed towards the screen.
- When the beam strikes on the screen, the phosphor coating on the screen produces

illumination at that spot.

- The electron beam is deflected horizontally and/or vertically using horizontal and vertical deflecting plates.
- To produce an image, the beam is turned on or off.
- The video information from the computer is used for turning the beam on or off at appropriate places when the beam scan the screen.




**Block Diagram of CRT monitor**

## Flat Panel Display (FDP) Monitor:

- Flat-panel display (FPDs) is thin, bright display outputs that are gaining a foothold on desktops as a replacement for traditional CRT monitors.
- The most obvious benefit id the much smaller amount of desk space required, because there is no big case housing the electron gun, nor a heavy glass front.
- Because they don't rely on transitory phosphors to create an image, they are free from flicker (and produce no radiation).
- FPDs are also two to the three times brighter than CRT screens. Since the screen is flat, this means that there is no distorted image at the edge of the viewing area, as there is with curved CRT monitors.
- FPDs are generally easier on the eyes and don't require a "warm-up" period to reach full color saturation.
- FPDs create an image made of pixels, just like their CRT counterparts, but they use different technology to accomplish that task.
- Serval different types of FPDs are available today, varying in cost, image quality, and several other factors that affect both suitability to different computing applications and user acceptance.

## 4. Explain in detail Display controller

### Display Controllers

### Image Formation on the screen (working of Display Controller)

- The display controller gets the inputs and commands from the user and determines the image to be displayed on the monitor.
- The display controller will divide the image into a number or pixels.
- The image which is to be displayed is stored in the frame buffer.The image will be stored as a matrix of intensity values.
- The image will be display onto the television monitor and the video controller will act as a simple interface that passes the contents of the frame buffer to the monitor.
- The image must be repeatedly passed to the monitor. 30 or more times a second. These help you to maintain a steady picture on the screen.
- The video controller simple reads each successive byte of data from the frame buffer and converts its 0s and 1s into the corresponding video signal.
- This signal is then fed into the monitor. Producing a black and white pattern on the screen.
- The video controller repeats this operation 30 times a second in order to maintain a steady picture on the screen.

### Memory Mapped Video

- Most peripheral devices on the PC use I/O mapped input/output.
- While the video controller chips that appear on PC video display adapters also map registers to the PC's I/O space. These cards also employ a second from of I/O addressing: memory mapped I/O (input/output).

- In particular, the 80 x 25 text display is nothing more than a two dimensional array of words with each word in the array corresponding a character on the screen.
- This array appears just above the 640K point in the PC's memory address space..
- The display page consumes slightly less than 4 Kilobytes in the memory map; the color display adapters actually provide 32K for text displays and let you select one of eight different displays.

## 5. Explain in detail digital display technology.

### Thin Film Display (TFT)

- A thin-film transistor is a thin substrate, like glass, coated with various thin films or metal, silicon, or plastic.
- The idea is to form a big sheet of very small switching transistor and capacitors.
- It's simply a means of changing the current applied to individual pixels on a display-virtually all active-matrix displays, from AMOLED displays to nearly all LCDs, use TFTs.

### Liquid Crystal Displays (LCD)

- It is used for a wide variety of inexpensive applications, from digital watches to children's toys, from pagers and cell phone to ATMs.
- LCDs form an image by using transparent organic polymers sandwiched between a pair of polarizing filters, with some form of black-lighting.
- The filters are set at a 90-degree angle to each other.
- In an uncharged state (no current applied), the crystals are aligned so that light can pass through the top filter.
- When a current is added, the crystals align to the electric field, blocking the transmission of light. Not all LCD panels are created equal.
- The greater the twist angle, the higher the contrast and the more responsive the display is to changes in current.
- Color light-emitting diode (LED) displays have three adjoining cells, each equipped with a different color filter: one red, one blue, and one green. This allows a display that makes use of the RGB color system.

### Electroluminescent Displays (ELD)

- Electroluminescent Displays (ELD) actually emit light, rather than simply controlling the transmission of a back-light source.
- The light generation comes from phosphors layered between front and back electrodes.
- There are both passive-and active-matrix variations of ELDs. Much like those in LED technology.
- Right now most ELD products are found in technical applications (medical and defence) as

well as ATM machines.

