

CS602 Final Term Preparation

CS602 Past Papers Solution:

Solved by Masters

2022,2021,2020,2019, 2018

Cs602 paper # 1

March 2022

mostly from mozz and wqar sidhu file

2. $Ax+by+cz+d$ explain all variable in equation

The triplet $\langle a,b,c \rangle$ represents what is called the normal of the plane. A *normal* is a unit vector that, conceptually speaking, sticks directly out of a plane. A stronger mathematical definition would be that the normal is a vector that is perpendicular to all of the points that lie in the plane. The d component in the equation represents the distance from the plane to the origin.

(page 207)

3. In 32bit red green and blue color pixle ko explain krna tha

32-bit color, something seen on most new graphics cards. Many 3D accelerators keep 8 extra bits per pixel around to store transparency information, which is generally referred to as the *alpha channel*, and therefore take up 4 bytes, or 32 bits, of storage per pixel. (page 224)

4. Opengl function of all properties of light

The command used to specify all properties of lights is **glLight*()**; it takes three arguments: to identify the light whose property is being specified, the property, and the desired value for that property. (page 398)

5. Forward and backward scattering explain krna tha long question

Backscattering is when a rough surface bounces around a light ray and then reflects the ray in the direction the light originally came from. Note that there is a similar but different effect called retro reflection. **Retro reflection is the effect of reflecting light toward the direction from which it came, no matter the orientation of the surface.** This is the same effect that we see on bicycle reflectors. However, this is due to the design of the surface features (made up of v shaped or spherical reflectors) rather than a scattering effect. In a similar manner, when the light direction is closer to the view direction, we get the effect of forward scattering. Forward scattering is just backscattering from a different direction. In this case, instead of near uniform illumination though, we get near uniform loss of diffuse lighting. We can get the same effects here on Earth.

March 2022 Cs602 paper#2

95%mcqs from past papers

Describe fractal.

Fractal are geometric patterns that is repeated at ever smaller scales to produce irregular shapes and surfaces that cannot be represented by classical geometry. Fractals are used in computer modeling of irregular patterns and structure in nature

What will be the behavior of light when hitting the boundary layer at intersection of two media? 3 marks

Ans: There's an incident light hitting a surface. At the boundary of the two media there are two resulting rays of light. The reflected ray is the one and the other ray is the refracted or transmitted ray. In addition to examining the interaction of light with the surface boundary, we need a better description of real surface geometries. Unfortunately, this prevents us from getting some interesting effects. (page 293)

Torrance sparrow model? 3 marks

Ans: Torrance—Sparrow model is used for rough surfaces with isotropic roughness and provided parameters to account for the various surface structures found in the Torrance—Sparrow model. By comparing their model with actual data, they simplified their model to the terms that had the most significant impact. (page 291)

3 OpenGL functions or routines that are used in modeling transformation?

Ans: The three OpenGL routines for modeling transformations are **glTranslate*()**, **glRotate*()**, and **glScale*()**.

Define hidden surface removal & its importance in 3D? 5 marks

The hidden surface removal is the procedure used to find which surfaces are not visible from a certain view. A hidden surface removal algorithm is a solution to the visibility issue, which was one of the first key issues in the field of three dimensional graphics. When referring to line rendering it is known as hidden-line removal. Hidden-

surface determination is necessary to render a scene correctly, so that one may not view features hidden behind the model itself, allowing only the naturally viewable portion of the graphic to be visible.

Does temperature affects the refractive index of glass. Explain in either case?5 marks

Refractive index is a function of temperature, mostly due to density changes in materials with changes in temperature. A simple correction can be applied in most circumstances to allow us to use a value **given** at one temperature at another. For example, suppose the index of refraction value we have is given at 25°C: η_{25} . To convert the index to another temperature, η_t , we can use the following equation:

$$\eta^t = \eta^{25} + (25.0 - t)(0.00045)$$

Where the actual temperature we want is t , and the 25 is the temperature (both in °C) of the actual index we have, η_{25} .

Cs602 today paper #3

March 2022

some mcqs from w**aqar siddhu ki file se**

Long question "The camera analogy" .

The transformation process to produce the desired scene for viewing is analogous to taking a photograph with a camera. Set up your tripod and pointing the camera at the scene Arrange the scene to be photographed into the desired composition choose a camera lens or adjust the zoom. Determine how large we want the final photograph to be - for example, we might want it

enlarged (viewport transformation).

After these steps are performed, the picture can be snapped or the scene can be drawn.

Aik math k jasy swal tha uska **scale find krna tha.**

b) SCALING:-

◆ Coordinate transformations for scaling relative to the origin are

◆ $X' = X \cdot S_x$

◆ $Y' = Y \cdot S_y$

◆ $Z' = Z \cdot S_z$

Uniform Scaling

◆ We preserve the original shape of an object with a uniform scaling

◆ $(S_x = S_y = S_z)$

Differential Scaling

◆ We do not preserve the original shape of an object with a differential scaling

◆ $(S_x \neq S_y \neq S_z)$

Scaling w.r.t. Origin

$$\begin{bmatrix} S_x & 0 & 0 & 0 \\ 0 & S_y & 0 & 0 \\ 0 & 0 & S_z & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

Degree of curves

Degree of a Bezier curve is equal to $n-1$, where n is the number of control points.

Difference between phong shading and Gouraud shading.

III. Phong

Phong shading is the most realistic shading model We are going to talk about, and also the most computationally expensive. It tries to solve several problems that arise when we use Gouraud shading. If we're looking for something more realistic, some authors have also discussed nicer shading models like Tarrence-Sparrow, but they aren't real time (at least not right now). First of all, Gouraud shading uses a linear gradient. Many objects in real life have sharp highlights, such as the shiny spot on an apple. This is difficult to handle with pure Gouraud shading. The way Phong does this is by interpolating the normal across the triangle face, not the color value, and the lighting equation is solved individually for each pixel.

Sep 2022 CS602 paper #4

Mostly mcqs are from past papers

***What is phong shading? Explain**

Phong shading is the most realistic shading model also the most computationally expensive. It tries to solve several problems that arise when we use Gouraud shading. Phong shading isn't technically supported in hardware. But we can now program our own Phong rendering engine, and many other special effects, using shaders, a hot new technology.

***Explain modeling transformation**

We use the modeling transformation to position and orient the model. For example, we can rotate, translate, or scale the model - or perform some combination of these operations. In Example 1, **glScalef()** is the modeling transformation that is used.

(page 372)

***Find refracting index values given thi.**

$$n_a \sin(\phi_a) = n_b \sin(\phi_b)$$

(Page 294)

*** Explain hermite curve**

These are **curves defined by four control points and a cubic polynomial defined in terms of a parameter t** . The control points q_0 and q_1 define the position of the curve at $t=0$ and $t=1$ respectively, and q'_0 and q'_1 its derivative.

*** names three lighting schemes**

(a) Direct Lighting. (b) Semi-direct Lighting. (c) Semi-indirect Lighting. (d) Indirect Lighting. 29-Feb-2020

***explain implicit equation of plane**

The **implicit equation** for a plane is:

$$ax + by + cz + d = 0$$

***write Rotation equation of new coordinate**

◆ Rotation about z-axis
(i.e. in xy plane):

$$\begin{aligned}x' &= x \cos\theta - y \sin\theta \\y' &= x \sin\theta + y \cos\theta \\z' &= z\end{aligned}$$

by Cyclic permutation

Rotation about x-axis
(i.e. in yz plane):

$$\begin{aligned}x' &= x \\y' &= y \cos\theta - z \sin\theta \\z' &= y \sin\theta + z \cos\theta\end{aligned}$$

and

Rotation about y-axis
(i.e. in xz plane):

$$\begin{aligned}x' &= z \sin\theta + x \cos\theta \\y' &= y \\z' &= z \cos\theta - x \sin\theta\end{aligned}$$

Sep 2022 CS602 Paper # 5

Done my paper today

Most of MCQS were from past papers

About 5/6 were new

Q: What is storyboard?

Ans: The storyboard should serve as a blueprint for any film project and as the first visual impression of the film. It is at this stage that the major decisions are taken as far as the film's content is concerned. It is generally accepted that no production

should proceed until a satisfactory storyboard is achieved and most of the creative and technical problems.

