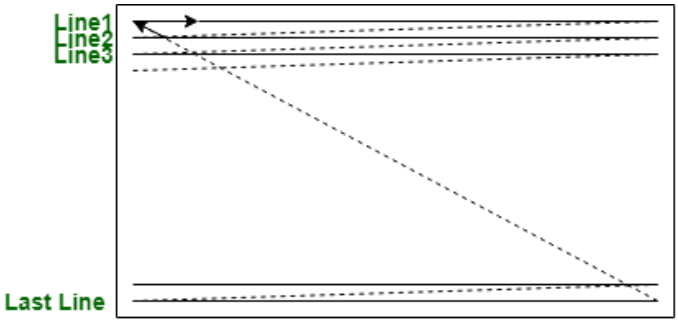
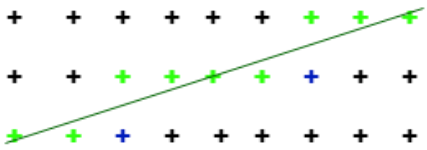
Difference between Random scan and Raster scan :

S.NO	Base of Difference	Random Scan	Raster Scan
1.	Resolution	The resolution of random scan is higher than raster scan.	While the resolution of raster scan is lesser or lower than random scan.
2.	Cost	It is costlier than raster scan.	While the cost of raster scan is lesser than random scan.
3.	Modification	In random scan, any alteration is easy in comparison of raster scan.	While in raster scan, any alteration is not so easy .
4.	Interlacing	In random scan, interlacing is not used.	While in raster scan, interlacing is used.
5.	Line Drawings	In random scan, mathematical function is used for image or picture rendering. It is suitable for applications requiring polygon drawings.	While in which, for image or picture rendering, raster scan uses pixels. It is suitable for creating realistic scenes.
6.	Motion of Electron Beam	Electron Beam is directed to only that part of screen where picture is required to be drawn, one line at a time.	Electron Beam is directed from top to bottom and one row at a time on screen. It is directed to whole screen.
7.	Picture Definition	It stores picture definition as a set of line commands in the Refresh buffer.	It stores picture definition as a set of intensity values of the pixels in the frame buffer.

S.NO	Base of Difference	Random Scan	Raster Scan
8.	Refresh Rate	Refresh rate depends on the number of lines to be displayed i.e. 30 to 60 times per second.	Refresh rate is 60 to 80 frames per second and is independent of picture complexity.



Raster Scan



Random Scan

Bresenham's Line Algorithm

This algorithm is used for scan converting a line. It was developed by Bresenham. It is an efficient method because it involves only integer addition, subtractions, and multiplication operations. These operations can be performed very rapidly so lines can be generated quickly.

In this method, next pixel selected is that one who has the least distance from true line.

The method works as follows:

Assume a pixel $P_1'(x_1',y_1')$,then select subsequent pixels as we work our may to the night, one pixel position at a time in the horizontal direction toward $P_2'(x_2',y_2')$.

Once a pixel in choose at any step

The next pixel is

1. Either the one to its right (lower-bound for the line)
2. One top its right and up (upper-bound for the line)

Computer Graphics Tutorial

It is difficult to display an image of any size on the computer screen. This method is simplified by using Computer graphics. Graphics on the computer are produced by using various algorithms and techniques.

Introduction of Computer Graphics

Computer Graphics involves technology to access. The Process transforms and presents information in a visual form. The role of computer graphics insensible. In today life, computer graphics has now become a common element in user interfaces, T.V. commercial motion pictures.

Computer Graphics is the creation of pictures with the help of a computer. The end product of the computer graphics is a picture it may be a business graph, drawing, and engineering.

In computer graphics, two or three-dimensional pictures can be created that are used for research. Many hardware devices algorithm has been developing for improving the speed of picture generation with the passes of time. It includes the creation storage of models and image of objects. These models for various fields like engineering, mathematical and so on.

Today computer graphics is entirely different from the earlier one. It is not possible. It is an interactive user can control the structure of an object of various input devices.