## Plasma Display Panels (PDP)

- Plasma display panels (PDPs) work much like the fluorescent lights found in most offices by energizing an inert gas.
- Phosphor films are used to produce a color image.
- This technology is used to manufacture very large FPDs.
- Like florescent lights, PDPs are relative power consumption. Have thus far limited their use for PC applications.

### Working:

- A plasma display consists of millions of tiny cells filled with xenon and neon gas, held between two plates of glass.
- Lines of electrodes run beneath all the cells, and perpendicular lines of electrodes run above them, forming a basic grid.
- The plasma display controllers charge the electrodes beneath and above the cell it needs to light up, and the current passing through the gas in the cell make it glow.
- In many ways, it works just like a tiny fluorescent light.
- The controller lights up the cells each in turn, in a fraction of a second. Too fact for the eye to see.

### Disadvantages:

- Plasma screens are too thick, heavy, and power-hungry to work well in smart phones or tablets.
- It's also difficult to pack a lot of pixels into a small plasma screen, so small devices would suffer from low resolutions.
- The technology produces a noticeable gap between pixels that can lead to the dreaded "screen door effect." You can't see it sitting 10 feet away from a big TV, but it would stand out on a laptop or PC monitor.

## Light Emitting Displays (LED)

- An LED display is a flat panel display, which uses an array of light-emitting diodes as a video display.
- The light behind an LCD panel is one of two major varieties. The first type is CCFL (cold cathode fluorescent lamp), a technology that's sort of like the fluorescent bulbs in your home, only thin and flat.
- The other type is LED (light-emitting diode).
- Using LEDs typically gives a TV a wider color range, a longer life, and lower power consumption.
- Some TVs have LEDs only analog the edge (marketed as "edge-lit LED"), which is less

described because it makes achieving high brightness and even lighting difficult.

## 6. Explain in detail graphics card

- Graphics card also known as, video cards or display adapter, is a device that interfaces with the computer and the monitor is attached to the video adapter. The video adapter is working as a middle man between the processor and the monitor.
- A convectional video card can translate the processor's processed data into a form that the monitor can display. Older video cards only take what the processor created and send it to the monitor. The processor can do all of the work of deciding what would be displayed.

**Components of graphic cards**

The modern PC graphics card consists of four main components

1) **The graphics processor unit (GPU)**
2) **The video memory**
3) **The random access memory digital-to-analogous converter (RAMDAC)**
4) **The driver software**

**1) The graphics processor unit (GPU)**

- A graphics processing unit (GPU), also occasionally called visual processing unit (VPU), is a specialized electronic circuit designed to rapidly manipulate and alter memory to accelerate the creation of images in a frame buffer intended for output to a display.
- The GPUs of the most powerful class typically interface with the motherboard by means of an expansion slot such as PCI Express or Accelerated assuming the motherboard is capable of supporting the upgrade.

**2) The video memory**

- The memory that holds the video image is also referred to as the frame buffer and is usually implemented on the graphics card itself.
- Early system implemented video memory in standard DRAM.
- Modern graphic card implemented video memory on graphic cards. An advantage of implementing video memory on the graphics board itself is that it can be customized for its specific task and, indeed, this has resulted in a proliferation of new memory technologies.
- The following are six popular types of memory used in graphic card.

1. **Video RAM (VRAM):**

   A special type of dual-ported DRAM, which can be written to and read from at the same time. It also requires far less frequent refreshing than ordinary DRAM and consequently performs much better.

2. **Windows RAM (WRAM):**

   Used by the hugely successful Matrix Millennium card, is also dual-ported and can run slightly faster than convectional VRAM

3. **EDO DRAM**

   Provides a higher bandwidth than DRAM, can be clocked higher than normal DRAM and manages the read/write cycles more efficiently

4. **SDRAM**

   Similar to EDO RAM except the memory and graphics chips run on a common clock used to latch data. Allowing SDRAM to run faster than regular EDO RAM

5. **SGRAM**

   Same as SDRAM but also supports block writes and write-per-bit, which yield better performance on graphics chips that support these enhanced features

6. **DDRAM**

   Direct RDAM is a totally new, general-purpose memory architecture which promises a 20-fold performance improvement over conventional DRAM.

**3) The random access memory digital-to-analogue converter (RAMDAC)**

- The computer data is in form of digital while monitor work on analog data.
- In order to display image on the screen, the information in video RAM must be converted to analog signal and sent to the monitor.
- The device that does this is called the RAMDAC (Random Access Memory Digital-Analog Converter).
- The function of RAMDAC is to reads the information on video memory, converts this information and sends it over the video cable to the monitor.