Q: Difference between glLoadIdentity() and glLoadMatrix function of gluLookAt()

glLoadIdentity():

The glLoadIdentity function replaces the current matrix with the identity matrix.

glLoadMatrix

glLoadMatrix replaces the current matrix with the one whose elements are specified by m . The current matrix is the projection matrix.

gluLookAt()

The gluLookAt function creates a viewing matrix derived from an eye point, a reference point indicating the center of the scene, and an up vector.

A question was about translation points were given

Distances are given by t_x , t_y and t_z .

For any point $P(x,y,z)$ after translation we have $P'(x',y',z')$ where

$$x' = x + t_x,$$

$$y' = y + t_y,$$

$$z' = z + t_z$$

and (t_x, t_y, t_z) is Translation vector

Now this can be expressed as a single matrix equation:

$$P' = P + T$$

Where:

$$P = \begin{bmatrix} x \\ y \\ z \end{bmatrix}$$

$$P' = \begin{bmatrix} x' \\ y' \\ z' \end{bmatrix}$$

$$T = \begin{bmatrix} t_x \\ t_y \\ t_z \end{bmatrix}$$

A question was about Rotation points were given

Column vector representation:

$$P' = R \cdot P$$

Where

$$P' = \begin{bmatrix} x' \\ y' \end{bmatrix}$$

$$R = \begin{bmatrix} \cos \theta & -\sin \theta \\ \sin \theta & \cos \theta \end{bmatrix}$$

$$P = \begin{bmatrix} x \\ y \end{bmatrix}$$

Rotation: Homogeneous Coordinates

The rotation can now be expressed using homogeneous coordinates as:

$$\begin{bmatrix} x' \\ y' \\ 1 \end{bmatrix} = \begin{bmatrix} \cos \theta & -\sin \theta & 0 \\ \sin \theta & \cos \theta & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} x \\ y \\ 1 \end{bmatrix}$$

Abbreviated as:

$$P' = R(\theta) \cdot P$$

A question was to write two dimensional rotational matrix when angle is 60

$$\begin{bmatrix} x' \\ y' \\ 1 \end{bmatrix} = \begin{bmatrix} \cos \theta & -\sin \theta & 0 \\ \sin \theta & \cos \theta & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} x \\ y \\ 1 \end{bmatrix}$$

$$P' = R(\theta) \cdot P$$

What is Phong Shading and how to shine animation by it (repeat)

A question was about to calculate the color contribution

$$\text{light color } i_d = [0.34765, 0.92578, 0.24609]$$

Let's say we shine this light on a nice magenta surface given by c_s .

$$\text{surface color } c_s = [0.86719, 0.00000, 0.98828]$$

So, to calculate the color contribution of this surface from this particular light, we perform a piecewise multiplication of the color values.

$$\begin{aligned} i_d \otimes c_s &= [0.34765, 0.92578, 0.24609] \otimes [0.86719, 0.00000, 0.98828] \\ &= [(0.34765)(0.86719), (0.92578)(0), (0.24609)(0.98828)] \\ &= [0.30148, 0.00000, 0.243210] \end{aligned}$$

Sep 2022 CS602 paper # 6

MY TODAY'S PAPER

80% MCQ's ARE FROM PAST PAPERS LIKE MOAAZ

QUESTIONS I REMEMBERED:

DESCRIBE TWO-DIMENSIONAL EVALUATOR? (3 MARKS)

Evaluator The evaluator stage of processing provides an efficient way to approximate curve and surface geometry by evaluating polynomial commands of input values.

GIVE glRotate FUNCTION SIGNATURE? (3MARKS)

glRotated, glRotatef

The **glRotated** and **glRotatef** functions multiply the current matrix by a rotation matrix.

```
void glRotated(  
    GLdouble angle,  
    GLdouble x,  
    GLdouble y,  
    GLdouble z);
```

WHAT ARE THE USE OF glut HEADER IN PROGRAMS? EXPLAIN (3 MARKS)

GLUT is designed so that a program with only a single window and/or menu will not need to keep track of any window or menu identifiers. This greatly simplifies very simple GLUT programs. GLUT is designed for simple to moderately complex programs focused on OpenGL rendering. GLUT implements its own event loop.

WRITE A NOTE ON glut Library Functions? (5 MARKS)

GLUT provides high-level utilities to simplify OpenGL programming, especially in interacting with the Operating System (such as creating a window, handling key and mouse inputs). The following GLUT functions were used in the above program: **glutInit** : initializes GLUT, must be called before other GL/GLUT functions.

WHAT IS TANGENT VECTOR OF THE CURVES AND ALSO WRITE ITS MATHEMATICAL FORMULATION (5 MARKS)

at each end of the curve, instead. Every point on a curve has a straight line associated with it called the tangent line, which is related to the first derivation of the Parametric functions $x(u)$, $y(u)$, and $z(u)$, such as those given by Equation 2 of previous lecture. Thus

$$\frac{d}{du}x(u), \quad \frac{d}{du}y(u), \quad \text{and} \quad \frac{d}{du}z(u) \quad (1)$$

From elementary calculus, we can compute, for example,

$$\frac{dy}{du} = \frac{dy(u)/du}{dx(u)/du} \quad (2)$$

We can treat $dx(u)/du$, $dy(u)/du$, and $dz(u)/du$ as components of a vector along the tangent line to the curve. We call this the *tangent vector*, and define it as

$$P''(u) = \left[\frac{d}{du}x(u)i \quad \frac{d}{du}y(u)j \quad \frac{d}{du}z(u)k \right] \quad (3)$$

Or more simply as

$$P'' = [x'' \quad y'' \quad z''] \quad (4)$$

Q: FOLLOWING ARE THE CASES OF THE TRANSFORMATIONS. ARE YOU AGREE WITH THESE CASES TO BE GENERATE DIFFERENT RESULTS?

CASE#1 OBJECT IS ROTATE FIRST THEN TRANSLATED.

Agreed

The matrix multiplication is done in the order SRT, where S, R, and T are the matrices for scale, rotate, and translate, respectively. The order of the composite transformation is **first scale, then rotate, then translate**. 27-Jul-2022

CASE#2 OBJECT IS TRANSLATE FIRST THEN ROTATED.

Not agreed

The matrix multiplication is done in the order SRT, where S, R, and T are the matrices for scale, rotate, and translate, respectively. The order of the composite transformation is **first scale, then rotate, then translate**. 27-Jul-2022

OTHERS ARE VERY DIFFICULT TO REMEMBER BECAUSE OF THE MATRIX AND MATHEMATICAL EQUATIONS TYPE QUESTIONS...

CS602 todays paper March 2022

types of transformation

27.32 Types of Transformation

There are various types of transformations as we have seen in case of 2D transformations. These include:

- a. Translation
- b. Rotation
- c. Scaling
- d. Reflection
- e. Shearing

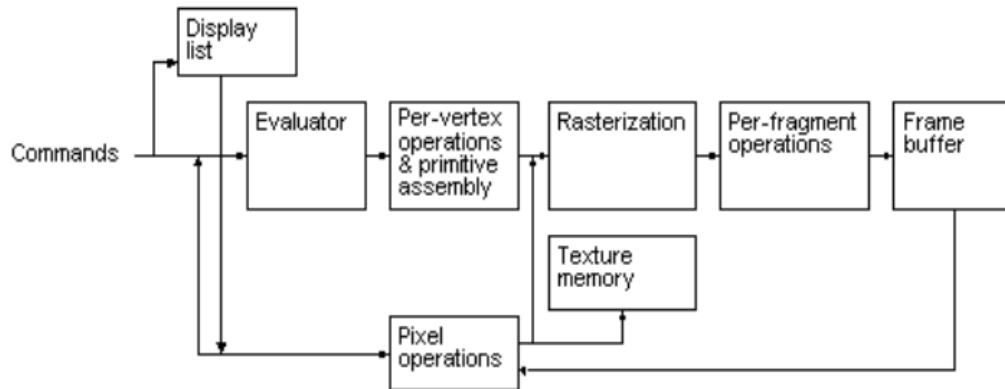
emission term what you understand define 5mark

Emission **makes a rendered object appear to be self-luminous**. Emission affects an object's color and can, for example, make a dark material brighter and take on part of the emitted color. Emissive lighting is described by a single term. Emissive color. 20-Oct-2022

Q: one figure is shown explain the operation its from opengl operation 5mark

Basic OpenGL Operation

The following diagram illustrates how OpenGL processes data. As shown, commands enter from the left and proceed through a processing pipeline. Some commands specify geometric objects to be drawn, and others control how the objects are handled during various processing stages.