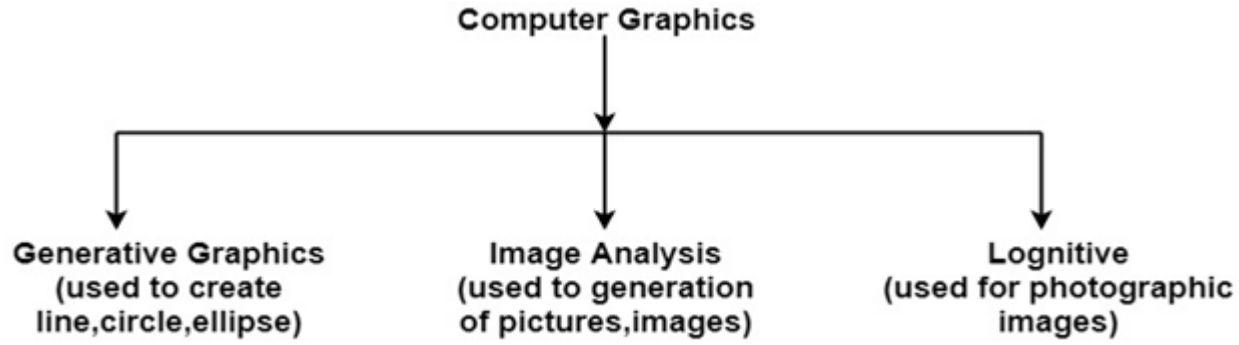
Definition of Computer Graphics:

It is the use of computers to create and manipulate pictures on a display device. It comprises of software techniques to create, store, modify, represents pictures.

Why computer graphics used?

Suppose a shoe manufacturing company want to show the sale of shoes for five years. For this vast amount of information is to store. So a lot of time and memory will be needed. This method will be tough to understand by a common man. In this situation graphics is a better alternative. Graphics tools are charts and graphs. Using graphs, data can be represented in pictorial form. A picture can be understood easily just with a single look.

Interactive computer graphics work using the concept of two-way communication between computer users. The computer will receive signals from the input device, and the picture is modified accordingly. Picture will be changed quickly when we apply command.



Applications of Computer Graphics

Computer graphics deals with creation, manipulation and storage of different type of images and objects.
Some of the applications of computer graphics are:

1. **Computer Art:**
   Using computer graphics we can create fine and commercial art which include animation packages, paint packages. These packages provide facilities for designing object shapes and specifying object motion.Cartoon drawing, paintings, logo design can also be done.

2. **Computer Aided Drawing:**
   Designing of buildings, automobile, aircraft is done with the help of computer aided drawing, this helps in providing minute details to the drawing and producing more accurate and sharp drawings with better specifications.

3. **Presentation Graphics:**
   For the preparation of reports or summarising the financial, statistical, mathematical, scientific, economic data for research reports, managerial reports, moreover creation of bar graphs, pie charts, time chart, can be done using the tools present in computer graphics.

4. **Entertainment:**
   Computer graphics finds a major part of its utility in the movie industry and game industry. Used for creating motion pictures , music video, television shows, cartoon animation films. In the game industry where focus and interactivity are the key players, computer graphics helps in providing such features in the efficient way.

5. **Education:**
   Computer generated models are extremely useful for teaching huge number of concepts and fundamentals in an easy to understand and learn manner. Using computer graphics many educational models can be created through which more interest can be generated among the students regarding the subject.

6. **Training:**
   Specialised system for training like simulators can be used for training the candidates in a way that can be grasped in a short span of time with better

understanding. Creation of training modules using computer graphics is simple and very useful.

7. **Visualisation:**
   Today the need of visualise things have increased drastically, the need of visualisation can be seen in many advance technologies , data visualisation helps in finding insights of the data , to check and study the behaviour of processes around us we need appropriate visualisation which can be achieved through proper usage of computer graphics
8. **Image Processing:**
   Various kinds of photographs or images require editing in order to be used in different places. Processing of existing images into refined ones for better interpretation is one of the many applications of computer graphics.

