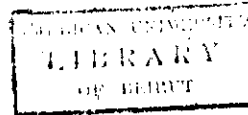


American University of Beirut
Faculty of Arts & Science
Dept. of Mathematics



Name: _____

ID: _____

Course: Computer Graphics - 285
Time : 2 Hours

Exam : Final
Term : Fall 1995-96

Please read clearly all parts before you answer. Keep your answers, clear, clean and well organized.
Good work Ahmad Nasri

General (11pts)

1. Answer by True (Tick) or False (X) each of the following questions:

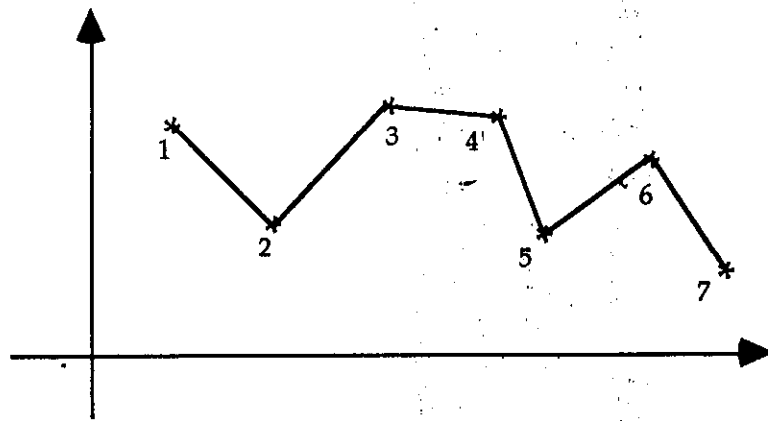
- a) The video-controller is capable of modifying the contents of the frame buffer during the fly back time only.
- b) The output of the x and y registers are used to determine the vertical and the horizontal deflection voltages.
- c) In Moving pen techniques for producing thick primitives, the thickness problem can be eliminated by the use of a circular footprint.
- d) In weighted area sampling, the intensity of the pixel is obtained by multiplying the maximum intensity I_{max} by the area of overlap.
- e) Panning is the process of mapping a variable size window to a variable size viewport.
- f) In the replicating pixels method for producing thicker primitives, horizontal lines are thicker than vertical lines.
- g) With a 16 colors that can be displayed simultaneously from a palette of 64 colors, there are 4 bits per an entry in the color table.
- h) If the number of available colors is 512, there are 8 gray levels among them.
- i) Using homogeneous coordinates in 2D, the triple $[0, -0, 0]$ may represent the origin.
- j) Scan Conversion is the process of digitizing a picture into a set of pixel values for storage in the frame buffer.
- h) In Hardware interaction, the concept of handles is very useful in the Construction Technique.

Line Drawing and Text (23 pts)

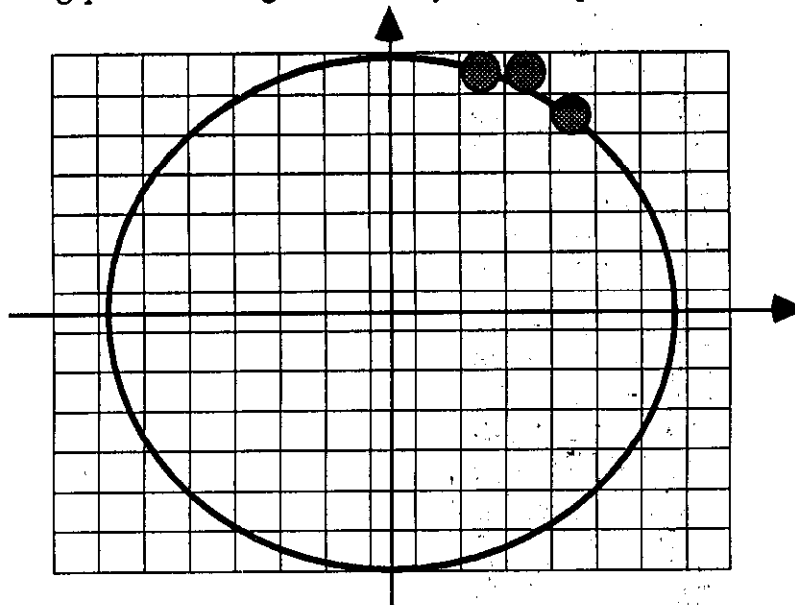
2. Write a function that takes as a parameter a polygon stored in a PHIGS array P of type wcPoints of 4 points and returns true if that polygon is a rectangle, false otherwise. *It is enough to provide an algorithm.*



3. Give the graphics commands to output the following polygons assuming that (*) is given the code 6 and the data points are stored in WCPoints. The axes are not to be output.