The processing stages in basic OpenGL operation are as follows:

- **Display list** Rather than having all commands proceed immediately through the pipeline, you can choose to accumulate some of them in a display list for processing later.
- **Evaluator** The evaluator stage of processing provides an efficient way to approximate curve and surface geometry by evaluating polynomial commands of input values.
- **Per-vertex operations and primitive assembly** OpenGL processes geometric primitives—points, line segments, and polygons—all of which are described by vertices. Vertices are transformed and lit, and primitives are clipped to the view port in preparation for rasterization.
- **Rasterization** The rasterization stage produces a series of frame-buffer addresses and associated values using a two-dimensional description of a point, line segment, or polygon. Each fragment so produced is fed into the last stage, per-fragment operations.
- **Per-fragment operations** these are the final operations performed on the data before it's stored as pixels in the frame buffer.

Per-fragment operations include conditional updates to the frame buffer based on incoming and previously stored z values (for z buffering) and blending of

incoming pixel colors with stored colors, as well as masking and other logical operations on pixel values.

Data can be input in the form of pixels rather than vertices. Data in the form of pixels, such as might describe an image for use in texture mapping, skips the first stage of processing described above and instead is processed as pixels, in the pixel operations stage. Following pixel operations, the pixel data is either:

- Stored as texture memory, for use in the rasterization stage.
- Rasterized, with the resulting fragments merged into the frame buffer just as if they were generated from geometric data.

(Handouts Page 302 ,303)

Sep 2020 CS602 paper # 7

Q:what is "emission?(repeat)

Q:what is evaluator?(repeat)

Q:What is difference between glLoadIdentity function and glLoadMatrix function ?(repeat)

Q;glRotate ka syntax likna ta?

glRotated, glRotatef

The **glRotated** and **glRotatef** functions multiply the current matrix by a rotation matrix.

```
void glRotated(  
    GLdouble angle,  
    GLdouble x,  
    GLdouble y,  
    GLdouble z );
```

Q;what is different b/w triangle strip and fan?draw diagram?

triangles to dedicated hardware to draw them. They are called *triangle strips* and *triangle fans*.

Triangle fans, conceptually, look like the folding fans you see in Asian souvenir shops. They are a list of triangles that all share a **common point**. The first three elements indicate the first triangle. Then each new element is combined with the first element and the current last element to form a new triangle. Note that an N-sided polygon can be represented efficiently using a triangle fan

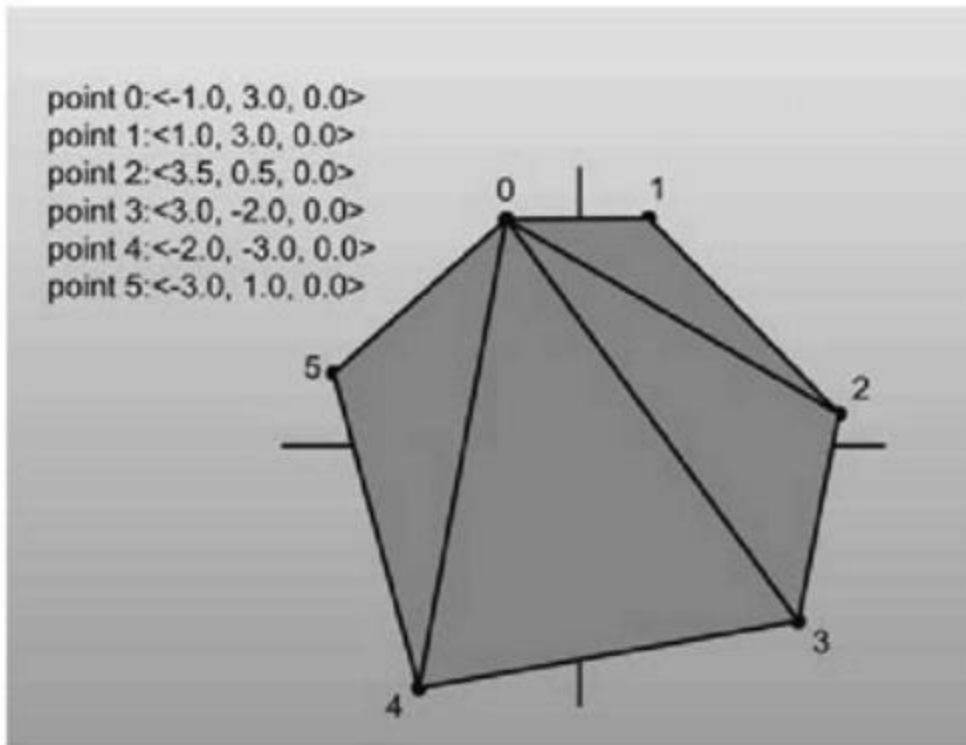


Figure: A list of points composing a triangle fan

Q: what is matrix negation and why we need it?

The negation of a matrix is formed by negating each element of the matrix: $-A = -1A$. So,

Q; why sutherland algorithms is not so good explain?

In general, the Liang_Barsky algorithm is more efficient than the Cohen_Sutherland algorithm, since intersection calculations are reduced. Each update of parameters u_1 and u_2 requires only one division; and window intersections of the line are computed only once, when the final values of u_1 and u_2 have computed. In contrast, the Cohen-Sutherland algorithm can repeatedly calculate intersections along a line path, even though the line may be completely outside the clip window, and, each intersection calculation requires both a division and a multiplication. Both the Cohen_Sutherland and the Liang_Barsky algorithms can be extended to three-dimensional clipping.

CS602 paper # 8 16 July 2020

1. Write three OpenGL transformation routines. 3 Marks

The three OpenGL routines for modeling transformations are **glTranslate*()**, **glRotate*()**, and **glScale*()**.

2. Write three that can be use between glBegin & glEnd. 3 Marks

GL_POLYGON Draws a single, convex polygon. Vertices 1 through N define this polygon. Only a subset of GL commands can be used between glBegin and glEnd. The commands are **glVertex**, **glColor**, **glIndex**, **glNormal**, **glTexCoord**, **glEvalCoord**, **glEvalPoint**, **glMaterial**, and **glEdgeFlag**.

3. How polygon emissions can speed up the process of rendering. 5 marks

27.27 **Rendering**

- The process of computing a two dimensional image using a combination of a three-dimensional database, scene characteristics, and viewing transformations. Various algorithms can be employed for rendering, depending on the needs of the application.

5. How many control Points are required for Bezier curve, how can we calculate them? 5 Marks

Example 1 : Bézier Curve with Four Control Points:

```
#include <GL/gl.h>
#include <GL/glu.h>
#include <stdlib.h>
#include <GL/glut.h>
```

To find any point P along a line, use the formula: $P = (1-t)P_0 + (t)P_1$, where t is the percentage along the line the point lies and P_0 is the start point and P_1 is the end point.

Can we use SCAN system in Televisions? explain. Also list down the name of systems.

Which scanning is used in TV systems?

This is known as **interlaced scanning**, and it is used in all the standard television broadcast services of the world. Each set of alternate lines is known as a scanning field; the two fields together, comprising the whole scanning pattern, are known as a scanning frame.

How light attenuation can be calculate?

