

# UNIVERSITY OF SWAZILAND

FACULTY OF SCIENCE

*DEPARTMENT OF COMPUTER SCIENCE*

SUPPLEMENTARY EXAMINATION, JULY 2019

Title of Paper : Computer Graphics  
Course Number : CSC 352  
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

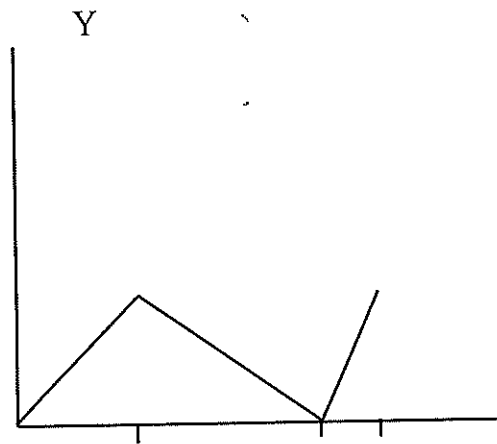
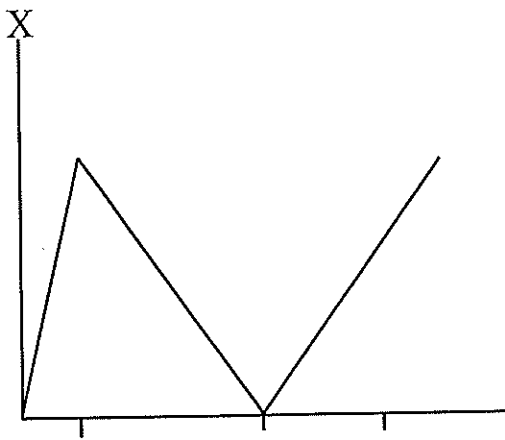
Answer *all* questions from this section.

Question 1.

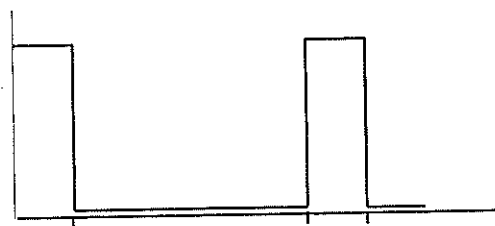
- (a) Discuss the differences between direct manipulation, menu driven and command driven user interfaces. [8]
- (b) Briefly describe how people see objects. [2]
- (c) Why should we study user interfaces alongside computer graphics? [2]
- (d) Why was computer graphics not so widespread at its inception? [5]
- (e) Why don't we see the colour black, yet recognize it? [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]



Intensity



## SECTION B

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

### Question 3

- (a) Sketch 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  $90^\circ$ ;  
– rotation around the point  $(3, 2)$  through an angle of  $30^\circ$ . [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  $90^\circ$ , 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]