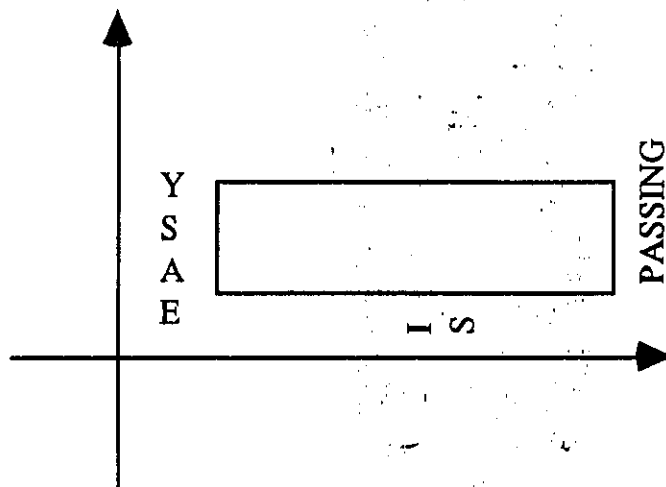


4. The following pixels were generated by the Midpoint Circle Algorithm.



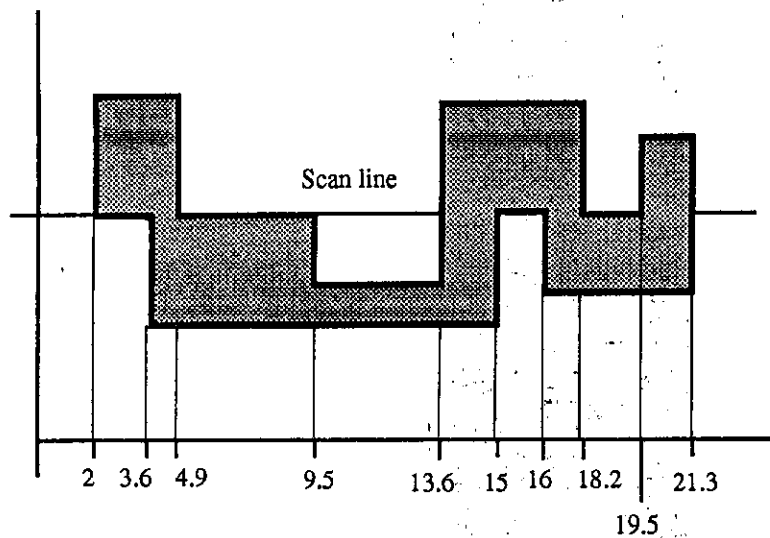
Draw the corresponding pixels on the other parts of the circle.

5. What is the character up vector to output each word of the text "PASSING IS EASY" as depicted in the figure below. Determine the corresponding text attributes in each case (no need to output the text itself):

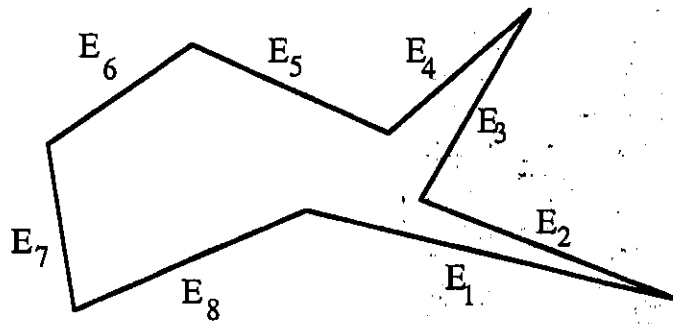


Fill Area (10 pts)

6. Indicate (on the figure) the missing pixels after filling the area specified by the following polyline. Give also the spans on the scan line indicated. Give your answer in terms of an ordered set of intervals, e.g. $[11,12[$ means all pixels starting from 11 until 12 (12 not included) are filled.



7. Show how to split the concave 2D polygon below into convex polygons using the vector method:

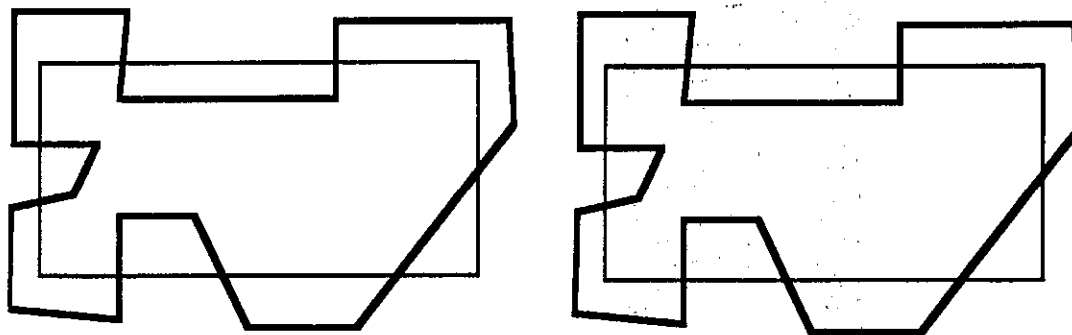


Window and Viewport (8 pts)

8. A rotated window in world coordinates is defined by the view up vector $(-1,1)$ with one of its corners at the origin. Write a piece of PHIGS code to map the contents of this window to the upper left corner of the screen.