. The attenuation factor is calculated by the following equation:

$$f_{\text{atten}} = 1 / (k_c + k_l d + k_q d^2)$$

How many control Points are required for Bezier curve, how can we calculate them?(repeat)

A question about "Perspective Projection"? 3 marks:

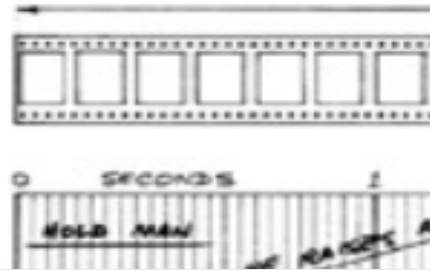
28.1 *Perspective Projection*

As opposed to parallel projection, perspective projection gives a more realistic view of the objects in the scene. The objects away from the POV are projected smaller whereas those nearby are projected to appear proportionately larger. The idea is that of looking at the scene through the projection plane / screen.

what time of unit is used in animation

The basic unit of time in animation

The basis of timing in animation is the fixed projection speed of 24 frames per second (fps) for film and video. While



what time of unit is used by animator in animation? [repeated question]

what is clipping polygon? why it is used? describe briefly

Polygon clipping is an important operation that computers execute all the time. An algorithm that clips a polygon is rather complex. Each edge of the polygon must be tested against each edge of the clipping window, usually a rectangle.

Name 4 areas where OpenGL is used.

fields of computer-aided design (CAD), virtual reality, scientific visualization, information visualization, flight simulation, and video games.

March 2022 CS602 paper # 9

Asslam O Aliakum

what is gamut? 2 marks

world. The gamut of a device is simply the physical range of colors the device can display. Typically, a high-quality display has a better gamut than a cheap one. A good

define and explain refraction of light? 2 marks

Refraction is **the bending of light (it also happens with sound, water and other waves) as it passes from one transparent substance into another**. This bending by refraction makes it possible for us to have lenses, magnifying glasses, prisms and rainbows. Even our eyes depend upon this bending of light. 26-Apr-2012

what are tradeoff between the display speed and quality of image when subdividing in case of polygon and surface?
2marks

It may be surprising to discover that there's more than one way to calculate the shading of an object, but that's because the **model is empirical, and there's no correct way**, just different ways that **all have tradeoffs**. Until now though, the **only lighting equation we've been able to use has been the one we just formulated**. Most of the interesting work in computer graphics is **tweaking that equation**, or in some cases, throwing it out altogether and coming up with something new.

what two aspects of timing in an animation? 2 marks

In animation, timing is used to show three things, these are **weight, scaling properties**, and the emotions of a character. The weight of different objects can be shown by altering their timings.

Give traditional light calculation equation? 3 marks

Traditional 3D Hardware-Accelerated Lighting Models

We will now take a look at the traditional method of calculating lighting in hardware—a method that we'll find is sufficient for most of our needs. The traditional approach in real-time computer graphics has been to calculate lighting at a vertex as a sum of the ambient, diffuse, and specular light. In the simplest form (used by OpenGL and Direct3D), the function is simply the sum of these lighting components (clamped to a maximum color value). Thus we have an ambient term and then a sum of all the light from the light sources.

$$i_{total} = k_a i_a + \sum (k_d i_d + k_s i_s)$$

Where i_{total} , is the intensity of light (as an **rgb** value) from the sum of the intensity of the global ambient value and the diffuse and specular components of the light from the light

differentiate between the function using gl and glu prefixes of glut library? 3marks

glu: This is OpenGL utilities library, which has been not updated for long time. Don't need to use this header file. glut: OpenGL Utility Toolkit for Windowing API. This is good for small to medium size OpenGL program. 25-Aug-2012

write down simplified third degree of bezier curve? 3mark (repeat)

write down three routines for modeling transformation? 3 marks

Modeling Transformations. The three OpenGL routines for modeling transformations are **glTranslate*()**, **glRotate*()**, and **glScale*()**. As you might suspect, these routines transform an object (or coordinate system, if you're thinking of it that way) by moving, rotating, stretching, shrinking, or reflecting it.

what do you understand by the term "emission"? 5 marks(repeat)

write down the uses of glut library? 5 marks

The GLUT library supports the following functionality:

- Multiple windows for OpenGL rendering.
- Callback driven event processing.
- An 'idle' routine and timers.
- Utility routines to generate various solid and wire frame objects.
- Support for bitmap and stroke fonts.
- Miscellaneous window management functions.

explain oren nayer diffuse reaction? How it is different from limbertian diffuse shading?

Oren—Nayar Diffuse Reflection

Though there's been a lot of research on specular reflection models, there's been less research on diffuse reflection models. One of the problems of the standard Lambertian model is that it considers the surface as a smooth diffuse surface. Surfaces that are really rough, like sandpaper, exhibit much more of a backscattering effect, particularly when the light source and the view direction are in the same direction.

The classic example of this is a full moon. If we look at the picture of the moon shown in Figure 5, it's pretty obvious that this doesn't follow the Lambertian distribution—if it did, the edges of the moon would be in near darkness. In fact, the edges look as bright as the center of the moon. This is because the moon's surface is rough—the surface is made of a jumble of dust and rock with diffuse reflecting surfaces at all angles—thus the quantity of reflecting surfaces is uniform no matter the orientation of the surface; hence no matter the orientation of the surface to the viewer, the amount of light reflecting off the surface is nearly the same.

model rough surfaces, Oren and Nayar [OREN 1992] came up with a generalized version of a Lambertian diffuse shading model that tries to account for the roughness of the surface. They applied the Torrance—Sparrow model for rough surfaces with isotropic roughness and provided parameters to account for the various surface structures found in the Torrance—Sparrow model. By comparing their model with actual data, they simplified their model to the terms that had the most significant impact. The Oren—Nayar diffuse shading model looks like this.

$$i_d = \frac{\rho}{\pi} E_0 \cos(\theta_i) (A + B \max[0, \cos(\phi_r - \phi_i)] \sin(\alpha) \tan(\beta))$$

Where

$$A = 1 - 0.5 \frac{\sigma^2}{\sigma^2 + 0.33}$$

$$B = 0.45 \frac{\sigma^2}{\sigma^2 + 0.09}$$

Sep 2021 CS602 paper # 10

MCQ's 95% from mooaz file. exam was easy
formula for calculating diffuse light

The equation for calculating diffuse lighting is

$$\hat{r}_d = (\hat{n} \bullet \hat{l})(m_d \otimes s_d)$$

bezier cure definition

A Bézier curve is a **parametric curve that uses the Bernstein polynomials as a basis**. A Bézier curve of degree (order) is represented by. (1.40) The coefficients, , are the control points or Bézier points and together with the basis function. determine the shape of the curve.

matrix for rotation and scaling (5)

Rotation:

Column vector representation:

$$P' = R \cdot P$$

Where

$$P' = \begin{bmatrix} x' \\ y' \end{bmatrix}$$

$$R = \begin{bmatrix} \cos \theta & -\sin \theta \\ \sin \theta & \cos \theta \end{bmatrix}$$

$$P = \begin{bmatrix} x \\ y \end{bmatrix}$$

Rotation: Homogeneous Coordinates

The rotation can now be expressed using homogeneous coordinates as:

$$\begin{bmatrix} x' \\ y' \\ 1 \end{bmatrix} = \begin{bmatrix} \cos \theta & -\sin \theta & 0 \\ \sin \theta & \cos \theta & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} x \\ y \\ 1 \end{bmatrix}$$

Abbreviated as:

$$P' = R(\theta) \cdot P$$

Scaling:

▼ Coordinate transformations for scaling relative to the origin are

◆ $X' = X \cdot S_x$

◆ $Y' = Y \cdot S_y$

◆ $Z' = Z \cdot S_z$

Uniform Scaling

◆ We preserve the original shape of an object with a uniform scaling

◆ ($S_x = S_y = S_z$)

Differential Scaling

◆ We do not preserve the original shape of an object with a differential scaling

◆ ($S_x \neq S_y \neq S_z$)

Scaling w.r.t. Origin

$$\begin{bmatrix} S_x & 0 & 0 & 0 \\ 0 & S_y & 0 & 0 \\ 0 & 0 & S_z & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

properties of triangles in lambertian model

Triangles that use Lambertian shading are painted with one solid color instead of using a gradient. Typically each triangle is lit using that triangle's normal. The resulting object looks very angular and sharp. Lambertian shading was used mostly back when computers weren't fast enough to do Gouraud shading in real time. To light a triangle, you compute the lighting equations using the triangle's normal and any of the three vertices of the triangle.

thats all i remember

CS602 paper # 11 Feb 25, 2017 at 2:00pm

Mcq's where all-most from past papers,

1. What time of unit is used in animation (2)(repeat)

2. Which function is used to change to the size of the Current Window

glutReshapeWindow

glutReshapeWindow requests a change to the size of the *current window*.

