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UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER I
SESSION 2012/2013**

COURSE NAME : GRAPHIC PROGRAMMING
COURSE CODE : BIT 2023/BIT 20203
PROGRAMME : 2 BIT
EXAMINATION DATE : DECEMBER 2012 / JANUARY 2013
DURATION : 3 HOURS
INSTRUCTION : ANSWER ALL QUESTIONS.

THIS QUESTIONS PAPER CONSISTS OF FIVE (5) PAGES

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SECTION A

Instruction: State whether the following statements are **TRUE** or **FALSE**.

- Q1** A *Discriminator Function* has properties considering points inside, outside and on a circle.
- Q2** Midpoint Ellipse algorithm emphasizes on sampling direction.
- Q3** The `evaluateViewMappingMatrix()` is used to define about the viewing reference system.
- Q4** Translation distance pair (t_x, t_y) is called *shift vector*.
- Q5** Any positive and negative value can be assigned to *scaling factors* s_x and s_y .
- Q6** Image is generated relative to an axis of reflection by rotating the object 360° about the reflection axis.
- Q7** In raster algorithm, we sample at unit intervals & determine the closest pixel position to the specified circle path at each step.
- Q8** *Cohen-Sutherland Line Clipping* algorithm is used in clipping a polygon against successive window boundary.
- Q9** *Shear* is a transformation that produces a mirror image of an object.
- Q10** In OpenGL, we rotate objects about the axes x, y and z with the function `glRotated(angle, x, y, z)`.

(10 marks)

SECTION B

Instruction: Answer **ALL** questions.

Q11 Describe the function for each OpenGL statement below.

(a) `glClearColor(1.0, 1.0, 1.0,1.0);` (2 marks)

(b) `glEnd();` (2 marks)

(c) `glViewport(0,0,w,h);` (2 marks)

(d) `glTranslatef(4.0,0.0,0.0);` (2 marks)

(e) `glutInitWindowPosition(0,0);` (2 marks)

Q12 Given the ellipse parameters are $r_x = 8$ and $r_y = 6$, use the following midpoint ellipse algorithm to:

$$2r_y^2x = 0 \qquad 2r_x^2y = 2r_x^2r_y \qquad p1_0 = r_y^2 - r_x^2r_y + \frac{1}{4}r_x^2$$

$$p1_{k+1} = p1_k + 2r_y^2x_{k+1} + r_y^2$$

$$p1_{k+1} = p1_k + 2r_y^2x_{k+1} - 2r_x^2y_{k+1} + r_y^2 \quad \text{with}$$

$$2r_y^2x_{k+1} = 2r_y^2x_k + 2r_y^2, \quad 2r_x^2y_{k+1} = 2r_x^2y_k - 2r_x^2$$

- a) calculate each possible pixel coordinates along the ellipse path in the first quadrant. Copy the following Table 1 onto your answer script with complete calculations. (16 marks)

Table 1: Ellipse pixel coordinates

k	$p1_k$	(x_{k+1}, y_{k+1})	$2r_y^2x_{k+1}$	$2r_x^2y_{k+1}$
0				
1				
2				
3				
4				
5				
6				

- b) plot the pixel coordinates.

(4 marks)

Q13 Given the circle radius is 5, use the following midpoint circle algorithm to:

$$P_0 = 1 - r$$

$$p_{k+1} = p_k + 2x_{k+1} + 1$$

$$p_{k+1} = p_k + 2x_{k+1} + 1 - 2y_{k+1}$$

Where $2x_{k+1} = 2x_k + 2$ and $2y_{k+1} = 2y_k - 2$

- (a) calculate each possible pixel coordinates along the circle octant in the third quadrant from $x=0$ to $x=y$. Copy the following Table 2 onto your answer script with complete calculations.

(12 marks)

Table 2: Midpoint circle pixel coordinates

k	P_k	(x_{k+1}, y_{k+1})
0		
1		
2		

- (b) plot the pixel coordinates.

(3 marks)

- Q14** Using the following scaling and rotation functions, write a complete program that will illustrate scaling transformation (from object A to object B) as depicted in **Figure Q14**. Given that scaling factor $(s_x, s_y) = (3, 3)$, coordinate for object A = $\{(5, 5), \{15, 5\}, \{10, 30\}\}$ and object A are black in color and B are green in color.

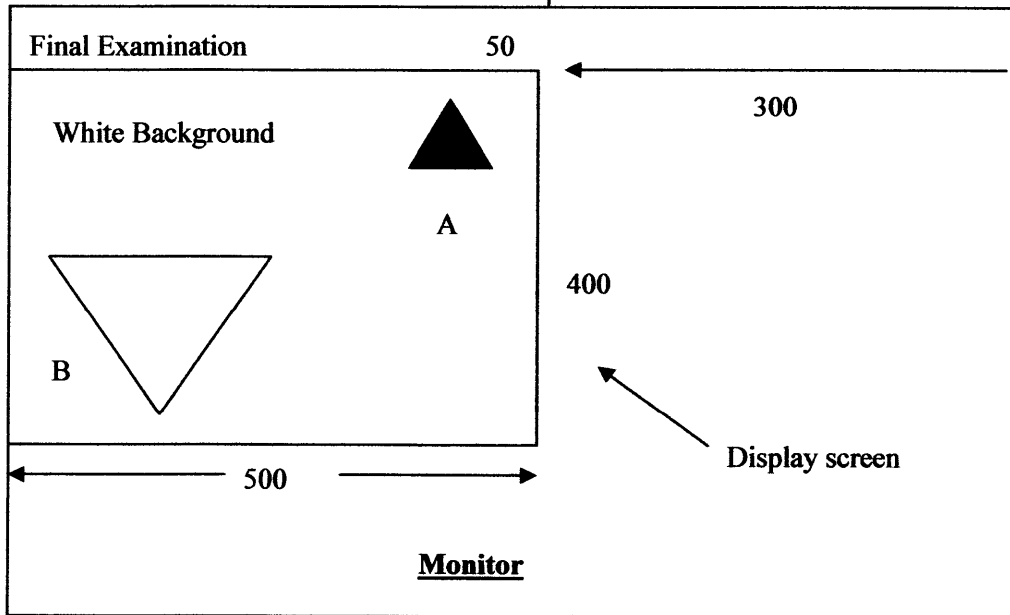


FIGURE Q14

(20 marks)

- Q15** Describe about the *Two-Dimensional Viewing Pipeline* using appropriate diagram.

(10 marks)

- Q16** Compare between the techniques used in Cohen-Sutherland Line Clipping algorithm and Nicholl-Lee-Nicholl (NLN) Line Clipping algorithm. Write at least **THREE (3)** comparisons by supporting it with appropriate diagrams.

(15 marks)

END OF QUESTION