Clipping (6 pts)

9. Using the Cohen Sutherland algorithm for line clipping show how to clip the following polygon (solid lines) against each of the Left edge of the window:



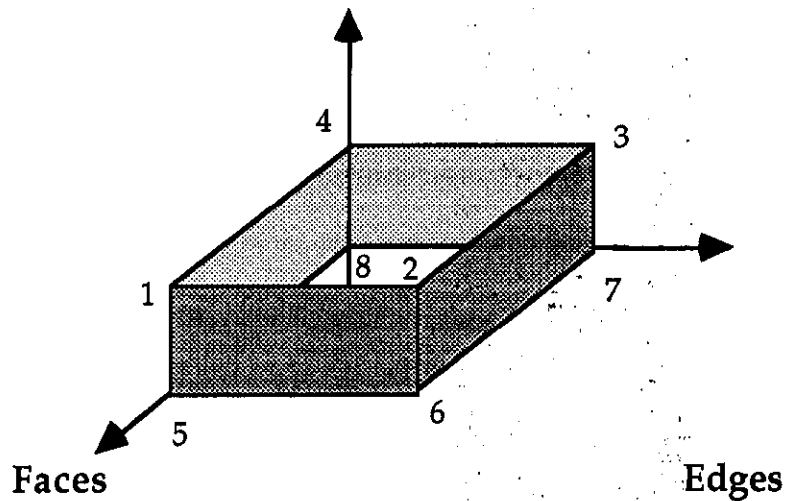
Left Edge

Bottom

After clipping against the left edge of the window, show the result of clipping against the bottom edge.

Object Representation (7 pts)

10. Give the 3-D representation of the following object. You do not need to show the coordinates of the vertices.



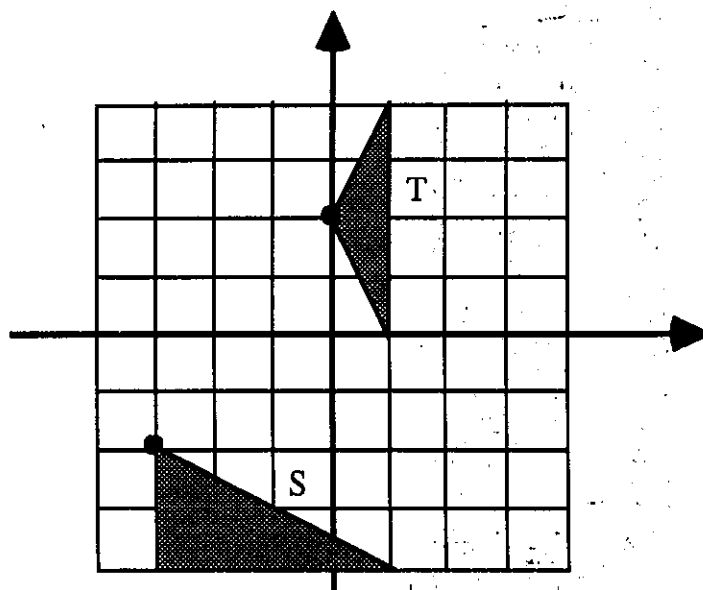
Transformation and Segment (27pts)

11. In terms of the transformations :

- $T(a,b)$ -- Translate by (a,b) ,
- $R(q)$ -- Rotate counter clockwise q degrees about the origin,
- $S(a,b)$ -- Scale x by a and scale y by b with respect to the origin.
- $Sh_x(a)$ -- Shearing in the x direction by a .
- $Sh_y(b)$ -- Shearing in the y direction by b .

