Uva Wellassa University of Sri Lanka
Faculty of Science and Technology
Department of Computer Science and Technology
300 level 1st Semester Examination – June/July 2017
CST372-3 Computer Graphics

Uva Wellassa University

Instructions to candidates:
Duration: Three (03) hours
Number of questions: Six (06)
Answer all questions
Mark allocation: 100
Calculators are allowed.

1.

a. Differentiate Computer Graphics over Digital Image Processing.

(2 mark)

b. What are the benefits expected from a LED-backlit display compared to LCD displays equipped in Cold Cathode Fluorescent Lamp (CCFL)?

(2 mark)

c. List the key milestones incurred in the technological evolution of video system interfaces on mainboards and compatible graphics adapters.

(3 mark)

d.

i. Briefly explain the working principle of an Active-Pixel Sensor (APS).

(2 mark)

ii. Compare and contrast the CMOS and CCD sensor technologies.

(4 mark)

e. Discuss the key implication of High-dynamic-range imaging (HDRI or HDR) technology.

(2 mark)

2.

a.

i. Explain the necessity of using **two (02)** different colour models for display devices (RGB) and printing (CMYK).

(2 mark)

ii. Clearly stating the formulae and the intermediate steps to convert the RGB values (255,155,0) to CMYK.

(3 mark)

b.

i. Distinguish between the spatial resolution and bit-depth resolution.

(2 mark)

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ii. Vector graphic approach is preferred when designing company logos and fonts. Justify the vector graphic approach while giving the reasons clearly.

(2 mark)

c.

i. What are the major concerns associated with a typical illumination model?

(3 mark)

ii. Define an illumination model and explain the terms i.e. coefficients which the model comprised of. (3 mark)

3.

a.

i. What is meant by Scan Conversion? (2 mark)

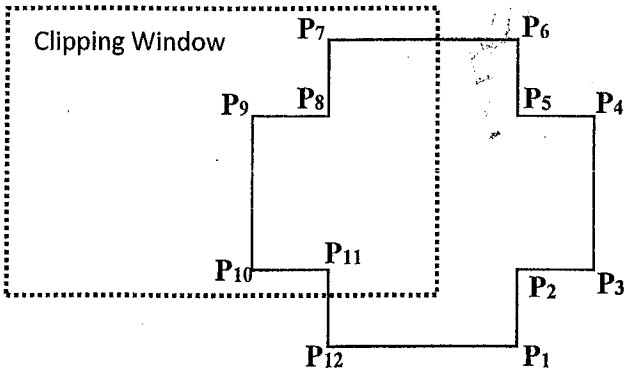
ii. Briefly explain the DDA (Digital Differential Analyzer) algorithm for line drawing.

(4 mark)

b. Using appropriate examples, explain the Cohen-Sutherland Clipping algorithm which is used to determine whether a line is inside, outside or partially inside of the world window.

(3 mark)

c. Using Sutherland Hodgman polygon clipping algorithm, clip the polygon below. Clearly state the intermediate steps.



(6 mark)

4.

a. Define the building blocks used in generating the 2D projection of a 3D object.

(3 mark)

b. Briefly explain the key advantages of using homogeneous coordinate systems.

(2 mark)

c.

i. List the sequence of transformations required to rotate an object about an arbitrary point (x_a, y_a). (3 mark)

ii. Derive the composite transformation matrix for the sequence given in c.(i). (3 mark)

iii. Find the resulting points after rotating +60° about the point (13, 9), for the following case (Refer Fig. 01.), using the derived composite transformation matrix in above c.(ii).

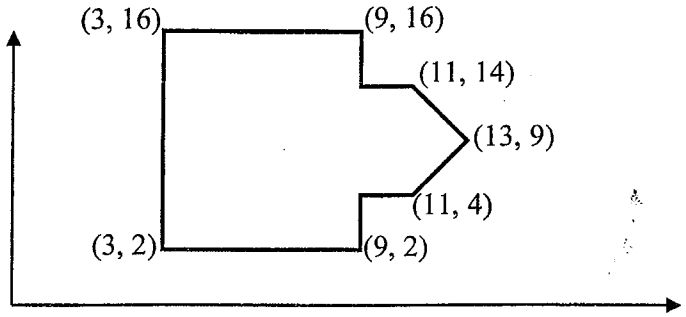


Fig. 01

(8 mark)

5.

a.

i. List the steps to be followed in order to perform a rotation of an object about its vertical axis in a 3D space. Assume that the object is symmetrical about its vertical axis and the vertical axis is parallel to the y axis. (3 mark)

ii. Derive the formula for the composite transformation $\boldsymbol{R(\theta)}$ stated in a.(i). (3 mark)

b. Derive the composite matrix for the following sequence of transformations.

i. Translate by $-t_x$, $-t_y$, $-t_z$ along x, y, and z respectively, in order to move a generic point to the origin.
ii. Scale the object by scale factors $S_x = S_y = S_z = 3$.
iii. Rotate by an angle of α about y-axis.
iv. Reflex through x-z plane.

(10 mark)

c. Transform the position vector [4 -2 5 1] according to the above 5.b. sequence of operations. ($t_x = 6$, $t_y = 7$, $t_z = 3$, $\alpha = +30°$) (2 mark)

6.

a

What are the different types of 3D coordinate systems used in computer graphics?

(3 mark)

b. Define the following term with the aid of graphical illustrations.

i. World Window (1 mark)

ii. Viewport (1 mark)

c.

i. Explain the importance of normalization in the perspective of mapping a window in to a device viewport.

(2 mark)

ii. Discuss the basic principles of window-to-viewport mapping.

(3 mark)

d. Write down short-notes on the following standards.

i. Graphical Kernel System (GKS)

ii. Programmer's Hierarchical Interactive Graphics System (PHIGS)

iii. Open Graphics Library (OpenGL)

iv. Microsoft DirectX

(8 mark)