SECOND TERM EXAMINATION, 2014

Q.1. (a) Differentiate between perspective and parallel projection.

Ans. Perspective projection is seeing things larger when they're up close and smaller at a distance. It is a 3-D projection of object on a 2-D medium such as paper. It allows an artist to produce a visual reproduction of an object which resembles the real one.

The center of projection in a perspective projection is a point which is at a distance from the viewer or artist. Objects located at this point appear smaller and will appear bigger when they are drawn closer to the viewer. Perspective projection produces more realistic and detailed representation of an object allowing artists to create scenes that from perspective projection is parallel projection.

Parallel projection, on the other hand, resembles seeing objects which are located far from the viewer through telescope. It works by making light rays entering the eyes parallel, thus, doing away with the effects of depth in drawing. Objects produced using parallel projection do not appear larger when they are near or smaller when they are far. It is very useful in architecture. However, when measurements are involved, perspective projection is best.

It provides an easier way of reproducing objects on any medium while having no definite center of projection. When it is not possible to create perspective projection, especially in cases where its use can cause flaws or distortion, parallel projection is used.

1. Perspective projection is representing or drawing objects which resemble the real thing while parallel projection is used in drawing objects when perspective projections cannot be used.
2. Parallel projections are much like seeing objects through a telescope, letting parallel light rays into the eyes which produce visual representation without depth while perspective projections represent objects in a three-dimensional way.
3. In perspective projection, objects that are far away appear smaller, and objects that are near appear bigger while parallel projection does not create this effect.
4. While parallel projection may be best for architectural drawings, in cases wherein measurements are necessary, it is better to use perspective projection.

Q.1. (b) Differentiate between image space and object space methods of hidden surface removal.
Ans. Image Space Vs Object Space

In 3D computer animation images have to be stored in frame buffer converting two dimensional arrays into three-dimensional data. This conversion takes place after many calculations like hidden surface removal, shadow generation and Z buffering. These calculations can be done in Image Space or Object Space. Algorithms used in image space for hidden surface removal are much more efficient than object space algorithm. But object space algorithms for hidden surface removal are much more functional than image space algorithms for the same. The combination of these two algorithms gives the best output.

Image Space: The representation of graphics in the form of raster or rectangular pixels has now become very popular. Raster display is very flexible as they keep on refreshing the screen by taking the values store in frame buffer. Image space algorithms are simple and efficient as their data structure is very similar to that of frame buffer. The most commonly used image space algorithms is Z buffer algorithm that is used to define the values of z coordinate of the object.

Object Space: Space object algorithms have the advantage of retaining the relevant data and because of this ability the interaction of algorithm with the object becomes easier. The calculation done for the color is done only once. Object space algorithm also allow shadow generation to increase the depth of the 3 dimensional objects on the screen. The incorporation of these algorithms is done in software and it is difficult to implement them in hardware.

- Image space algorithms are much more efficient that object space algorithm.
- Object space algorithms are much more functional that image space algorithms.

- Color calculation in object space algorithms is done only one time and is retained by it but in image space algorithm the calculation once done is over written later.

Q.1. (c) Define the term multimedia, interactive multimedia and non-interactive multimedia.
Ans. MULTIMEDIA: - Multimedia is the field concerned with the computer-controlled integration of text, graphics, drawings, still and moving images (Video), animation, audio, and any other media where every type of information can be represented, stored, transmitted and processed digitally.

INTERACTIVE MULTIMEDIA: Interactive multimedia has been called a "hybrid technology." It combines the storage and retrieval capabilities of computer database technology with advanced tools for viewing and manipulating these materials. Multimedia has a lot of different connotations, and definitions vary depending on the context. For the purpose of this Guide, in the context of upper secondary and postsecondary education, interactive multimedia is defined by three criteria:

- Interactive Multimedia is any package of materials that includes some combination of texts, graphics, still images, animations, video, and audio;
- These materials are packaged, integrated, and linked together in some way that offers users the ability to browse, navigate and analyze these materials through various searching and indexing features as well as the capacity to annotate or personalize these materials;
- Interactive Multimedia is always "reader-centered." In interactive multimedia, the reader controls the experience of reading the material by being able to select among multiple choices, choosing unique paths and sequences through the materials. One of the key features of interactive multimedia is the ability to navigate through material in whatever way are most meaningful for individual users.

