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**UNIVERSITI TUN HUSSEIN ONN MALAYSIA**

**FINAL EXAMINATION  
SEMESTER I  
SESSION 2018/2019**

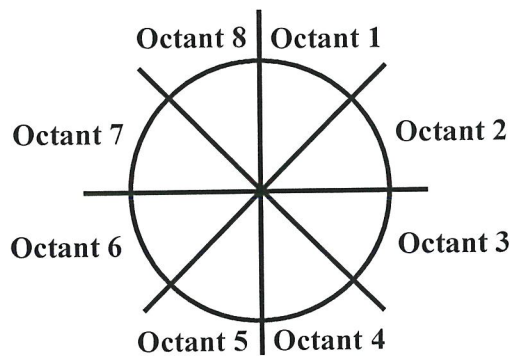
COURSE NAME : COMPUTER GRAPHICS AND ANIMATION  
COURSE CODE : BIM 20303  
PROGRAMME CODE : BIM  
EXAMINATION DATE : DECEMBER 2018 / JANUARY 2019  
DURATION : 3 HOURS  
INSTRUCTION : ANSWER ALL QUESTIONS

THIS QUESTION PAPER CONSISTS OF SIX (6) PAGES

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**TERBUKA**

- Q1**
- (a) Define the term geometric transformation in computer graphics. (2 marks)
  - (b) State and draw any **TWO (2)** basic geometric primitives that can be transformed. (4 marks)
  - (c) Explain why we need to use the homogeneous coordinate representation in calculating the geometric transformations. Provide an example to support your answer. (4 marks)
  - (d) Given a triangle with coordinates,  $A(-1, 7)$ ,  $B(-6, 11)$  and  $C(-6, 3)$ . Calculate the new coordinates of the triangle if it is enlarged about the fixed point  $A$ , 2.5 bigger than the original size uniformly using the homogeneous coordinate in matrix form. (10 marks)



**Figure Q2**

- Q2** Figure Q2 shows the eight octants of a circle. Given a circle with  $radius = 7$  and the center of the circle is at the origin. You are required to use the midpoint circle algorithm to draw this circle. The formulas for the decision parameters are as follows:

$$\begin{aligned}
 p_0 &= 1 - r \\
 p_{k+1} &= p_k + 2x_{k+1} + 1 \\
 p_{k+1} &= p_k + 2x_{k+1} + 1 - 2y_{k+1}
 \end{aligned}$$

- (a) Determine the pixels to be plotted in the **Octant 1**. Show your answer in table form as follows:

$k$	$p_k$	$(x_{k+1}, y_{k+1})$

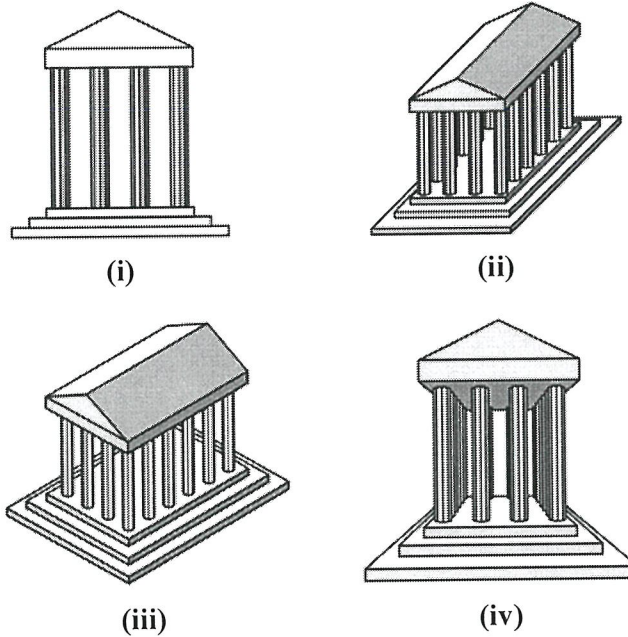
(8 marks)

- (b) Determine the pixels to be plotted in the **Octant 3**. (4 marks)

- (c) Predict the pixels to be plotted in the **Octant 6** if the center of the circle is changed to  $(4, 3)$ . Show step-by-step solutions. (8 marks)

- Q3** (a) Describe any **THREE (3)** properties of creating a 3D world. (6 marks)

- (b) Differentiate between parallel and perspective projections. (4 marks)

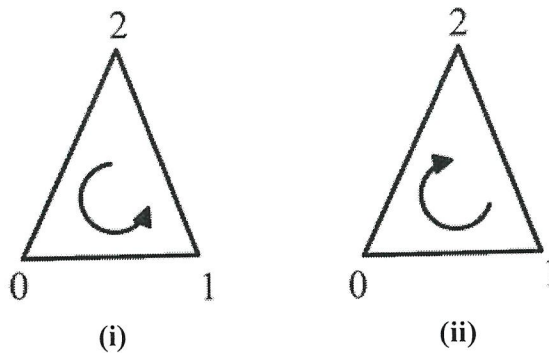


**Figure Q3**

- (c) Figure **Q3** shows the different types of projections. Name the labeled (i)-(iv). (4 marks)