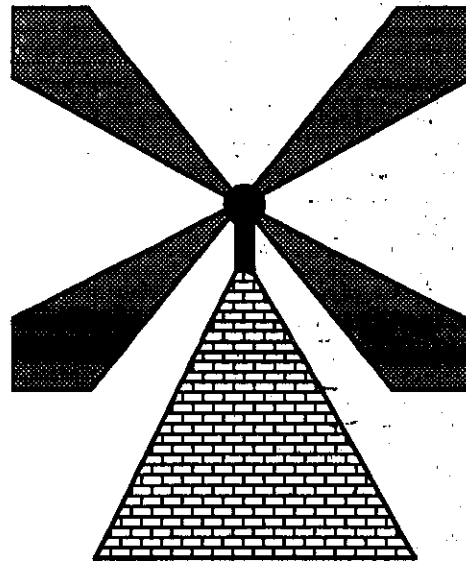
Give a sequence of transformations that will :

a. take the solid triangle T to the triangle S as indicated below.



- b. Consider the reflection about the line (D) which makes an angle of $\frac{3\pi}{4}$ with the X-axis and whose intercept on each axis is 1. Determine the equations that relate a point P(x,y) to a point P'(x',y') under this transformation.

- c. The data of a fan of a windmill is stored in the PHIGS variable Fan of type wcPoints.



- (i) Write in PHIGS a segment structure fan to display the fan filled with color of index gray.

(ii) Use the structure fan of (i) to write another structure **RotateFan** that rotates the fan by an angle **Theta** degree.

(iii) Write the code to animate the rotation of the fan. What factors can determine its speed of rotation.

User Interface (8 pts)

12. Consider the following snapshots of a dialogue for the **AudioShop** software. Answer the following questions for the snapshot indicated:

Snapshot 1.

Disk Management

When **Audio CDs** are inserted, automatically

Create new player Randomise

Add Tracks Start playing

Miscellaneous

Multiply the play rate by **2.0** when REW

2.0 when FF

Load Partial track prior to playing

Whole

Down and Up cycles tracks at playlist ends

Simulate VU meter for CD Tracks

Cancel OK

a. What type of interaction task is used to enter the option Load

b. What is the difference between a choice box and a radio button?
Give example of each of them from this dialogue:

choice box : _____ radio button: _____

c. Does this dialogue contain an UNDO operation? If yes what is it?

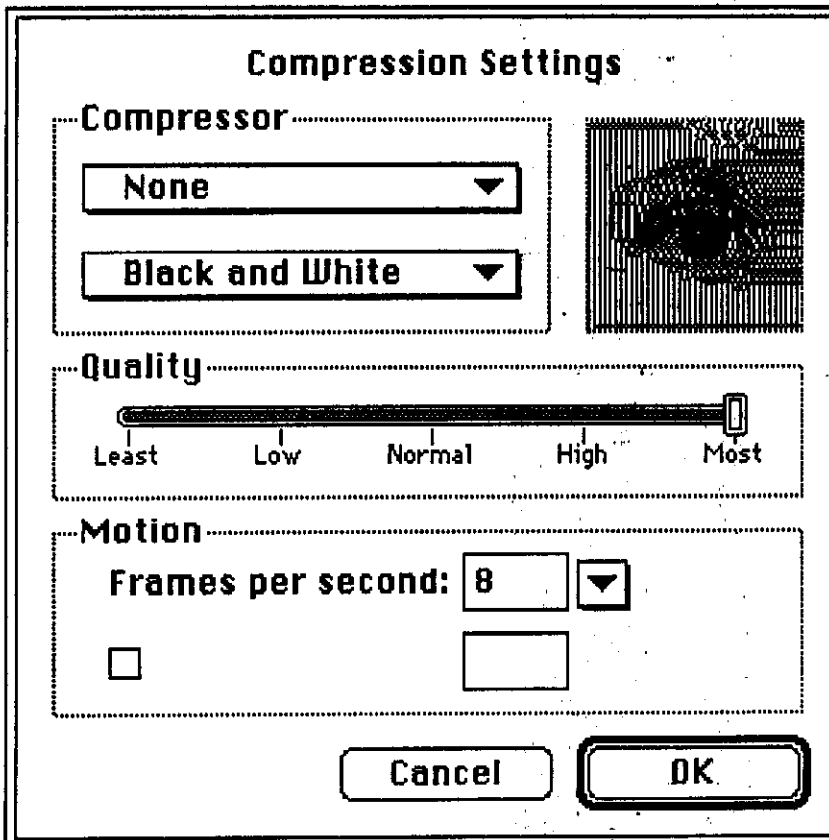
c. Does this dialogue contain a variable sized choice or a Fixed sized choice? If yes indicate which menu this set belongs to?

d. What interaction task is used to input the Multiply the rate by?

e. Why the OK button is in Bold?

In the following user dialogue, answer each of the following questions:

Snapshot 2



- f. Which task is used to select the **quality** in compression dialogue and what feedback is involved?
-
- g. What task is used to input the number of frames per second in the compression dialogue?
-
- h. Show how to replace the quality menu by a slot menu.
-
- i. What style is used to represent the items in the menu compressor?