Non-Interactive Multimedia: A fixed, self-contained and pre-conceived passiv experience, fictional or not, typically featuring a narrative, often with a beginning, a middle and an end. The audience members are observers and not able to interact and participate and thereforeincapable of influencing or changing the experience directly. The various forms of non-interactive entertainment have their own immersion and emotional delivery language: For novels it'd be choice of structure, words, perspective, perception, etc whilst audiovisual media like film and TV use narrative structure, camera framing, editing, lighting, sound, music, actor performance, etc.

Q.1. (d) Explain the file format- AVI, MOV, MPEG and JPEG?
Ans. AVI: is a multimedia container format introduced by Microsoft in November1992 as part of its Video for Windows software. AVI files can contain both audio and video data in a file container that allows synchronous audio-with-video playback. Like the DVD video format, AVI files support multiple streaming audio and video, although these features are seldom used.

MOV: MOV, an MPEG-4 video container, is a common multimedia format, often used in Apple's QuickTime for saving movies and other video files, using a proprietary compression algorithm developed by **Apple Customer**, compatible with both Macintosh and Window platforms.

MPEG: Moving Pictures Experts Group, and pronounced m-peg, is a working group of the ISO. The term also refers to the family of digital video compression standards and file formats developed by the group. MPEG generally produces better-quality video than competing formats, such as Video for Windows, Indeo and QuickTime. MPEG files previously on PCs needed hardware decoders (codecs) for MPEG processing. Today, however, PCs can use software-only codecs including products form Real Networks, QuickTime or Windows Media Player.

JPEG: JPEG compression is used in a number of image file formats. JPEG is the most common image format used by digital cameras and other photographic image capture devices; along with JPEG/JFIF, it is the most common format for storing and transmitting photographic images on the World Wide Web. These format variations are often not distinguished, and are simply called JPEG.

Q.2. (a) Why do we compress the data? Explain any one of the compression technique.

Ans. **Huffman Code:** Huffman Code assigns shorter encodings to elements with a high frequency, F:e. It differs from block encoding I that it is able to assign codes of different bit lengths to different elements. Elements with the highest frequency, F:e , get assigned the shortest bit length code. The key to decompressing Huffman code is a Huffman tree.

A Huffman tree is a special binary tree called a trie. A binary trie is a binary tree in which a 0 represents a left branch and a 1 represents a right branch. The numbers on the nodes of the binary trie represent the total frequency, F:e , of the tree below. The leaves of the trie represent the elements, e , to be encoded. The elements are assigned the encoding which corresponds to their place in the binary trie. Below is an example.

Message to be encoded

dad ade fade bead ace dead cab bad fad café face

Block Encoding

011 000 011 000 011 100 000 011 101 001 100 000 011 000 010 100 011 100 000 011 010 000 001 001 000 011 101 000 011 010 000 101 100 101 000 010 100

The block encoding above is a fixed length encoding. if a message contains I elements, block encoding requires log i bits to encode each element, e.

Spaces have been inserted between the strings of bits which represent each character in both the Block Encoding and the Huffman Encoding.

Huffman Encoding:

01 10 01 10 01 111 110 10 01 111 000 111 10 01 10 001 111 10 01 001 10 000 000 10 01 110 10 01 001 10 001 111 110 10 001 111

Element	Frequency	Block Code	Huffman Code
a	11	000	10
b	3	001	000
c	4	010	001
d	9	011	01
e	7	100	111
f	4	101	110

Entropy: The average information content of a message is called its entropy. The information content is related to uncertainty. The less likely a message is to occur the larger its information content. This makes sense if we think of an example: if a person knows what message is about to be sent to him, how new information has he learned by receiving that message? None. This is all that the above statement is saying.

Entropy , E, is information content. The entropy of a source is inversely propotional to its probability of occurrence:

$$E = -\log P$$

We use the log function because we are converting all sources into the binary alphabet, B.