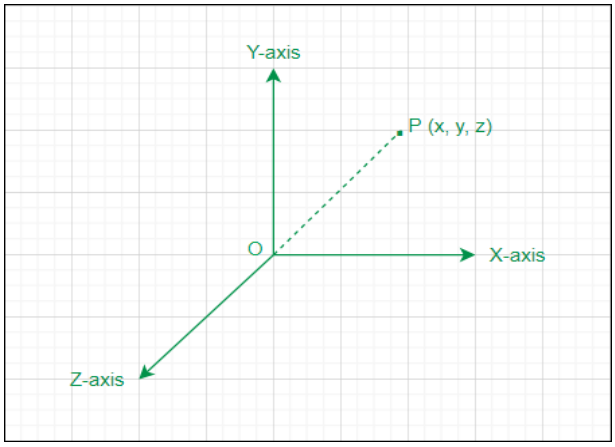
9. **Machine Drawing:**
   Computer graphics is very frequently used for designing, modifying and creation of various parts of machine and the whole machine itself, the main reason behind using computer graphics for this purpose is the precision and clarity we get from such drawing is ultimate and extremely desired for the safe manufacturing of machine using these drawings.

10. **Graphical User Interface:**
    The use of pictures, images, icons, pop-up menus, graphical objects helps in creating a user friendly environment where working is easy and pleasant, using computer graphics we can create such an atmosphere where everything can be automated and anyone can get the desired action performed in an easy fashion.

These are some of the applications of computer graphics due to which it's popularity has increased to a huge extend and will keep on increasing with the progress in technology.

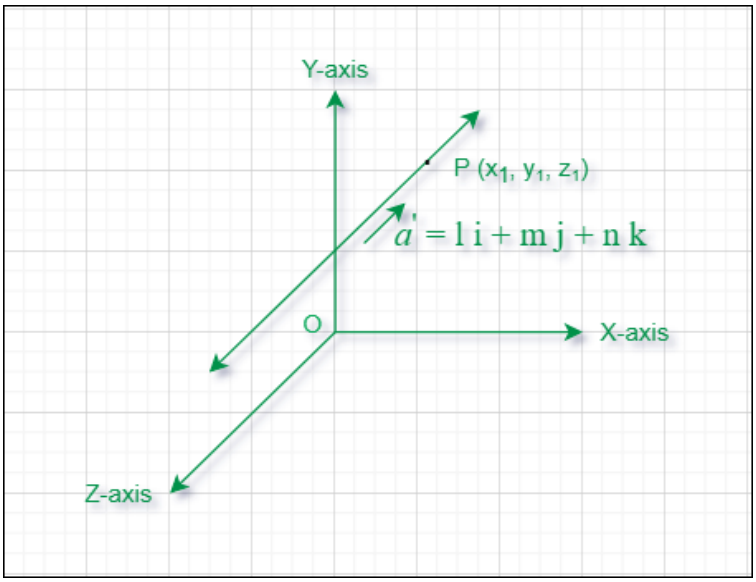
Points, Lines and Planes

A **Point** in three-dimensional geometry is defined as a location in 3D space that is uniquely defined by an ordered triplet (x, y, z) where x, y, & z are the distances of the point from the X-axis, Y-axis, and Z-axis respectively.