3. Write down about modeling transformation briefly

The **Modeling Transformation**

We use the modeling transformation to position and orient the model. For example, we can rotate, translate, or scale the model - or perform some combination of these operations. In Example 1, **glScalef()** is the modeling transformation that is used. The

4. 3rd degree equation of bezier (repeat)

5. utility library functions

Change the **glFrustum()** call in Example 1 to the more commonly used Utility Library

Use the Utility Library routine **gluLookAt()** to define a line of sight. This routine encapsulates a series of rotation and translation commands.

“glut” are the OpenGL utility library functions.

The **gluPerspective** is the function of gl utility library. 1

6. Lighting equation se related th (repeat)

7. Aik question OpenGL se related tha (repeat)

8. What is the light attenuation formula and how can be calculated. (repeat)

Sep 2019 CS602 paper # 12

MCQs are totally from past papers.

Key difference between gl and glu?

All those functions that start with the prefix “gl” are the core OpenGL functions and those which start with “glu” or “glut” are the OpenGL utility library functions.

Write a note on utility of glut library? 5 marks (repeat)

Difference between glLoadIdentity and glLoadMatrix? 5 marks (repeat)

Tangent vector parametric equation?(repeat)

Find a Vnorm of a vector (2,3,4)? 2 marks

Explanation: The norm of a vector is simply the square root of the sum of each component squared.

What is meant by evaluator? 2 marks (repeat)

Write the most common names of three lighting schemes that have a effects on colors?

Parameter Name	Default Value	Meaning
GL_LIGHT_MODEL_AMBIENT	(0.2, 0.2, 0.2, 1.0)	ambient RGBA intensity of the entire scene
GL_LIGHT_MODEL_LOCAL_VIEWER	0.0 or GL_FALSE	how specular reflection angles are computed
GL_LIGHT_MODEL_TWO_SIDE	0.0 or GL_FALSE	choose between one-sided or two-sided lighting

Sep 2022 cs602 todays paper # 13

aik ax bx cx ki values find krni thi (repeat)

bezier curve ki equation likhni thi 3rd degree ki(repeat)

aik curve dia hua tha k ye uniform ha ya ni

scaling or rotating matrices ka ques tha

spot light ka tha(repeat)

backscattering or retro scattering sy tha(repeat)

which projection is used for real pictures

Photographic lenses and the human eye work in the same way, therefore **perspective projection** looks most realistic. Perspective projection is usually categorized into one-point, two-point and three-point perspective, depending on the orientation of the projection plane towards the axes of the depicted object. 07-Nov-2022

or environmental mapping ka b aik ques tha or spot light k liye do library packages btany thy

If we think all of this sounds mathematically expensive, we're right. **Some library packages like OpenGL and Direct3D implements lighting for us**, so we won't need to worry about the implementation of the math behind spotlights, but rest assured that they're extremely expensive and can slow down our graphics application a great deal.

241

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OpenGL camera function command.....2marks

$$\mathbf{v}' = \mathbf{M}\mathbf{v}$$

(Remember that vertices always have **four coordinates (x, y, z, w)**, though in most cases w is 1 and for two-dimensional data z is 0.) Note that **viewing and modeling transformations are automatically applied to surface normal vectors**, in addition to vertices. (Normal vectors are used only in eye coordinates.) This ensures that the normal vector's relationship to the vertex data is properly preserved.

The viewing and modeling transformations we specify are combined to form the modelview matrix, which is applied to the incoming object coordinates to yield eye coordinates. Next, if we've specified additional clipping planes to remove certain objects from the scene or to provide cutaway views of objects, these clipping planes are applied. After that, **OpenGL applies the projection matrix to yield clip coordinates**. This

OpenGL command function to change size of window.....2marks(repeat)

value of refractive index when wavelength of light is changed or increased.....2marks

Refractive index of a medium decreases with an increase in wavelength of light.

Refractive index of a medium for violet light (least wavelength) is greater than that for red light (greatest wavelength).

equation of line and plane...2cases...when they cut & not cut...write equations.....3marks

The equation of a straight line is **$y=mx+c$** $y = m x + c$ m is the gradient and c is the height at which the line crosses the y -axis, also known as the y -intercept.

the equation of the plane is established as **$a(x - x_1) + b(y - y_1) + c(z - z_1) = 0$** .

gl and glu difference.....3marks (repeat)

parallel lights direction and attenuation equation.....3marks (repeat)

equation of tangent and how it is drawn.....5marks (repeated)

equation of normal to plane...3 points given.....5marks

The normal to the plane these 3 points define is:

$$\text{normal} = (p_1 - p_2) \times (p_3 - p_2)$$

$$= (0, -1, 0) \times (1, -1, 0)$$

$$= \langle (-1) \cdot 0 - 0 \cdot (-1), 0 \cdot 1 - 0 \cdot 0, 0 \cdot (-1) - (-1) \cdot 1 \rangle$$

$$= \langle 0, 0, 1 \rangle$$

5 marks questions

Does change in temperature has any effect on refractive index.

Justify your answer with either case.(repeated)

In Bizere, how many control points are required and how it can

be calculated?(repeated)

Explain cases of Oblique projection.

Two special cases of oblique projection

Cavalier

Cabinet

1) Cavalier

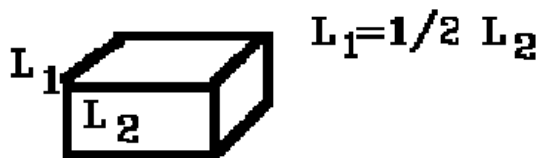
$\text{Alpha} = 45^\circ$, $\tan(\text{Alpha}) = 1 \Rightarrow L_1 = 1$ this is a **Cavalier** projection such that all lines perpendicular to the projection plane are projected with no change in length.



2) Cabinet

$\tan(\text{Alpha}) = 2$, $\text{Alpha} = 63.40^\circ$, $L_1 = 1/2$

Lines which are perpendicular to the projection plane are projected at $1/2$ length. This is a **Cabinet** projection



What is meant by emission?(repeated)

3 marks questions

Behavior of light in case of backscattering and retro reflection (repeated)

Write three OpenGL functions/routines used for modeling transformation(repeated)

Difference b/w oblique projection and orthographic projection

There are two different types of parallel projections:

Orthographic

Oblique

1) Orthographic Projection

If the direction of projection is perpendicular to the projection plane then it is an **orthographic** projection.

Oblique Projection

If the direction of projection is not perpendicular to the projection plane then it is an **oblique projection**.

2 marks questions

Write glut header file (repeated)

2 properties of triangle in lambertian shadr(repeated)

What is meant by evaluator(repeated)

CS602 Final Term Paper # 14

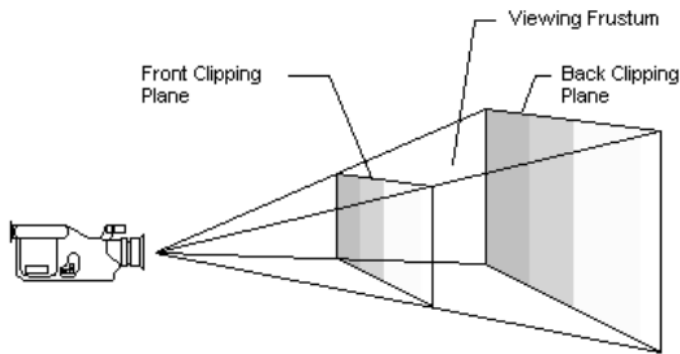
MY tOdays CS602 ppr.....

1_what makes OpenGL most widely adOpted Graphics standard

Most Widely Adopted Graphics Standard

OpenGL is the premier environment for developing portable, interactive 2D and 3D graphics applications. Since its introduction in 1992, OpenGL has become the industry's most widely used and supported 2D and 3D graphics application programming interface (API), bringing thousands of applications to a wide variety of computer platforms. OpenGL fosters innovation and speeds application development by incorporating a broad set of rendering, texture mapping, special effects, and other powerful visualization functions. Developers can leverage the power of OpenGL across all popular desktop and workstation platforms, ensuring wide application deployment.

