Code:1925

Roll No.:.....

M.Sc(Informatics),IInd-Sem., 2019

Paper IT-25: Computer Graphics and Multimedia

Time:3hrs

Max.Marks:75

Write your Roll.No. on the top right corner immediately on receipt of this question paper

Attempt five questions in all

Question No. 1 is compulsory

Q.1(a) Consider a TV camera where the maximum intensity of a color signal is represented by $1volt$. An unsturated magenta signal is formed by mixing $70\%R$, $20\%G$ and $60\%B$. What is the luminance output voltage for the signal? (4)

(b) Calculate the bit rate and memory required to store a $1hour$ movie in NTSC formats, assuming $4:2:2$ chroma-subsampling , according to CCIR-601 recommendation. (4)

(c) If we want to cut a 512×512 sub-image out from the center of an 800×600 image, what are the coordinates of the pixel in the large image that is at the lower left corner of the small image? (3)

(d) Find the CMY coordinates of a color at $(0.2, 1, 0.5)$ in RGB space. (2)

(e) The direct coding method is flexible in that it allows the allocation of a different number of bits to each primary color. If we use $5bits$ each for red and blue and $5bits$ for green for a total of $16bits$ per pixel, how many possible simultaneous colors do we have? (2)

Q.2(a) If $[T] = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$ denote the transformation matrix , then find the result of its action on the point $[X] = [x \quad y]$. (3)

(b) Find the conditions on the elements a, b, c and d under which transformation $[T]$ corresponds to (i) Identity, (ii) reflection through the x-axis , (iii) shear , (iv) scaling of both x and y coordinates. (4)

(c) Derive the transformation that rotates an object point $\theta°$ about the origin. Write the matrix representation for this rotation. (4)

(d) What are the new coordinates of the point $P(2, -4)$ after the rotation of the object by $30°$ about the origin. (4)

Q.3(a) Show that when a general 2×2 matrix is used to transform a pair of intersecting straight lines, the result is also a pair of intersecting lines. (4)

(b) In a triangle ABC with coordinates $A = (4, 1)$, $B = (5, 2)$ and $C = (4, 3)$ is first reflected about the x-axis and then about the line $y = -x$. Find the resulting coordinates of the triangle. (3)

(c) Explain the need for introducing homogeneous coordinates. Write the general form of the matrix for rotation about a point $P(h, k)$. (4)

(d) Perform a $45°$ rotation of triangle $A(0, 0), B(1, 1), C(5, 2)$, (i) about the origin and (ii) about $P(-1, -1)$. (4)

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Q.4(a) Write the transformation matrix $[T]$ for rotation through θ° about x-axis, y-axis and z-axis. (4)

(b)An object has position vectors

$$[X] = \begin{bmatrix} 0 & 0 & 1 & 1 \\ 2 & 0 & 1 & 1 \\ 2 & 3 & 1 & 1 \\ 0 & 2 & 1 & 1 \\ 0 & 0 & 0 & 1 \\ 2 & 0 & 0 & 1 \\ 2 & 3 & 0 & 1 \\ 0 & 2 & 0 & 1 \end{bmatrix}$$

The object is first rotated through $\theta = 90^\circ$ about the x-axis and then about the y-axis by $\phi = 90^\circ$. Find the transformed object. (5)

(c) Find the effet of a translation in the x, y, z directions by -1, -1, -1, respectively , followed successively by a $= 30^\circ$ rotation about the x-axis, and a $= 45^\circ$ rotation about the y-axis on the homogeneous coordinate positin vector $[3 \quad 2 \quad 1 \quad 1]$. (6)

Q.5(a) What do you understand by two-dimensional viewing and clipping. Deduce a relation for computing (vx, vy) from (wx, wy) in terms of a translate-scale-translate transformation N. (6)

(b) Explain in detail the Cohen-Sutherland clipping algorithm. What is the significance of midpoint subdivision in the algorithm. (6)

(c) How to determine whether a point $P(x, y)$ lies to the left or to the right of a line segment joining the point $A(x_1, y_1)$ and $B(x_2, y_2)$? (3)

Q.6(a) Describe the Bresenham's scan converting line algorithm. (5)

(b) Indicate which raster locations would be chosen by Bresenham's algorithm when scan converting a line from pixel coordinate $(1, 1)$ to pixel coordinate $(8, 5)$. (5)

(c) What is meant by resolution of CRT monitor? Presume that a monitor produces what is called the standard white D_{65} with $x_w = 0.313$, $y_w = 0.329$, and $Y_w = 1.0$ when $R = G = B = 1$, and chromaticity coordinatesof its phosphors are given as:

$$\begin{bmatrix} 0.62 & 0.34 & 0.04 \\ 0.29 & 0.59 & 0.12 \\ 0.15 & 0.06 & 0.79 \end{bmatrix}$$

Find the color transformation matrix M for the monitor. (5)

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