UNIVERSITY OF SWAZILAND

FACULTY OF SCIENCE

DEPARTMENT OF COMPUTER SCIENCE

MAIN EXAMINATION, 2006

Title of Paper   :   Computer Graphics

Course Number   :   CS246

Time Allowed   :   Three (3) Hours

Instructions   :   Answer **ALL** questions in Section A
Answer **only THREE** 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.
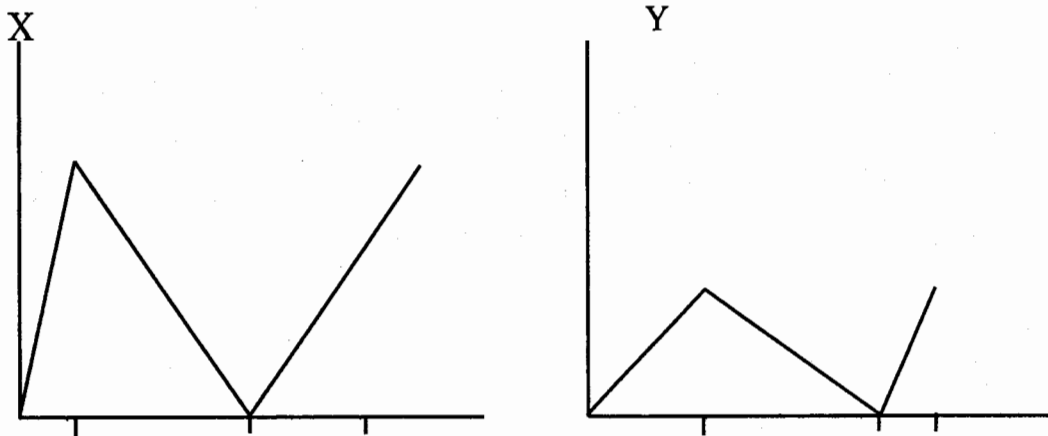
SECTION A

Answer all questions from this section.

Question 1.

    (a)   Discuss the differences between direct manipulation, menu driven and command driven user interfaces.   **[8]**

    (b)   Briefly describe how people see objects.   **[2]**

    (c)   Why should we study user interfaces alongside computer graphics?   **[2]**

    (d)   Good user interfaces are difficult to produce due to some technical and human problems. Describe any:

        –   two technical problems of this nature;   **[5]**

        –   one human problem which contributes to this.   **[3]**

Question 2

    (a)   How does a vector graphics display work?   **[8]**

    (b)   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]**

    (c)   Use a graph paper to draw the output resulting from the following signals, indicating all important points, time marks are all at corresponding equal times:

[6

]

Intensity

SECTION B

*Answer any **three** questions from this section.*

Question 3

(a) Vector display started off with some problems which were quickly ratified by technological improvements. However, despite these technological advancements vector graphics was disused due to two serious disadvantages – discuss these two serious disadvantages. [4]

(b) Briefly discuss the meaning of the tem raster graphics. [4]

(c) Sizes of CRTs are normally given by the length of their diagonal (the ratio of the width and height is standardised at 2:3). With a 14" tube and a *640* x *480* frame-buffer, what are the horizontal and vertical resolutions? What area of screen should be used to get an aspect ratio of 1:1? [6]

(d) How much memory is needed for a *2048* x *2048* frame-buffer with depth 6?

[6]

Question 4

(a) Lines are an important aspect of computer graphics – hence their quality. List four criteria for judging a good line drawing algorithm. [4]

(b) Show that the Bresenham line drawing algorithm is purely integer arithmetic i.e., there are no fractions and no multiplications. [8]

(c) Draw the line segments between the following points using the recursive line drawing algorithm:
  − (10, 10) to (15, 18)
  − (3, 3) to (9, 8). [6]

(d) Explain why the end points will always be drawn in the Bresenham's algorithm.

[2]

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°. [4]

(b) Find the transformation matrix for rotation around the point (*x, y*) over an arbitrary angle. [4]

(c) Draw the diagram resulting from joining the following points: (*5, 7*), (*5, 4*), (*2, 1*) and (*2, 3*) and draw the images that will result after performing the following transformations in succession (one image after the other):
  − scaling by scale factor 2;
  − clipping using the clipping window (0, 0) – (10, 10);
  − rotation through 90°, around the origin. [12]

Question 6

(a) Group, describe and differentiate the following devices: scanner, loudspeaker, data-glove, plotter, and frame-grabber. [8]

(b) Give an example of a situation where a loudspeaker would be the only best form of output stating why you think the loudspeaker would be the best in that situation. [4]

(c) Discuss four user interface design principles. [8]