2_figure this or viewing frustum sy related btana tha



If you imagine that you are standing in a dark room and looking through a square window, you are visualizing a viewing frustum. In this analogy, the near clipping plane is the window, and the back clipping plane is whatever finally interrupts your view—the skyscraper across the street, the mountains in the distance, or nothing at all. You can see everything inside the truncated pyramid that starts at the window and ends with whatever interrupts your view, and you can see nothing else.

3_describe four steps necessary required for calculating all the lighting contributions to get the final color.

The final step after calculating all the lighting contributions is to add together all the lights to get the final color. So a shader might typically do the following:

1. Calculate the overall ambient light on a surface.
2. For each light in a scene, calculate the diffuse and specular contribution for each light.
3. Calculate any emissive light for a surface.
4. Add all these lights together to calculate the final color value.

4_Elaborate the term "Icosahedron" with example.

To illustrate some of the considerations that arise in approximating a surface, let's look at some example code sequences. This code concerns the vertices of a regular icosahedron (which is a Platonic solid composed of twenty faces that span twelve vertices, each face of which is an equilateral triangle). An icosahedron can be considered a rough approximation for a sphere. Example 1 defines the vertices and triangles making up an icosahedron and then draws the icosahedron.

5_name three OpenGL functions that are used for modeling transformation (most important and repeated one)

6_key difference b/w gl and glu, (repeated)

7_lighting equation with attenuation factor and also give attenuation equation. (repeated)

8_es qstn main cOde deya huwa tha

9_ye wala qstn yad nai.....

10_describe fractal (repeated)

11_describe three axonometric projection.

There are three axonometric projections

isometric

Dimetric

Trimetric

1) Isometric

The most common axonometric projection is an **isometric** projection where the projection plane intersects each coordinate axis in the model coordinate system at an equal distance or the direction of projection makes equal angles with all of the three principal axes

2) Dimetric

The direction of projection makes equal angles with exactly two of the principal axes

3) Trimetric

The direction of projection makes unequal angles with the three principal axes

12_rOtaion metrix for transformation find krna tha (repeated)

CS602 Final Term Paper #15

Today my paper CS602

20: Because clipping against one edge is independent of all others, so it is _____ to arrange the clipping stages in a pipeline.

Sometimes impossible

None of the given

Possible (Page 150)

Impossible

Tessellation can be adaptive to the _____ degree of

curvature of a surface.

Local (Page 170)

----- reflection is the effect of reflecting light toward the direction from which it came, no matter the orientation of the surface.

- ▶ Forward scattering
- ▶ Diffuse Lambertian
- ▶ Backscattering

▶ Retro (Page 293)

1) In class, we discussed physically-based simulation. In order to maintain a simulation, a set of variables must be maintained called “state variables”. State variables are those variables which must be maintained from one timestep to the next in a simulation to maintain correct simulation. Of all of the following variables, only one is NOT a state variable. Which is it?

- a) mass
- b) position
- c) velocity

d) acceleration

A series of _____ computer operations convert an object's three-dimensional coordinates to pixel positions on the screen. Transformations, which are represented by matrix multiplication, include modeling, viewing, and projection operations. Such operations include rotation, translation, scaling, reflecting, orthographic projection, and perspective projection.

Three (Page 371)

Two

Four

Ten

When obtaining normals for a triangle, which of the following mathematical constructs is NOT used?

Vector normalization

Vector cross products

Vector dot products

Point-Point subtraction

The traditional approach in real-time computer graphics has been to calculate lighting at a vertex as a sum of the _____ light.

Ambient

Ambient, diffuse, and specular (Page 281)

Specular

Diffuse, and specular

1) Which of the following parts of our Bezier curve discussion was compared to 3D projections onto a 2D plane?

- a) End point tangency
- b) deCasteljau subdivision
- c) Degree elevation
- d) Swept surfaces

e) Rational Beziers (i.e. weights)

1) In class, we discussed 3 forms of Fractals. Which one required some randomness and several thousand loop executions to give a result?

- a) Non-linear fractals

b) Iterated Function Systems

c) L-Systems

An independent consortium, the OpenGL Architecture Review Board, guides the OpenGL specification. With broad industry support, OpenGL is the only truly open, vendor-neutral, ----- graphics standard.

Tertiary

Binary

Single platform

Multiplatform (Page 301)

Refractive index is a function of temperature, mostly due to changes in ----- of materials with changes in temperature. A simple correction can be applied in most circumstances to allow us to use a value given at one temperature at another.

Density (Page 300)

pressure

nature

volume

The attenuation formula is $f = \frac{1}{C + Ld + Qd^2}$, where C, L and Q are the constant, linear and quadratic attenuation factors and d is the distance between the vertex being lit and the light source.

$$\frac{1}{C + Ld + Qd^2}$$

$$\frac{1}{C + Ld + Qd}$$

$$\frac{1}{C + L + d + Qd^2}$$

$$\frac{1}{Cd + Ld + Qd^2}$$

A parametric curve is one whose defining equations are given in

terms of a -----, common, independent variable called the parametric variable.

Triple

Double

Single (Page 325)

None of the given

To ensure a smooth transition from one section of a piecewise _____ to the next, we can impose various

continuity conditions at the connection points

non parametric curve

parametric curve

polygon vector (not confirm)

1) Which of the following properties of Bezier curves guarantees that any affine transform performed on the control points also directly applies to the curve itself?

a) Coordinate System Independence

b) Convex-Hull

c) Symmetry

d) Variation Diminishing

e) End-point interpolation

Best of Luck

CS602 paper # 16

50% quizz from moiz file

41 to 52 question

parallel light

How light attenuation can be calculated? (repeated)

How many control Points are required for Bezier curve, how can we calculate them? (repeated)
why use glBegin and glEnd.

The **glBegin** and **glEnd** functions delimit the vertices of a primitive or a group of like primitives.

difference b/w 2nd degree 3rd degree curve

We rearrange terms to obtain a more compact vector equation of a **second degree Bezier curve**:

$$p(u) = (1-u)^2 p_0 + 2u(1-u)p_1 + u^2 p_2 \quad (10)$$

$$p(u) = (1-u)^3 p_0 + 3u(1-u)^2 p_1 + 3u^2(1-u)p_2 + u^3 p_3 \quad (15)$$

rotation and scaling calculate the value given the
rotation matrix formula(repeated)
tangent formula(repeated)
Bezier curve ka tha (repeated)
topic yehi thi bs

CS602 paper # 17

Paper was very easy and short mostly from Past papers.

MCQ 30 – 35 from Past papers

6 to 8 Mcqs was from Mid term simple and easy . 3 to 4

Mcqs was new from

Handouts

Question No: 1 (Marks: 1) - Please choose one

----- reflection is the effect of reflecting light toward the direction from which it came, no matter the orientation of the surface.

► Forward scattering

- ▶ Diffuse Lambertian
- ▶ Backscattering
- ▶ **Retro (Page 293)**

Question No: 2 (Marks: 1) - Please choose one

The reflected light wave turns out to be a -----case since light is reflected at the same angle as the incident wave (when the surface is smooth and uniform, as we'll assume for now).

- ▶ Abnormal
- ▶ Complex

▶ **Simple (Page 296)**

- ▶ Unknown

Question No: 3 (Marks: 1) - Please choose one

_____ sets the reshape callback for the *current window*.

The reshape callback is triggered when a window is reshaped.

- ▶ glutMainLoop
- ▶ glutIdleFunc

▶ **glutReshapeFunc (Page 312)**

- ▶ glutDisplayFunc

Question No: 4 (Marks: 1) - Please choose one

An orthogonal set of vectors-----

▶ **Must be a set of linearly independent vectors**

- ▶ Must be a set of linearly dependent vectors
- ▶ Must be made up of the basis vectors (e_1 , e_2 , and e_3)
- ▶ Can be made up of any set of vectors

Question No: 5 (Marks: 1) - Please choose one

Bezier curve is numerically the ----- of all the

polynomial-based curves used in these applications.