**4) The driver software**

- A modern graphics card's driver software is vitally important when it comes to performance and features.
- It is the driver's job to decide on the most efficient way to use these graphics processor features, depending on what the application requires to be display.
- In most cases, a separate driver is used for each resolution or color depth.

## 7. Explain in detail Video Display Standards

- Initial video standards were developed by IBM as one of the only players in the PC marketplace. Later, Video Electronics Standard Association (VESA) was formed to define new standards for computer video displays.

**1) Monochrome Display Adapter (MDA)**

- MDA was introduced in 1981. It has only support text with 80 character lines and 25 vertical lines on the screen. Typically, the display was green text on a black background. Each character was made by 9 pixel wide and 14 pixels high. The character represented by 7 x 11 pixel matrix and remaining pixel was used for spacing. If you multiply that out you get a resolution of 720 x 350, with refresh rate was 50 Hz.

**2) Hercules Graphics Card**

- A company called Hercules Computer Technology in early 80s developed a MDA-compatible video card that could display MDA text as well as monochrome graphics. The full resolution of the Hercules Graphics Card was 720 x 348. The Hercules card was actually

a very widely-accepted standard in the mid 80s; support for the card was included in popular software package such as Lotus 1-2-3 to allow the display of graphs and charts on the computer screen.

**3) Color Graphics Adapter (CGA)**

- The CGA standard, introduced in 1981, came with 16 KB of video memory and supported several different modes:

**A. Text mode :**

- This included 80 x 25 texts in 16 different colors.
- The resolution however was lower as each character was made up of 8 x 8 pixels instead of the MDA's 9 x 14 pixels.
- A 40 x 25 text mode was also supported in 16 different colors. In both the foreground and background color could be charged for each character.

**B. Monochrome graphics mode:**

- This displayed graphics at 640x200 pixels.
- This was lower than the Hercules card but seemed to serve the purpose for an initial release and this was quickly replaced with the EGA standard.

**C. Color graphics mode:**

- This came in two flavors: a 320x200 pixel mode with four colors and a lesser-used resolution of 160x200 in 16 colors.
- The four-color mode only had two official palettes to choose from: Magenta, cyan, white and background color (black by default). Red, green, brown/yellow and background color (black by default).

**4) Enhanced Graphics Adapter (EGA)**

- The Enhanced Graphics Adapter was introduced by IBM in 1984 as the primary display for the new PC-AT Intel 286-based computer. EGA increased resolution to 640x350 pixels in 16 colors. The card itself contained 16 KB of ROM to extend the system BIOS to add graphics functions.

**A. High-resolution mode:**

- This has 640x350 pixel resolution.
- On any given screen display a total of 16 colors could be displayed; however, these could be selected from a palette of 64 colors.

**B. CGA mode:**

- This has full 16-color version of the CGA 640x200 and 320x200 graphics modes.
- The original CGA modes were present in the card but EGA is not 100% hardware compatible with CGA.

**C. MDA mode:**

- It could be supported to some degree. By setting switches on the card an MDA monitor could be driven by an EGA card however only the 640x350 could be supported.

**5) Video Graphics Array (VGA)**

- With VGA you see a change in the terminology from adapter to array. This was a result of the fact that VGA graphics started to come on the motherboard as a single chip and not as plug-in adapter boards that took up an expansion slot in the computer. While since replaced with other standards for general use. VGA's 640x480 remains a sort of lowest common denominator for all graphics cards.
- VGA supports both graphics and text modes of operation and can be support most of the EGA, CGA, and MDA modes of operation. The most common VGA graphics modes include: 640x480 in 16 colors. Others supported mode by VGA is 640x350 in 16 colors. 320x2000 in 256 colors (Mode 13h).

**6) Super VGA (AVGA)**

- Super VGA was first defined in 1989 by the Video Electronics Standards Associations (VESA); an association dedicated to providing open standards instead of the closed standards from a single company (IBM). While initially defined as 800x600 with 16 colors, SVGA evolved to 1024x786 with 256 colors and even higher resolutions and colors as time went on. The VESA SVGA standard was also called the VESA BIOS EXTENSION (VBE). VBE could be implemented in either hardware or software. Often you would find a version of the VBE in a graphic card's hardware BIOS with extensions in software drivers.

