University of Asia Pacific

Department of CSE

Name: Rashik Rahman

Reg ID: 17201012

Year: 4th

Semester: 2nd

Course Code: CSE 425

Course Title: Computer Graphics

Date: 14.09.2021

"During Examination and upload time I will not take any help from anyone. I will give my exam all by myself."

University of Asia Pacific

Admit Card

Mid-Term Examination of Spring, 2021

Financial Clearance	PAID

Registration No : 17201012

Student Name : Rashik Rahman

Program : Bachelor of Science in Computer Science and Engineering

Sl.NO.	COURSE CODE	COURSE TITLE	CR.HR.	EXAM. SCHEDULE
1	CSE 425	Computer Graphics	3.00	
2	CSE 426	Computer Graphics Lab	1.50	
3	CSE 429	Compiler Design	3.00	
4	CSE 430	Compiler Design Lab	1.50	
5	BUS 401	Business and Entrepreneurship	3.00	
6	BUS 402	Business and Entrepreneurship Lab	0.75	
7	CSE 457	Design and Testing of VLSI	3.00	
8	CSE 458	Design and Testing of VLSI Lab	0.75	
9	CSE 400	Project / Thesis	3.00	

Total Credit: 19.50

1. Examinees are not allowed to enter the examination hall after 30 minutes of commencement of examination for mid semester examinations and 60 minutes for semester final examinations.

2. No examinees shall be allowed to submit their answer scripts before 50% of the allocated time of examination has elapsed.

3. No examinees would be allowed to go to washroom within the first 60 minutes of final examinations.

4. No student will be allowed to carry any books, bags, extra paper or cellular phone or objectionable items/incriminating paper in the examination hall.
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Answer to the Q. No. 2 (a)

$a = 12 + 15 = 27$

$b = 12 + 5 = 17$

$c = 17 + 15 = 32$

$\therefore \cancel{\alpha = 27^\circ}$

$\therefore$ Viewing angle, $\alpha = 27^\circ$

near distance, $n = 17$

far distance, $f = 32$

We know,

Viewing matrix, $V = \begin{bmatrix} \cot\frac{\alpha}{2} & 0 & 0 & 0 \\ 0 & \cot\frac{\alpha}{2} & 0 & 0 \\ 0 & 0 & \frac{f+n}{f-n} & -1 \\ 0 & 0 & \frac{2fn}{f-n} & 0 \end{bmatrix}$

$\cancel{\cot(13.5^\circ)}$

$$= \begin{bmatrix} \cot\frac{27}{2} & 0 & 0 & 0 \\ 0 & \cot\frac{27}{2} & 0 & 0 \\ 0 & 0 & \frac{32+17}{32-17} & -1 \\ 0 & 0 & \frac{2\times 32\times 17}{32-17} & 0 \end{bmatrix}$$

$$= \begin{bmatrix} 4.17 & 0 & 0 & 0 \\ 0 & 4.17 & 0 & 0 \\ 0 & 0 & 3.27 & -1 \\ 0 & 0 & 72.53 & 0 \end{bmatrix}$$

$\therefore$ ~~Ve~~ Viewing matrix, $V = \begin{bmatrix} 4.17 & 0 & 0 & 0 \\ 0 & 4.17 & 0 & 0 \\ 0 & 0 & 3.27 & -1 \\ 0 & 0 & 72.53 & 0 \end{bmatrix}$

Answer to the Q.No. 2(b)

~~Using 2 out of~~
Camera transformation is done by using 2 out of 6 process in 3D rendering pipeline. These two processes are viewing transformation and projection transformation. So camera transformation is a part of 3D ~~rede~~ rendering pipeline.

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Before under standing the process of camera transformation, let's know some terms. These are the followings.

i) Camera point (c)
ii) Direction vector (v)
iii) Up direction (up)

These three paranmeters are used to orient the camera. Using these we can get camera position matrix denoted by C. Using C matrix camera can be placed in world coordinate.

$$\therefore \; C = \begin{bmatrix} x_c & y_c & z_c & w \\ x_v & y_v & z_v & w \\ x_{up} & y_{up} & z_{up} & w \end{bmatrix}$$

Now let's see the transformation process:

First we have to multiply object coordinates $[x \;\; y \;\; z \;\; 1]$ with C then multiply the result matrix with V. Here we consider object oriented coordinate thus multiply from left to right. After the the resulting matrix ~~will be in 4D~~ will render 4D object as it's w value will be greater than 1. So we have to convert it back to 3D by dividing the ~~val~~ values of new matrix with the w value of new matrix. The new result matrix will render a 3D object in perspective view. and it will be in image space.

Process:

~~(i) [x y z 1] x C x V = [x' y' z' w]~~ – (ii)

↳ depth

(i) $[x\ y\ z\ 1] \times C \times V = [x'\ y'\ z'\ w]$ ← point in camera space

(ii) $(\frac{x'}{w}, \frac{y'}{w}, \frac{z'}{w}, 1)$ ← Image space.