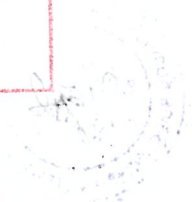
- (d) You are required to build a simulation of a moving bicycle. The bicycle consists of the main body frame, handle bars, seat post, pedals and two wheels. Construct a scene graph to represent this bicycle whereby it must be illustrated in hierarchical form and have the correct root, leaf and intermediate nodes and the correct parent-child node relationship. (6 marks)

- Q4** (a) Give the definition of 3D modeling. (2 marks)



**Figure Q4**

- (b) Figure **Q4** illustrates the orientation of polygons as surface elements. Describe the visibility of both polygons above. (4 marks)
- (c) Distinguish between the polygonal-based and volumetric-based modeling techniques. (4 marks)
- (d) Draw **ONE (1)** example of a quadtree structure and its corresponding space division. (2 marks)
- (e) Produce a solution to model a 3D symmetrical vase with a textured image using the spinning technique. Show the steps needed and sketch appropriate figures to support your answer. (8 marks)



- Q5** (a) Explain about the object-space and image-space methods used in determining the visible surfaces in computer graphics. (4 marks)
- (b) Outline **TWO (2)** advantages and **TWO (2)** disadvantages of using the depth buffer. (4 marks)

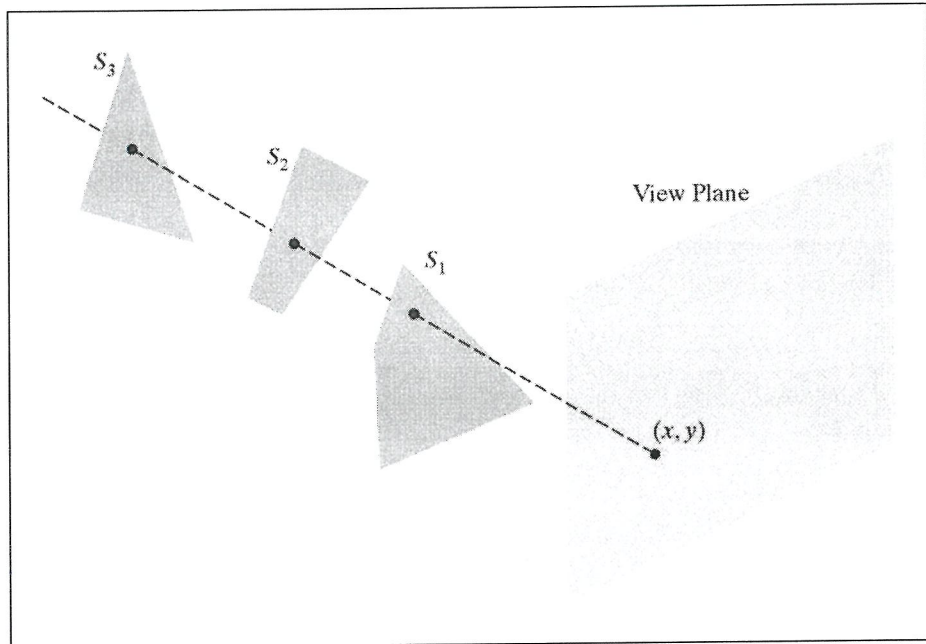
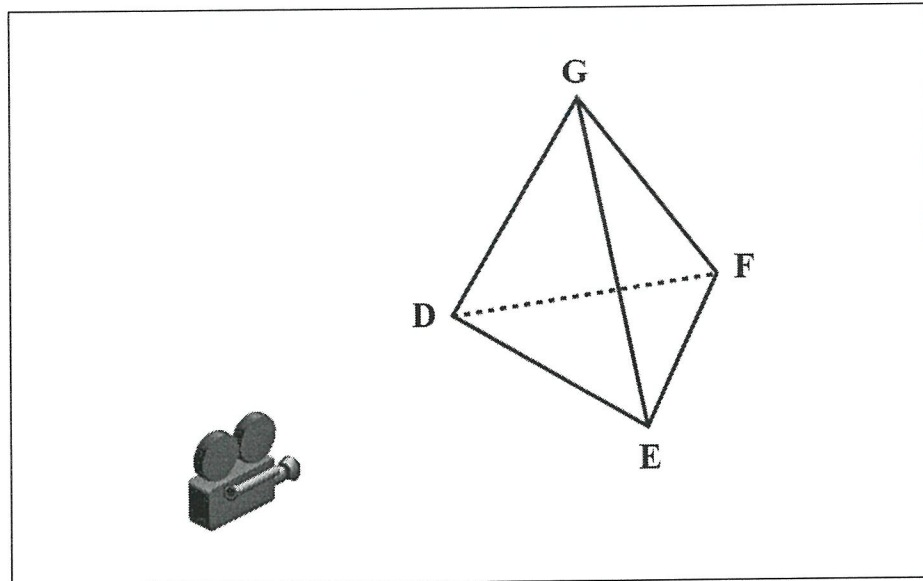


Figure Q5(a)

- (c) Given a 3D scene as illustrated in Figure **Q5(a)**. Write a pseudo code to represent the algorithm to fill out the correct pixel colors to the polygon surfaces when dealing with the overlapping objects in 3D environment. (8 marks)



**Figure Q5(b)**

- (d) Figure **Q5(b)** shows a camera and a triangular pyramid with their fix positions and orientations. Interpret how to detect the visibility status of all pyramid's surfaces: DEG, EFG, DFG and DEF using the backface culling algorithm.

(4 marks)

**- END OF QUESTION -**