- ▶ None of the given
- ▶ **Most stable (Page 338)**
- ▶ Less stable
- ▶ Most unstable

Question No: 6 (Marks: 1) - Please choose one

Bezier curve is the ideal standard for representing the -----
----- piecewise polynomial curves.

- ▶ None of the given
- ▶ Non complex
- ▶ Most complex
- ▶ **More complex (Page 338)**

Question No: 7 (Marks: 1) - Please choose one

Keep polygon orientations consistent to make sure that when viewed from the outside, all the polygons on the surface are oriented in the ----- direction.

- ▶ None of the given
- ▶ Neither
- ▶ Different
- ▶ **Same (page 345)**

Question No: 8 (Marks: 1) - Please choose one

A polygon is usually defined by a sequence of ----- and Edges.

- ▶ Ending lines
- ▶ Points
- ▶ **Vertices (Page 248)**
- ▶ Edges

Question No: 9 (Marks: 1) - Please choose one

_____ can be defined as a mapping of point $P(x, y, z)$ onto its image $P'(x', y', z')$ in the view plane which constitutes the display surface.

- ▶ Mapping plane
- ▶ Three Coordinate Planes
- ▶ View plane

▶ **Projection (Page 193)**

Question No: 10 (Marks: 1) - Please choose one

The reflected light wave turns out to be a / an _____ case since light is reflected at the same angle as the incident wave (when the surface is smooth and uniform, as we'll assume for now).

- ▶ Unknown
- ▶ **Simple (Page 296)**
- ▶ Complex
- ▶ Abnormal

Question No: 11 (Marks: 1) - Please choose one

----- sets the global idle callback to be „func“ so a GLUT program can perform background processing tasks or continuous animation when window system events are not being received.

glutIdle function (Page 313)

glutKeyboardFunc
glutReshapeFunc
glutDisplayFunc

Question # 12 (Total Marks: 1) Select correct option:

One problem with Gouraud shading is that the ----- intensities can never be greater than the intensities at

the edges.

Triangles (Page 246)

Squares

Rectangles

Polygons

Question # 13 (Total Marks: 1) Select correct option:

In order to get a more realistic representation of lighting, we'll need to understand how light passes through a medium and how hitting the boundary layer at the ----- of two media can affect light's properties.

Intersection (Page 296)

Union

Endpoints

Edges

Question # 14 (Total Marks: 1) Select correct option:

Lambertian shading was used mostly back when computers weren't fast enough to do _____ in real time.

Phong shading

Processing

Shading

Gouraud shading (Page 245)

Question # 15 (Total Marks: 1) Select correct option:

glutReshapeWindow requests a change in the size of the current window. The width and height parameters are size extents in pixels. The width and height must be ----- - values.

Neutral

Negative

Positive (Page 311)

None of the given

Question # 16 (Total Marks: 1) Select correct option:

Refractive index is a function of temperature, mostly due to changes in ----- of materials with changes in temperature. A simple correction can be applied in most circumstances to allow us to use a value given at one temperature at another.

Density (Page 300)

pressure

nature

volume

Question # 17 (Total Marks: 1) Select correct option:

If we assign a different value to the parametric variable for the intermediate point, then we obtain different values for the coefficients. This, in turn, means that a different curve is produced, although it passes through the ----- three points.

isolate

different

same (Page 328)

none

Question # 18 (Total Marks: 1) Select correct option:

The attenuation formula is $f = \frac{1}{C + Ld + Qd^2}$, where C, L and Q are the constant, linear and quadratic attenuation factors and d is the distance between the vertex being lit and the light source.

$\frac{1}{C + Ld + Qd^2}$

$\frac{1}{C + Ld + Qd}$

$$1/(C + L + d + Qd^2)$$

$$1/(Cd + Ld + Qd^2)$$

Question # 19 (Total Marks: 1) Select correct option:

End points and an intermediate point on the curve, then we now ----- quantities that we can express in terms of these coefficients (3 points x 3 coordinates each), and we can use these three points to define a unique curve.

Six

Three

Two

Nine (Page 326)

Question # 20 (Total Marks: 1) Select correct option:

A parametric curve is one whose defining equations are given in terms of a -----, common, independent variable called the parametric variable.

Triple

Double

Single (Page 325)

None of the given

Question # 21 (Total Marks: 1) Select correct option:

If the current matrix (according to glMatrixMode) is multiplied by the translation matrix, with the product replacing the current matrix. That is, if M is the current matrix and T is the translation matrix, then M is replaced with -----.

M-T

M+T

M/T

M*T (Page 317)

Question # 22 (Total Marks: 1) Select correct option:

Imagine a curve in three-dimensional space, each point on the curve has a unique set of coordinates: a specific x value, y value, and z value. Each coordinate is controlled by a ----- parametric equation.

Opposite

Similar

Separate (Page 325)

Question # 23 (Total Marks: 1) Select correct option:

Bezier curve can represent the more complex piecewise _____ curve.

Polynomial (Page 338)

Exponential

Cubic

None of above

Question # 24 (Total Marks: 1) Select correct option:

The value returned is a unique small integer identifier for the window. The range of allocated identifiers starts at ----- . This window identifier can be used when calling glutSetWindow.

Three

Two

One (Page 308)

Zero

Question # 25 (Total Marks: 1) Select correct option:

Bernstein polynomial functions are the basic functions of _____ curves.

NURBS

Bezier (Page 342)

Both NURBS and Bazier

None of the given

Question # 26 (Total Marks: 1) Select correct option:

The matrix generated by gluPerspective is multiplied by the current matrix, just as if glMultMatrix were called with the generated matrix. To load the perspective matrix onto the current matrix stack instead, precede the call to gluPerspective with a call to -----.

glRotated

gluPerspective

glTranslated

glLoadIdentity

Question # 27 (Total Marks: 1) Select correct option:

The _____ functions multiply the current matrix by a rotation matrix.

glRotated and glRotatef (Page 318)

Subjective

5 marks questions

A software company want to make Game using space curves. You as a manager do mathematicular work and formulate according to the scenario. (5 marks)

Lecture No.36 Space Curves

A space curve is not confined to a plane. It is free to twist through space. To define a space curve we must use parametric functions that are cubic polynomials. For $x(u)$ we write

$$x(u) = a_x u^3 + b_x u^2 + c_x u + d_x \quad (1)$$

With similar expressions for $y(u)$ and $z(u)$. Again the a , b , c and d terms are constant coefficients. As we did with Equation for a plane curve, we combine the $x(u)$, $y(u)$, and $z(u)$ expressions into a single vector equation :

$$p(u) = au^3 + bu^2 + cu + d \quad (2)$$

If $\mathbf{a} = \mathbf{0}$, then this equation is identical to Equation discussed in plane curves

Brief note on Icosahedron and give example (5 marks
(repeated)

Brief Note on utility glut library . (5marks) (repeated)

Intensity of light I_d

$I_d = (0.2345, 0.2436, 0.3613)$

surface color $cs = (0.2515, 0.3234, 0.3424)$

calculate the color contribution of this surface ? (5 marks)
(repeated)

3 marks Questions

parametric variable is $0 < u < 1$ (ya sahid $\leq$ tha not sure) what
type of curve will be form and was n't build. (3
marks)

Bazier curve of 2nd degree (3marks) (repeated)

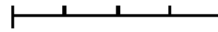
Values of T ($t_x = 3$, $t_y = 4$) and Point P (4 , 3) was given have
to calculate translation. (3marks) (repeated)

3 figures (given in lecture 40) was given, or pocha gia tha key

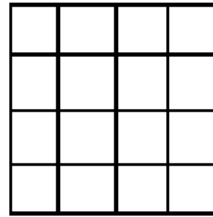
By looking at above three given figures what you

can interpret keeping in mind fractal dimensions? (3 marks) most
important

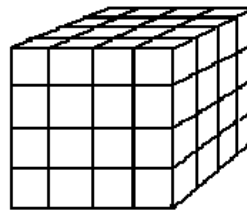
1. As you can see the line is broken into 4 smaller lines. Each of these lines is similar to the original line, but they are all $1/4$ the scale. This is the idea of *self similarity*.



