

UNIVERSITY OF SWAZILAND

FACULTY OF SCIENCE

DEPARTMENT OF COMPUTER SCIENCE

MAIN EXAMINATION, 2009

Title of Paper : **Computer Graphics**

Course Number : **CS246**

Time Allowed : **Three (3) Hours**

Instructions : **Answer only FIVE questions from Section B**
All questions are worth 20 marks

Special requirement : **Graph paper**

This paper should not be opened until permission has been granted by the invigilator.

Question 1.

- (a) Differentiate between computer graphics and image processing. [4]
- (b) Briefly describe how we see objects. [4]
- (c) Why is it that we do not recognize some of the objects that we look at? [2]
- (d) Why should we study user interfaces alongside computer graphics? [5]
- (e) Why was vector graphics discontinued? [3]

Question 2

- (a) How does a CRT work? [8]
- (b) Describe how a vector graphics display works [6]
- (c) Vector display was a great improvement over and above printers as a form of output. Despite this improvement over printers, computer graphics was not of widespread use during the vector display era. Explain giving three reasons, why graphics was not of widespread use. [6]

Question 3

- (a) Compare and contrast vector graphics and raster graphics. [4]
- (b) Describe high resolution and explain why it is desirable. [4]
- (c) The diagram defined by the following set of line segments has some points of intersection. Compute these points of intersection (do not estimate them) [12]
 - (i) the line $x = y$ clipped to the rectangle defined by $(0,0)$ and $(12, 15)$
 - (ii) segment joining the points $(0,4)$ and $(6,10)$
 - (iii) segment defined by:
$$\begin{pmatrix} x \\ y \end{pmatrix} = \lambda \begin{pmatrix} 1 \\ 7 \end{pmatrix} + \begin{pmatrix} 4 \\ 1 \end{pmatrix}; 0 \leq \lambda \leq 1$$
 - (iv) segment joining the points $(8,13)$ and $(14,6)$
 - (v) the line $x = 17$ clipped between the lines $y = 3$ and $y = 13$.

Question 4

- (a) Lines are an important aspect of computer graphics – hence their quality. Discuss the four criteria for judging a good line drawing algorithm. [4]
- (b) Why is vector graphics better than raster graphics in drawing straight lines. [6]
- (c) Draw the line segments between the following points using the recursive line drawing algorithm for a raster graphics system (1 pixel area = 1cm^2):
 - $(1, 2)$ to $(5, 8)$;
 - $(4, 2)$ to $(6, 9)$. [7]
- (d) Explain why the end points will always be drawn in the system above. [3]

Question 5

- (a) Compute the coordinates of the image of (3,2) after each of the following transformations:
- rotation around the point (4, 1) through an angle of 90° ;
 - rotation around the point (3, 2) through an angle of 30° . [5]
- (b) Derive the image point for rotating an arbitrary point (x, y) around the origin through an angle ϕ . [7]
- (c) Find the transformation matrix for rotation around the point (x, y) over an arbitrary angle ψ . [8]

Question 6

- (a) Define an API. [4]
- (b) Group, describe and differentiate the following devices: scanner, loudspeaker, data-glove, plotter, and frame-grabber [8]
- (c) Discuss four user interface design principles. [8]