Answer to the Q.No.1(a)

(a)

~~When~~ $\alpha_1+\alpha_2+\alpha_3+\ldots+\alpha_n=1$; ~~then~~

If you can combine two or more points with particular ~~functi~~ fractions with a condition that those fraction ~~sum~~ or parameters are sum upto 1, in that case combining two or more point one can get new point. This is affine combination.

$\therefore \alpha_1+\alpha_2+\alpha_3+\ldots+\alpha_m=1.$

(i) $Q_1=(1-t)^2P_1+2t^2(1-t)P_2+t^2P_3$

$\therefore \alpha_1=(1-t)^2;\ \alpha_2=2t^2(1-t);\ \alpha_3=t^2$

$\therefore \alpha_1+\alpha_2+\alpha_3=(1-t)^2+2t^2(1-t)+t^2$

$=1-2t+t^2+2t^2-2t^3+t^2$

$=1-2t+3t^2-2t^3$

$\therefore \alpha_1+\alpha_2+\alpha_3\neq 1$

So Q_1 is not affine combination.

(ii) $Q_2 = \underbrace{t^2}_{\alpha_1} P_1 + \underbrace{(1-t^2)}_{\alpha_2} P_2$

$\therefore \alpha_1 + \alpha_2 = t^2 + 1 - t^2$
$= 1$

$\therefore Q_2$ is affine combination.

Matrix formation:

$Q_2 = t^2 P_1 + (1-t^2) P_2$

$= \begin{bmatrix} t^2 & 1-t^2 \end{bmatrix} \begin{bmatrix} P_1 \\ P_2 \end{bmatrix}$

$= \begin{bmatrix} 1 & t & t^2 \end{bmatrix} \begin{bmatrix} 0 & 1 \\ 0 & 0 \\ 1 & -1 \end{bmatrix} \begin{bmatrix} P_1 \\ P_2 \end{bmatrix}$

Answer to the Q. No. 1(b)

$u = 12/50 = 0.24$

$v = 0.24 + 0.1 = 0.34$

$\therefore \alpha_1 = 0.24 ; \alpha_2 = 0.34$

$\therefore \alpha_3 = 1 - \alpha_1 - \alpha_2 = 1 - 0.24 - 0.34$

$= 0.42$

$$\begin{array}{lccc} & R & G & B \\ A = (& 1, & 0.5, & 0.1) \\ B = (& 0.5, & 0.8, & 0.3) \\ C = (& 0, & 0, & 1) \end{array}$$

$Q_R = \alpha_1 A_R + \alpha_2 B_R + \alpha_3 C_R$

$= 0.24 \times 1 + 0.34 \times 0.5 + 0.42 \times 0$

$= 0.41$

$Q_G = \alpha_1 A_G + \alpha_2 B_G + \alpha_3 C_G$

$= 0.24 \times 0.5 + 0.34 \times 0.8 + 0.42 \times 0$

$= 0.392$

$$Q_B = \alpha_1 A_B + \alpha_2 B_B + \alpha_3 C_B$$

$$= 0.24 \times 0.1 + 0.34 \times 0.3 + 0.42 \times 1$$

$$= 0.546$$

$$\therefore Q(R, G, B) = (0.41, 0.392, 0.546)$$

Answer to the Q.No. 4(a)

$a = 260° - 12° = 248° = H$

$b = 12/22 = 0.545 = S$

$c = 12/17 = 0.72 = I$

As $240° \leq H \leq 360$ so it falls under BR secton of HSI color model.

$\therefore H = H - 240° = 248° - 240° = 8°$

$$G = I(1 - S) = 0.71(1 - 0.545)$$
$$= 0.323$$

$$B = I\left[1 + \frac{S\cos H}{\cos(60° - H)}\right]$$

$$= 0.71\left[1 + \frac{0.545 \cos 8^\circ}{\cos(\cancel{60-8^\circ}\, 60^\circ - 8^\circ)}\right]$$

$$= 0.71\left[1 + \frac{0.539}{0.615}\right]$$

$$= 1.33$$

$$R = 3I - (G+B)$$

$$= 3 \times 0.71 - (0.323 + 1.33)$$

$$= 2.13 - 1.653$$

$$= 0.477$$

$$\therefore (R, G, B) = (\cancel{0.477}\ 0.477, 0.323, 1.33)$$

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Answer to the Q. No. 4(b)

$a = 12 + 10 = 22$

$b = 12 + 8 = 20$

$c = 22/2 = 11$

$d = 20/2 = 10$

(1) Translat $P_1(3, 2)$ and $P_2(15, 12)$ by (a, b)

$\therefore P_1' = (3 + a, 2 + b)$

$= (3 + 22, 2 + 20)$

$= (25, 22)$

$P_2' = (15 + a, 12 + b)$

$= (15 + 22, 12 + 20)$

$= (37, 32)$

(2) Scale P_1', P_2' by (c, d)

$P_1'' = (c \times P_1'x, d \times P_1'y)$

$= (11 \times 25, 10 \times 22)$

$= (275, 220)$

$P_2'' = (c \times P_2'x, d \times P_2'y)$

$= (11 \times 37, 10 \times 32)$

$= (407, 320)$

$\therefore$ New coordinates of P_1 is $(275, 220)$ and P_2 is $(407, 320)$.