2. The square below is also broken into smaller pieces. Each of which is $1/4$ th the size of the original. In this case it takes 16 of the smaller pieces to create the original.



3. As with the others the cube is also broken down into smaller cubes of $1/4$ the size of the original. It takes 64 of these smaller cubes to create the original cube.



2 marks Questions

T-intersection model surface? (2marks)

Try to avoid T-intersections in your models (see Figure 1). As shown, there's no guarantee that the line segments AB and BC lie on exactly the same pixels as the segment AC. Sometimes they do, and sometimes they don't, depending on the transformations and orientation. This can cause cracks to appear intermittently in the surface.

Name 4 areas where OpenGL is used. (2 marks)repeat

One questions was we have 6 changing in size X- axis and Y axis , Scalling Matrix btana tha kuch is trah ka questin tha (2marks)repeat

One question I forget (sorry)

CS602 Final Term Paper #18

My current Paper of cs602

MCQs almost moaaz ki file sy thy

or long questions ye hn

Q1: Apply following transformation on the point $P(x, y) = (2 \ 3)$

1: Translate using $T_x = 4$ and $T_y = 3$

2: Scale using $S_x = 3$ (5 Marks)

Q2: Write the equation that is used for calculation the diffuse lighting? (3 Marks)

The equation for calculating diffuse lighting is

$$\hat{i}_d = (\hat{n} \bullet \hat{l})(m_d \otimes s_d)$$

Q3: $X_1 = dx$

$X_2 = 1/27 ax + 1/9 bx + 1/3 cx + dx$

$X_3 = 8/27 ax + 4/9 bx + 2/3 cx + dx$

$X_4 = ax + bx + cx + dx$

find the values of ax , bx , cx , dx by given data ? (5 marks)

Q4: write the errors of glBegin and glEnd functions with reasons? (5 marks)

The glBegin and glEnd functions **delimit the vertices that define a primitive or a group of like primitives**. The glBegin function accepts a single argument that specifies which of ten primitives the vertices compose. 09-Mar-2021

Q5: suppose you work in a software house and thy want to build a puzzle game.... you are required to write mathematical formulation for the given scenario. (3 marks)

With this last piece of the puzzle, it is now possible to create the entire transformation pipeline. When you want to render a scene, you set up a world matrix (to transform an object's local coordinate points into world space), a view matrix (to transform world coordinate points into a space relative to the viewer), and a projection matrix (to take those viewer-relative points and project them onto a 2D surface so that they can be drawn on the screen). You then multiply the world, view, and projection matrices together (in that order) to get a total matrix that transforms points from object space to screen space.

$$\mathbf{v}_{\text{world}} = \mathbf{v}_{\text{local}} \mathbf{M}_{\text{world}}$$

$$\mathbf{v}_{\text{view}} = \mathbf{v}_{\text{world}} \mathbf{M}_{\text{view}}$$

$$\mathbf{v}_{\text{screen}} = \mathbf{v}_{\text{view}} \mathbf{M}_{\text{projection}}$$

$$\mathbf{v}_{\text{screen}} = \mathbf{v}_{\text{local}} (\mathbf{M}_{\text{world}} \mathbf{M}_{\text{view}} \mathbf{M}_{\text{projection}})$$

Good Luck To All of you

CS602 Final Term Paper #19

50% mcqs was frm moaz file.

Subjective:

Bezier third degree equation (repeated)

What is Bezier curve explain it. Define its degrees(repeated)

Translation, transformation, scaling in k conceptual question thy sahi sy statements yad nahi hn so :/ **Lecture 27 review**

1 question tha k cartoons develop krny hn compny ny cartoons characters k lie kya strategies hun gi jin sy best characters develop ho skain :/

Animation is expensive and time-consuming. It is not economically possible to animate more than is needed and edit the scenes later, as it is in live-action films. **In cartoons the director carefully pre-times every action so that the animator works within exact limits and does no more drawings than necessary.**

Ideally, the director should be able to view line test loops of the film as it progresses and so have a chance to make adjustments. But often there is no time to make corrections in limited animation and the aim is to make the animation work the first time.

1 question is about diffuse lightening value was given anfle was

90 deg we have to calculate id. (Repeated)

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Second degree and third degree Bezier curve (2) (Repeated)

What are trade-off between the display speed and the quality of the image when subdividing in the cases of polygon and surface (2) (Repeated)

How the world look like in following situation (2)

Without ambient light

With too ambient light

Ambient lighting is our friend. With it we make our scene seem more realistic than it is. A world without ambient light is one filled with sharp edges, of bright objects surrounded by sharp, dark, harsh shadows. A world with too much ambient light looks washed out and dull. Since the number of actual light sources supported by hardware FFP is limited (typically to eight simultaneous), we'll be better off to apply the lights to add detail to the

How glut file is included in program for using glut library function (2) repeated

Write down the simplified third degree equation of Bezier curve and retro reflection (3) repeated

Discuss the behavior of light in case of backscattering and retro reflection (3) (repeated) repeated

Discuss the purpose of OpenGL (3)

Main purpose of OpenGL

As a software interface for graphics hardware, the main purpose of OpenGL is to render two- and three-dimensional objects into a frame buffer. These objects are described as sequences of vertices (that define geometric objects) or pixels (that define images). OpenGL performs several processes on this data to convert it to pixels to form the final desired image in the frame buffer.

What would you meant by the term “Beizer Curve” (5) repeated

Q: Computer graphics related software company development required different equations. Same is the case with NextGen Software Company. They are developing software using different curve. You are required to explain parameter equation of a curve manipulation. (5)

Parametric Equations of a Curve

A parametric curve is one whose defining equations are given in terms of a single, common, independent variable called the parametric variable. We have already encountered parametric variables in earlier discussions of vectors, lines, and planes.

Imagine a curve in three-dimensional space, each point on the curve has a unique set of coordinates: a specific x value, y value, and z value. Each coordinate is controlled by a separate parametric equation, whose general form looks like

$$x = x(u), \quad y = y(u), \quad z = z(u) \quad \dots\dots\dots(1)$$

Given are the points that lie on a plane P1 (5)

P1 <2.0, 3.0, 4.0>

P2 <1.0, 5.0, 4.0>

P3 <7.0, 6.0, 2.0>

Find the equation normal to the plan P1

Same like this question was in assignment # 2 2022

Q NO. 2

Given are the points that lie on a plane P,

P1<8.0,7.0,3.0>

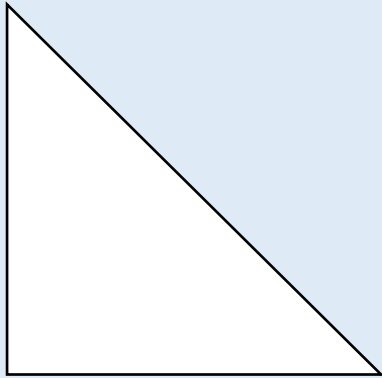
P2<2.0,2.0,2.0>

P3<6.0,6.0,4.0>

You are required to find the equation of a normal to the plane P.

Answer:

$$P1 = \langle 8.0, 7.0, 3.0 \rangle$$



$$P2 = \langle 2.0, 2.0, 2.0 \rangle$$

$$P3 = \langle 6.0, 6.0, 4.0 \rangle$$

The Normal to the Plane these 3 Points Define is

$$\text{Normal} = (P1 - P2) \times (P3 - P2)$$

$$= (\langle 8.0, 7.0, 3.0 \rangle - \langle 2.0, 2.0, 2.0 \rangle) \times (\langle 6.0, 6.0, 4.0 \rangle - \langle 2.0, 2.0, 2.0 \rangle)$$

$$= \langle 6, 5, 1 \rangle \times \langle 4, 4, 2 \rangle$$

$$= \begin{vmatrix} i & j & k \\ 6 & 5 & 1 \\ 4 & 4 & 2 \end{vmatrix}$$

$$= i(10 - 4) - j(12 - 4) + k(24 - 20)$$

$$= 6i - 8j + 4k$$

$$= \langle 6.0, -8.0, 4.0 \rangle$$

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