



GALGOTIAS
UNIVERSITY

**School of Computing
Science and Engineering**

Program: B.C.A.

Course Code: BCAS3003

Course Name: Computer Graphics

Course Prerequisites

- Knowledge of Mathematics**
- Fundamental knowledge of Computer**

Syllabus

Unit 3 – Attributes of Output Primitives

(8 hours)

- Line Attributes**
- Curve Attributes**
- Color and Gray-Scale levels**
- Area-Fill Attributes**
- Character Attributes**
- Bundled attributes**
- Inquiry functions.**

Recommended Books

Text books

- ❑ D. Hearn, P. Baker, "Computer Graphics - C Version", 2nd Edition, Pearson Education, 1997

Reference Book

- ❑ Heam Donald, Pauline Baker M: "Computer Graphics", PHI 2nd Edn. 1995.
- ❑ Harrington S: "Computer Graphics - A Programming Approach", 2nd Edn. Mc GrawHill.
- ❑ Shalini Govil-Pai, Principles of Computer Graphics, Springer, 2004

Additional online materials

- ❑ Coursera - <https://www.coursera.org/learn/fundamentals-of-graphic-design>
- ❑ <https://www.youtube.com/watch?v=fwzYuhduME4&list=PLE4D97E3B8DB8A590>
- ❑ NPTEL - <https://nptel.ac.in/courses/106/106/106106090/>
- ❑ <https://www.coursera.org/learn/research-methods>
- ❑ <https://www.coursera.org/browse/physical-science-and-engineering/research-methods>

Attributes of Output Primitives

- ❑ Any parameter that affects the way a primitive is to be displayed is referred to as an attribute parameter.
- ❑ Example attribute parameters are color, size etc.
- ❑ A line drawing function for example could contain parameter to set color, width and other properties.
- ❑ Line Attributes, Curve Attributes, Color and Grayscale Levels, Area Fill Attributes, Character Attributes, Bundled Attributes

Line Attributes

- ❑ Basic attributes of a straight line segment are its type, its width, and its color.
- ❑ In some graphics packages, lines can also be displayed using selected pen or brush options.
- ❑ Attributes of line are type, width, color, pen and brush

Line Type

- ❑ Possible selection of line type attribute includes solid lines, dashed lines and dotted lines.
- ❑ To set line type attributes in a PHIGS (Programmer's Hierarchical Interactive Graphics System) application program, a user invokes the function **setLinetype(lt)**
- ❑ Where parameter 'lt' is assigned a positive integer value of 1, 2, 3 or 4 to generate lines that are solid, dashed, dash dotted respectively. Other values for line type parameter it could be used to display variations in dot-dash patterns.

Line Attributes

Line Width

- ❑ Implementation of line width option depends on the capabilities of the output device to set the line width attributes.

setLinewidthScaleFactor(lw)

- ❑ Line width parameter '**lw**' is assigned a positive number to indicate the relative width of line to be displayed.
- ❑ A value of 1 specifies a standard width line. A user could set '**lw**' to a value of 0.5 to plot a line whose width is half that of the standard line.
- ❑ Values greater than 1 produce lines thicker than the standard.