Point in 3D space

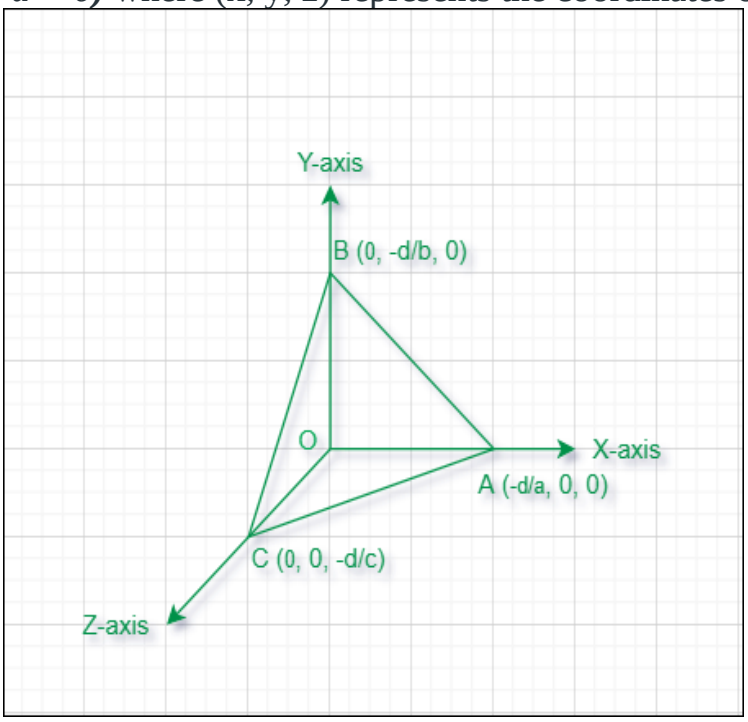
A **Line** in three-dimensional geometry is defined as a set of points in 3D that extends infinitely in both directions and is represented by L : (x – x1) / l = (y – y1) / m = (z – z1) / n; here (x, y, z) are the position coordinates of any variable point lying on the line, (x_1, y_1, z_1) are the position coordinates of a point P lying on the line, and l, m, & n are the direction ratios (DRs). In 3D a line is also formed by the intersection of two non-parallel planes.



Line in 3D space

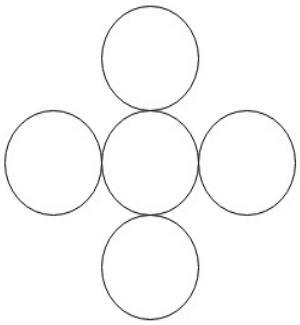
A **Plane** in three-dimensional (3D) geometry can be considered as a surface such that the line segment joining any two points on the surface lies completely on it. The general form of a plane in 3D is a first-degree equation in ***x, y, z*** i.e. ***(****a* ***x*** **+** ***b y***

+ *c* ***z*** + *d = 0)* where (x, y, z) represents the coordinates of a variable point on the plane.

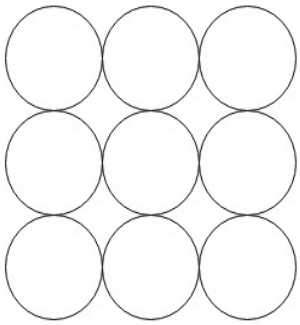


Boundary Filled Algorithm:

This algorithm uses the recursive method. First of all, a starting pixel called as the seed is considered. The algorithm checks boundary pixel or adjacent pixels are colored or not. If the adjacent pixel is already filled or colored then leave it, otherwise fill it. The filling is done using four connected or eight connected approaches.



Four Connected



Eight Connected

Four connected approaches is more suitable than the eight connected approaches.

1. Four connected approaches: In this approach, left, right, above, below pixels are tested.

2. Eight connected approaches: In this approach, left, right, above, below and four diagonals are selected.

Boundary can be checked by seeing pixels from left and right first. Then pixels are checked by seeing pixels from top to bottom. The algorithm takes time and memory because some recursive calls are needed.

DDA Algorithm

DDA stands for Digital Differential Analyzer. It is an incremental method of scan conversion of line. In this method calculation is performed at each step but by using results of previous steps.

Advantage:

1. It is a faster method than method of using direct use of line equation.
2. This method does not use multiplication theorem.
3. It allows us to detect the change in the value of x and y ,so plotting of same point twice is not possible.
4. This method gives overflow indication when a point is repositioned.
5. It is an easy method because each step involves just two additions.

Disadvantage:

1. It involves floating point additions rounding off is done. Accumulations of round off error cause accumulation of error.
2. Rounding off operations and floating point operations consumes a lot of time.
3. It is more suitable for generating line using the software. But it is less suited for hardware implementation.