

# Computer Graphics 3

## Vector Graphics

### Vector Graphics

- Vector Graphics was originally a graphical display system using a CRT where the electron beam could be moved to any X-Y position.
- Lines and polygons could be traced out by sweeping the beam from point to point, allowing wire-frame images to be displayed.
- Two techniques prevented the image from fading:
  - Continuous redrawing using a monitor with a long persistence phosphor.
  - Using a monitor with a special storage tube which held the image for about 10 minutes.

## Vector Image

- Today, vector graphics has evolved into the modern technique of creating **vector images** by drawing a sequence of **vector objects**.
- Each object is a basic shape of some particular size, colour, etc.
- Equivalent to a list of commands executed in a particular order.
- Examples include:
  - Postscript pages
  - Powerpoint slides
  - HTML pages
  - Java GUIs

## Drawing Programs

- Vector images are created and edited using a drawing program.
- Drawing programs are very common and include:
  - Powerpoint
  - Flash
  - MS Word
  - Star Draw
  - Fireworks
  - Used for this slide show
  - Animations
  - Word processing + simple graphics
  - Part of Sun's Star Office suite
  - Mixed vector+bitmapped graphics

## Typical Objects 1

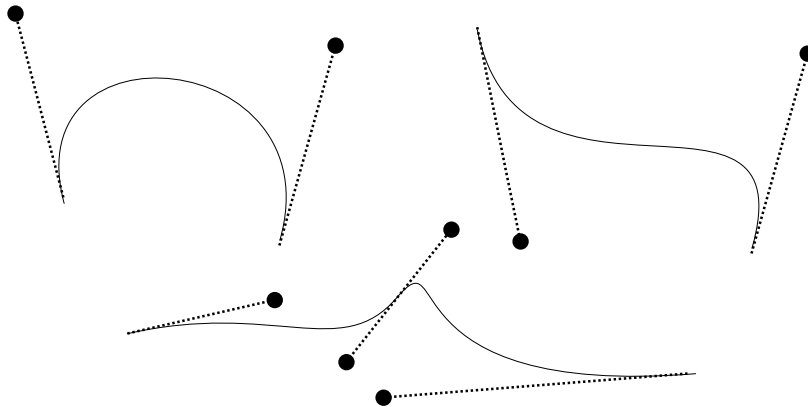
- **Straight Lines:**
  - Drawn between two X-Y positions
  - Colour and dotted line pattern
  - Optional arrow heads
- **Curves:**
  - Bezier curves with moveable control points
- **Squares and Rectangles:**
  - Drawn between two opposite corner points
  - Optional line and fill colours
- **Polygons**
  - Series of connected lines
  - Optional fill colours
  - Optionally open or closed

## Typical Objects 2

- **Circles and Ellipses:**
  - Centre position and radius
  - Optional line and fill colours
- **Text:**
  - Normally drawn inside invisible bounding rectangle
  - Font, size, colour.
  - Selectable left, centre, right alignment
- **Other Shapes:**
  - Stars
  - 3D shapes
  - Connectors

## Bezier Curves

- A Bezier curve is a maths function which is used to draw a smooth curve:
  - Bezier curves use four control points
  - Bezier curves can be smoothly joined together



## Editing Vector Objects

- All the vector objects making up an image are stored in a list.
- Editing the image is simply a case of modifying the appropriate object and then redrawing the list.
- The drawing program usually provides the following facilities:
  - Drag and drop to move objects (translation)
  - Re-sizing
  - Reflection
  - Create new object
  - Change colour, fill, dash-dot pattern
  - Change text, font, size, colour
  - Put on top or at behind other objects