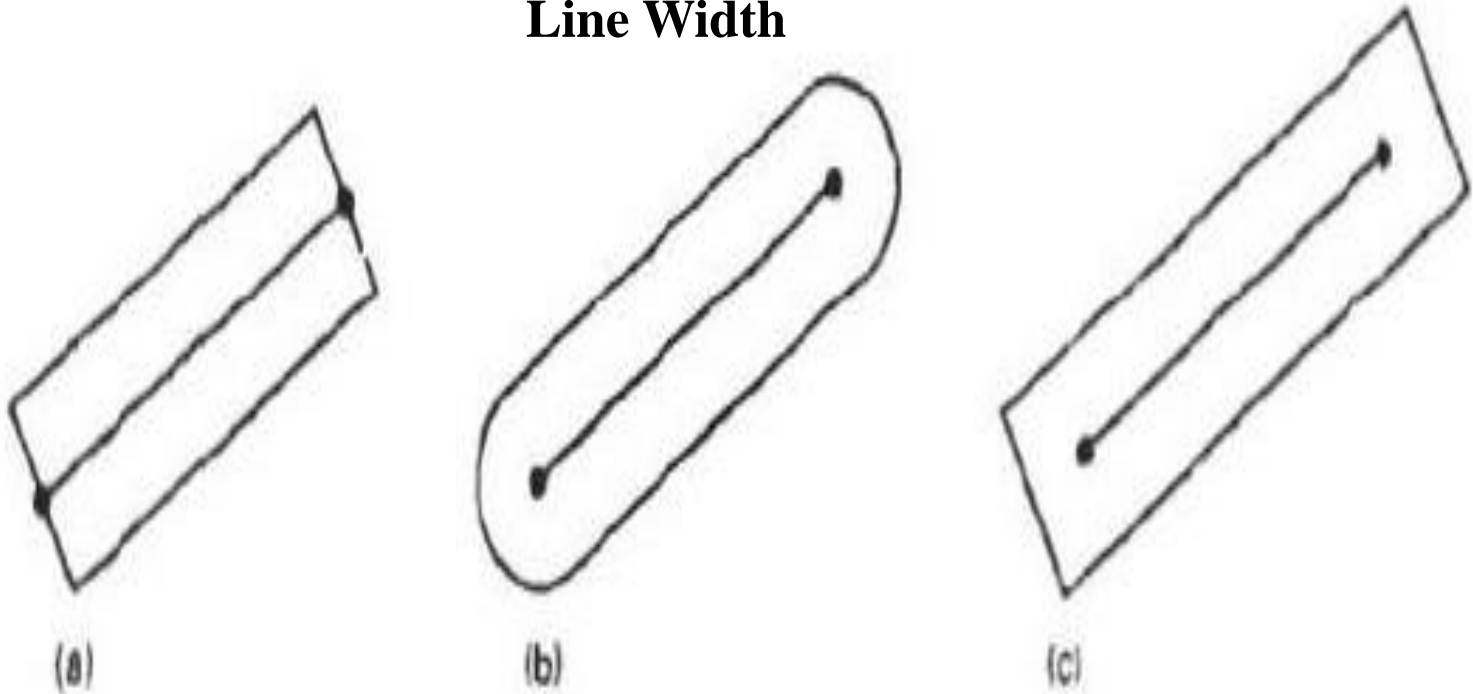
Line Attributes

Line Width

- ❑ We can adjust the shape of the line ends to give them a better appearance by adding **line caps**.
- ❑ There are three types of line cap such as Butt cap, Round cap, Projecting square cap.
- ❑ **Butt cap** is obtained by adjusting the end positions of the component parallel lines so that the thick line is displayed with square ends that are perpendicular to the line path.
- ❑ **Round cap** is obtained by adding a filled semicircle to each butt cap. The circular arcs are centered on the line endpoints and have a diameter equal to the line thickness.
- ❑ **Projecting square cap** is extend the line and add butt caps that are positioned one-half of the line width beyond the specified endpoints.

Line Attributes

Line Width



Thick lines drawn with (a) butt caps, (b) round caps, and (c) projecting square caps.

Line Attributes

Line Width

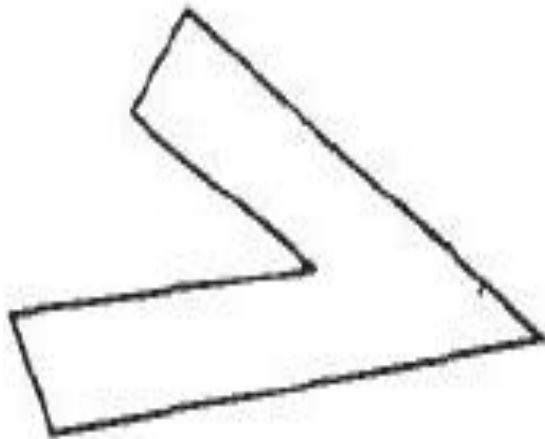
- ❑ Three possible methods for smoothly joining two line segments such as Mitter Join, Round Join, Bevel Join.

Mitter Join

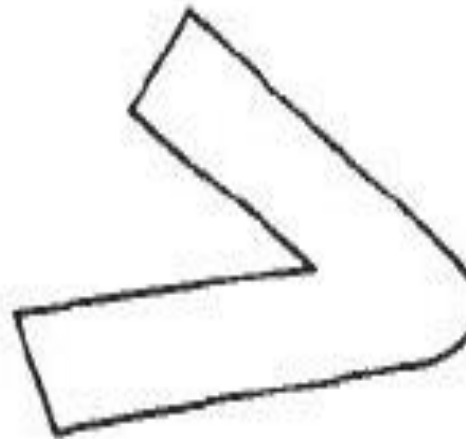
- ❑ A **miter join** is accomplished by extending the outer boundaries of each of the two lines until they meet.
- ❑ A **round join** is produced by capping the connection between the two segments with a circular boundary whose diameter is equal to the width.
- ❑ A **bevel join** is generated by displaying the line segment with but caps and filling in triangular gap where the segments meet.