The same rule applies to an element, e, in a message, M. its entropy can be defined as:

$$E:e + -\log (P:e)$$

P:e is the probability of an element in a message. It is equal to that element's frequency, F:e, divided by the frequency of the entire message, F:M:

$$P:e = F:E/F:M$$

The average information content or average entropy for a message, E:M, can now be defined. We know the entropy for each element in the message is E:e. we will index the elements, e, in a message, M , by assigning them inte+ (P:2*E:2) + (P:3*E:3)+……..+(P:i*E:i)

Entropy is an important concept to data compression. The entropy of an element (E:e) is the minimum number of bits needed to encode that a element. The entropy of an entire message (E:M) is the minimum number of bits needed to encode the entire message with a lossless compression. The entropy of a message can be used to determine if data compression is worth attempting. It can also be used to evaluate the effectiveness of a compression. The number of bits in a compressed code can be compressed code can be compared to the entropy for the message (E:M) revealing how close to optimal compression one's compressed code is.

ger positions, I, according to their place in the message. For example: the first element, e, in message M will be assigned 1, the second will be assigned 2… the ith will be assigned i. now we can define the entropy for an entire message, E:M, where there are t elements:

$$E:M = (P:1*E)$$

Q.2. (b) Explain Z-buffering method. Which is better and why- Z- Buffer or A- Buffer?

Ans. Z-buffering, also known as **depth buffering**, is the management of image depth coordinates in 3D graphics, usually done in hardware, sometimes in software. It is one solution to the visibility problem, which is the problem of deciding which elements of a rendered scene are visible, and which are hidden. The painter's algorithm is another common solution which, though less efficient, can also handle non-opaque scene elements.

When an object is rendered, the depth of a generated pixel (z coordinate) is stored in a buffer (the z-buffer or depth buffer). This buffer is usually arranged as a two-dimensional array (x-y). With one element for each screen pixel. If another object of the scene must be rendered in the same pixel, the method compares the two depths and overrides the current pixel if the object is closer to the observer. The chosen depth is then saved to the z-buffer l, replacing the old one. In the end, the z-buffer will allow the method to correctly reproduce the usual depth perception: a close object hides a farther one. This is called **z-culling.**

Z buffer Vs A buffer: Z buffer and A buffer are two of the most popular visible surface detection techniques used in 3D computer graphics. Visible surface detection (also known as hidden surface elimination) is used to identify what is visible within a scene from a certain viewing point in the 3D world. There are two main categories of surface detection methods known as Object Space Methods and Image Space Methods. Object Space Methods deals with comparing object and/ or parts of objects to determine which surfaces are visible. Image Space Methods deals with deciding visibility on a point-to-point basis at the pixel level. Image Space Methods are the most popular and Z buffer and A buffer belong to that category. Z buffer method computes the surface depth values of each pixel throughout the whole scene. A buffer method is an extension to Z buffer method, which adds transparency.

Q.2. (c) Define animation. How animations does play an important role in multimedia applications?

Ans. A simulation of movement created by displaying a series of pictures, or frames. Cartoons on televisions is one of the example if animation. Animation on computers is one of the chief ingredients of multimedia presentations. There are many software applications that enables you to create animations that you can display on a computer monitor.

Note the difference between animation and video. Whereas video takes continuous motion and it breaks it up into described frames, animation starts with independent pictures and puts them together to form the illusion of continuous motion.

Animation is the rapid display of a sequence of images to create an illusion of movement.

Animation plays a huge role in entertainment (providing action and realism) and education (providing visualization and demonstration). Entertainment multimedia titles in general and titles specifically, rely heavily on animation. But animation can also be extremely effective in other titles, such as training application. Animation adds visual impact to the multimedia project. Many multimedia applications for both the Macintosh and Windows provide animation tools, but you should first understand the principles of how the eye interprets the changes it sees as motion.

Q.3. (a) What are multimedia authoring tools? Describe the basic characteristics of requirement for selecting o multimedia authority tool.

Ans. The integration of audio, video, graphics and text on the desktop promises to fundamentally challenge the centuries – old model of printed document as the basis for information exchange. Before the potential can be realized, however, system must be devised that enable the production and presentation of complex, inter-related media objects. These systems are generically called multimedia authoring tools.

<u>TYPES OF AUTHORING TOOLS:</u>

1.Card or page-based tools.
2.Icon- based, event- driven tools.
3.Time-based tools.

