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CG

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Written Assignment 2

Q.1. The animation is widely used in movies advertisement games etc. Animation gives life to the objects present in the scene through various transformation operations animation can be computer assisted or computer generated.

The idea behind the animation is to fool the human eye by displaying images at a certain speed so that they are interpreted as video of moving objects.
Animation techniques can be classified as conventional animation and computer based animation.

Animation Techniques
- Conventional Animation
- Computer based Animation

→ In conventional, all the frames of video are designed and designed by hand. Frames are displayed at the rate of atleast 24 frames per second. The conventional method takes a tremendous amount of time & effort to create a video.

→ Steps:

Storyboard: The sequence of animation is first drafted on paper in the form of sketches which is called a storyboard.

→ Keyframes : keyframes are the first frame of every shot in the sequence. Keyframes are used to interpolate the animation sequence. As the animation is achieved using keyframes, such type of animation is also known as key frame animation.

→ Inbetween : Inbetween are the set of frames b/w successive keyframes. Objects in motion gradually move in subsequent frames and reach to the destination in keyframes.

→ Cels : Instead of applying animation to all the objects together the animation scene is decomposed into small parts called cels. These cels may be independent or partially dependent.

→ Exposure sheet : This is also known as camera instruction sheet or x-sheet. This tool allows the animator to organize his thoughts & give instruction to the camera operator how to shoot the animation.

(2) Parallel Projection	Perspective Proj.
1) Projectors are parallel to each other	Projectors are not parallel
2) Need to specify the direction of projection	Centre of ~~projection is at a finite distance~~ need to be specify
3) Does not produce a realistic view.	Produces realistic view.
4) Centre of projection is at infinite dist.	Centre of projection is at finite distance
5) Depth information is lost.	Depth information is preserved.
6) Preserve relative proportion of objec.	Does not preserve relative proper. of object.
7) Subtype: Orthographic projection, oblique projection.	Subtypes: Single point, two point, three point projection.

(3) In the Bezier curve, the degree of polynomial is always one less than the number of control points. So we cannot have more than four points for cubic Bezier curves.

B-spline curves are the most widely used class of curves for approximating the shape due to its following properties.

→ Degree of a polynomial is independent of a no. of control points.
→ They have local control over the curves & surfaces.
→ However, derivation and generation of B-spline are more complex.
→ Blending function - (n+1) control pts.

$$P(t) = \sum_{i=0}^{n} P_i \cdot B_{i,d}(t), \quad t_{min} \le t \le t_{max} \text{ and } 2 \le d \le n+1$$

→ B-spline blending f:n $B_{i,d}$ are polynomials with degree $d-1$. Degree d can take any integer value of control points.

→ Blending f:n for B-spline curve are defined using Cox-deboor recursive formula as shown below:

$$B_{i,1}(t) = \begin{cases} 1 & \text{if } t_i \le t \le t_{i+1} \\ 0 & \text{otherwise} \end{cases}$$

$$B_{i,d}(t) = \frac{t - t_i}{t_{i+d-1} - t_i}(t) + \frac{t_{i+d} - t}{t_{i+d} - t_{i+1}} \left(B_{i+1,d-1}(t)\right)$$

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(4) physical description of the object goes through multiple sequences as shown

→ Window to the viewport to transformation is necessary because the size of the window and viewport may not be the same all the time. So actual scene selected by window needs to be rescaled to fit it in the viewport.

→ Let (XW_{min}, YW_{min}) and (XW_{max}, YW_{max}) represent the lower left & upper top corner points of clipping window resp.

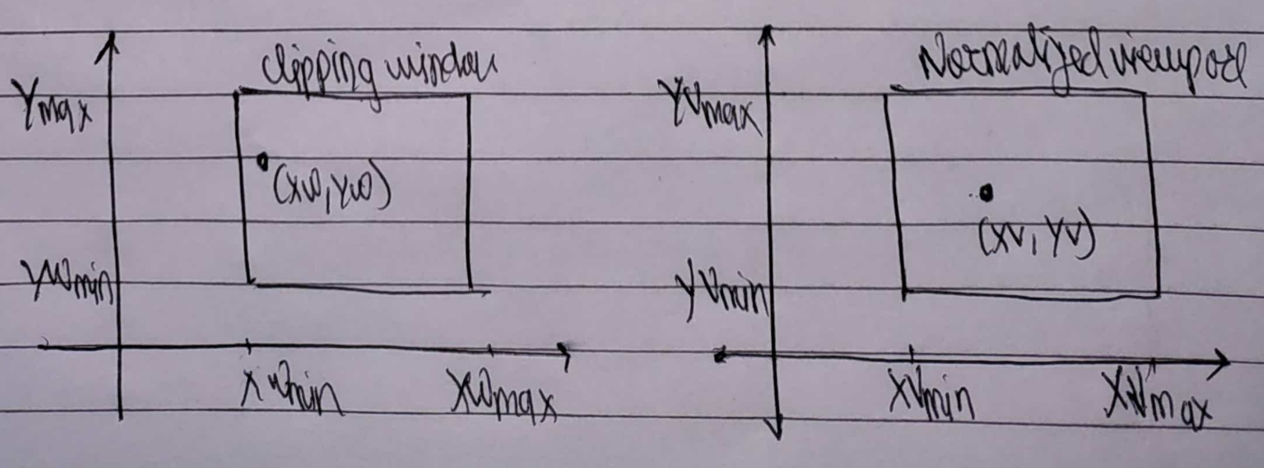
→ And let (XV_{min}, YV_{min}) and (XV_{max}, YV_{max}) represent the lower left and upper top corner points of viewport respectively.

→ To maintain the same relative placement in the viewport as in a window, we normalize both.

$$\frac{XV - XV_{min}}{XV_{max} - XV_{min}} = \frac{XW - XW_{min}}{XW_{max} - XW_{min}}$$

$$XV - XV_{min} = (XV_{max} - XV_{min}) \frac{XW - XW_{min}}{XW_{max} - XW_{min}}$$

$$XV = XV_{min} + (X_W - XV_{min})\, S_x$$



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Similarly
$$y_v = yv_{min} + (yw - yw_{min}) \cdot S_y$$

where
$$S_x = \frac{xv_{max} - xv_{min}}{xw_{max} - xw_{min}}$$

$$S_y = \frac{yv_{max} - yv_{min}}{yw_{max} - yw_{min}}$$