Line Attributes

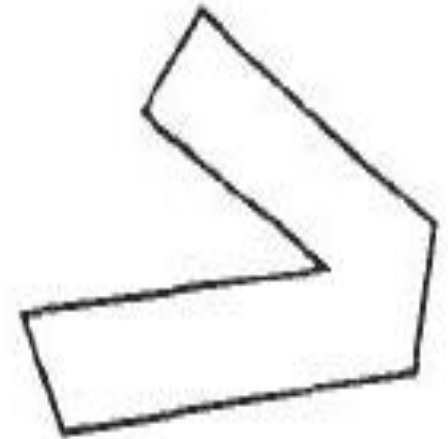
Line Width



(a)



(b)



(c)

Thick line segments connected with (a) miter join, (b) round join, and (c) bevel join.

Line Attributes

Line color

- A poly line routine displays a line in the current color by setting this color value in the frame buffer at pixel locations along the line path using the set pixel procedure.
- We set the line color value in PHIGS with the function **setPolylineColourIndex(lc)**
- Nonnegative integer values, corresponding to allowed color choices, are assigned to the line color parameter 'lc'.

Line Attributes

Example

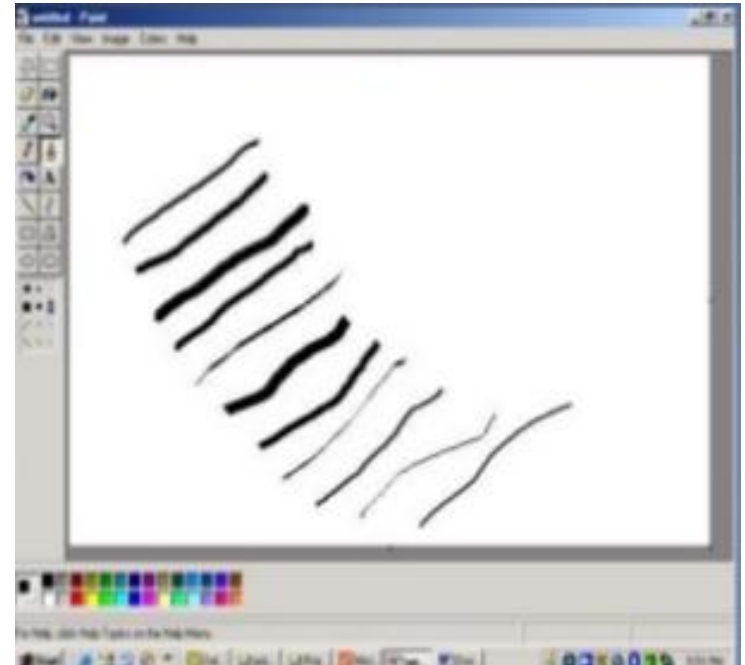
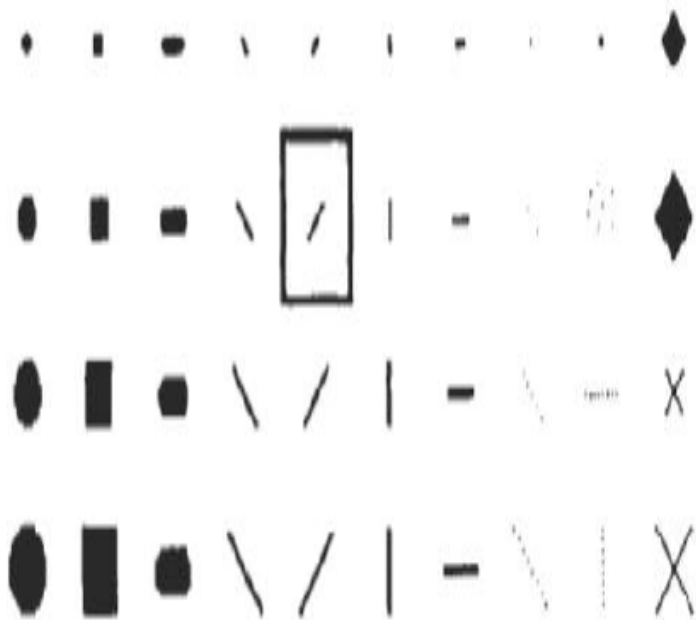
- The following program segment would display two figures, drawn with double-wide dashed lines. The first is displayed in a color corresponding to code 5, and the second in color 6.

```
setLinetype(2);  
setLinewidthScaleFactor(2);  
setPolylineColourIndex (5);  
polyline(n1, wc points1);  
setPolylineColorIndex(6);  
poly line (n2, wc points2);
```

Line Attributes

Pen and Brush Options

- ❑ With some packages, lines can be displayed with pen or brush selections.
- ❑ Options in this category include shape, size, and pattern. Some possible pen or brush shapes are given in Figure



Curve Attributes

- Parameters for curve attribute are same as those for line segments.
- Curves displayed with varying colors, widths, dot – dash patterns and available pen or brush options

Questions

- Explain Line Attributes.



Thank You