**7) Extended Graphics Array (XGA)**

- IBM's XGA was introduced in 1990 and is generally considered to be a 1024x786 pixel display. Initially, XGA was an enhancement to VGA and added two modes to VGA; 800x600 pixels at 16-bit/pixels for 65,536 colors and 1024x768 pixels at for 256 colors.
- At later, XGA-2 specification added 640x480 at true color, increased the 1024x768 mode to high color (16-bit/pixel for 65,536 colors) and improved the graphic accelerator performance. XGA was an IBM standard; the VESA released a similar standard called Extended Video Graphics Array (EVGA) in 1991. XGA, over time developed into a family of different standards.

**8) Super Extended Graphic Array (SXGA)**

- Super XGA (SXGA) was another step up in resolution and become a family of its own. SXGA support a resolution of 1280x1024 pixels with an aspect ratio of 5:4 and 1:3 million pixels. This resolution is common in 17-inch to 19-inch LCD monitors. The plus version has a resolution of 1400x1050 pixels with an aspect ratio of 4:3 and 1:7 million pixels. You might find this on notebook LCD screens.

**Table gives summary of video standards associated with IBM-PC-descended personal computers:**

| Video standard | Full name | Description | Display resolution (pixels) |
|---|---|---|---|
| MDA | Monochrome Display Adapter | • The original standard on IBM PCs and IBM PC XTs with 4 KB video RAMS.<br>• Supports text mode only. | 720x350 (text) |
| CGA | Color Graphics Adapter | • Introduced as the first color display standard for the IBM PC.<br>• The standard CGA graphics cards were equipped either 16 KB video RAM. | 640x200 (128k)<br>320x200 (64k)<br>160x200 (32k) |
| Hercules | | • A monochrome display capable of Sharpe text and graphics for its time of introduction.<br>• Very popular with the Lotus 1-2-3 spreadsheet, this was one of the PC's first killer apps. | 720x348 (250.5k) |
| EGA | Enhanced Graphics Adapter | • Introduced by IBM.<br>• A resolution of 640x350 pixels of 16 different colors (4 bits per pixel or bpp), selectable from a 64-color palette (2 bits per each of red-green-blue). | 640x350 (224k) |
| VGA | Video Graphics Array | • VGA is actually a set of different resolutions, but is most commonly used today to refer to 640x480 pixel displays with 16 colors (4 bits per pixel) and a 4:3 aspect ratio.<br>• Other display modes are also defined as VGA, such as 320x200 at 256 colors (8 bits per pixel) and a text mode with 720x400 pixels.<br>• VGA displays and adapter are generally capable of Mode X graphics, an undocumented mode to allow increased non-standard resolutions. | 640x480 (307k)<br>640x350 (224k)<br>320x200 (64k)<br>720x400 (text) |

| | | | |
|---|---|---|---|
| SVGA | Super VGA | • A video display standard created by VESA for IBM PC compatible personal computers. | 800x600 (480k) |
| XGA | Extended Graphics Array | • An IBM display standard.<br>• XGA-2 added 1024x768 supports for high color and higher rates, improved performance and support for 1360x1024 in 16 colors (4 bits per pixel). | 1024x768 (786k)<br>640x480 (307k) |
| SXGA | Super XGA | • A widely used de fact0 32 bit True color standard, with an unusual aspect ratio of 5:4 (1.25:1) instead of the more common 4:3 pictures and video will appear letterboxed on the narrower 5:4 screens.<br>• This is generally the physical aspect ratio & native resolution of standard 17th and 19th LCD monitors. | 1280x1024 (1310k) |

## 8. Explain in detail Accelerated Graphics Port (AGP).

- Accelerated Graphics Port (AGP) is an advanced port designed for Video cards and 3D accelerators.
- Designed by Intel and introduced in August of 1997, AGP introduces a dedicated point-to-point channel that allows the graphics controller direct access the system memory.
- The AGP channel is 32-bits wide and runs at 66 MHz. This translates in to a total bandwidth of 266MBps, which is much greater than the PCI bandwidth of up to 133 MBps.
- AGP also supports two optional faster modes, with throughput of 533 MBps and 1.07 GBps.
- It also allows 3-D textures to be stored in main memory rather than video memory.
- Each computer with AGP support will either have one AGP slot or on-board AGP video.