<u>CARD- BASED OR PAGE – BASED TOOLS:</u>

1.The elements are organized as pages of book or a stack of cards.
2.Cards-or page based authoring systems.
3.Best use when the bulk of your content consists of elements that can be viewed individually.
4. link these pages into a sequence.
5.jump to any page.
6.play sound elements and launch animations & digital video.

<u>ICON-BASED, EVENT -DRIVEN TOOLS:</u>

1.Multimedia elements and interaction vents are organized as objects in structural framework or process.
2.Simplify the organization of your project.
3.Display flow diagrams of activities along branching paths.
4.Incomplicated navigations structures, this charting is particularly useful during development.

TIME-BASED TOOLS:
1.Events and elements are organized along a timeline with resolution as high as or higher than 1/30sec.
2.Best to use when you have a message with a beginning and an end.
3.Played back at a speed that you set.
4.Other elements are triggered at a given time or location in the sequence of events.
5.Jumps to any location in sequence.

Q.3. (b)Find the general form of an oblique projection onto XY plane.

Ans. The term 'cabinet projection' (sometimes cabinet perspective) stems from its use in illustration by furniture industry. Live cavalier perspective, one face of the projected object is parallel to the viewing plane, and the third axis is projected as going off in an angle (30˚ or 45˚). Unlike cavalier projection, where the third axis keeps its length, the cabinet projection the length of recording lines is cut in half.
MATHEMATICAL FORMULA: As formula, if the plane facing the viewer is, and the receding axis is, then a point is projected like this:

$$P \quad \begin{matrix} x \\ y \\ z \end{matrix} = \begin{matrix} x+0.5.z.\cos\alpha \\ y+0.5.z.\sin\alpha \\ 0 \end{matrix}$$

Where α=angle given
The transformation matrix is:

$$P = \begin{matrix} 1 & 0 & 0.5.\cos\alpha \\ 0 & 1 & 0.5\sin\alpha \\ 0 & 0 & 0 \end{matrix}$$

Q.4. (a) Derive the simple illumination model. Including the contribution of diffuse and Specular reflection?

Ans. Illumination models model the interaction of light with the surfaces and range from simple to very complex. In computer graphics, we use physics to derive illumination model and then fudge it to make the picture look good. We will look at only a simple illumination model and consider approximation for two type of light (ambient and point source) and two type of light reflection (diffuse and specular).

$$I_r(x,y,z)= \int_{-\infty}^{\infty} \int_{\lambda=400}^{700} \int_{\Phi=0}^{\Pi/2} \int_{\Theta=0}^{\Pi} L(t,x,y,z,\Phi,\Theta,\lambda)\, R(t,\Phi,\Theta,\lambda)\, d\Theta\, d\Phi\, d\lambda\, dt$$

Where;
X,y,z = the coordinates of the point on the surface
t=time
λ=wavelength
Φ=azimuthal angle (from z axis)
Θ=angle about z axis

A local illumination model must handle diffuse and specular reflection. Diffuse reflection is fairly simple and easily handled.
The Phong model is not based on physics, but on empirical observation. Despite its lack of a theoretical grounding, it produces quite good results and has been based on the model for most computer graphics imaginary produced since it was developed in 1975.

The Blinn model, developed in 1977, is based on research results from physics and correct some of the deficiencies of Phong model. Both these models assume that the specular highlights are the color of light source and make no attempt to estimate the color contribution from material itself. An even more advanced model The Cook and Torrance does estimate the color contribution from the material and is more accurate for some substances specially metals.

Q.4. (b) Using the origin as the center of projection, derive the perspective transformation onto the plane passing through the point $R_0(X_0,Y_0,Z_0)$ and having normal vector N=Aî+Bĵ+Cκ.

Ans. $P(x,y,z)$ is projected onto $P'(x',y',z')$

$$x' = \alpha x,$$
$$y' = \alpha y$$
$$z' = \alpha z$$
$$n_1x' + n_2y' + n_3z' = d$$
$$\alpha = d/(n_1x + n_2y + n_3z)$$

$$\text{Per } N, R_0 = \begin{array}{cccc} 0 & d & 0 & 0 \\ 0 & 0 & d & 0 \\ 0 & 0 & 0 & d \end{array}$$