

UNIVERSITY OF SWAZILAND

FACULTY OF SCIENCE

DEPARTMENT OF COMPUTER SCIENCE

SUPPLEMENTARY EXAMINATION, JULY 2016

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

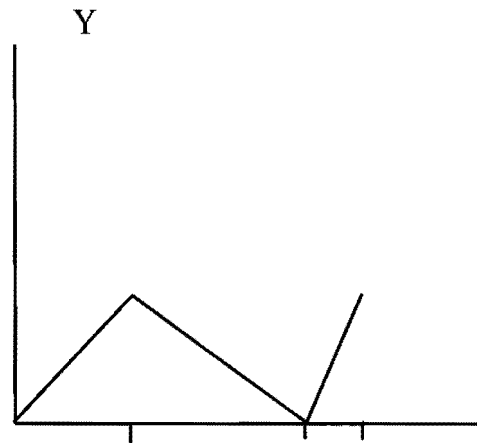
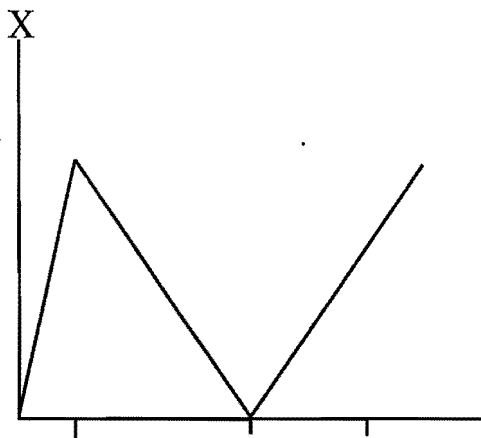
Answer all questions from this section.

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

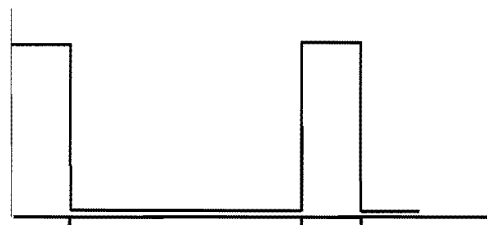
- (a) How does a vector graphics display work? [8]
- (b) Vector display was a great improvement over and above printers as a form of output. Despite this improvement over printers, computer graphics was not of widespread use during its era. Explain giving three reasons, why graphics was not of widespread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

1

Intensity



SECTION B

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

Question 3

- (a) Draw the diagram resulting from the following five segments and compute the coordinates (don't read them from the diagram) of their points of intersections, if any: [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:
$$\begin{pmatrix} x \\ y \end{pmatrix} = \lambda \begin{pmatrix} 1 \\ 7 \end{pmatrix} + \begin{pmatrix} 4 \\ 1 \end{pmatrix}; 0 \leq \lambda \leq 1$$
 - iii) segment joining the points $(8, 13)$ and $(14, 6)$
 - iv) the line $x = 17$ clipped between the lines $y = 3$ and $y = 13$.
- (b) Establish and briefly describe all the possible segment-segment relations. [8]

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 the point $(3, 2)$ 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]