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**UNIVERSITI TUN HUSSEIN ONN MALAYSIA**

**FINAL EXAMINATION  
(ONLINE)  
SEMESTER I  
SESSION 2020/2021**

COURSE NAME : COMPUTER GRAPHICS  
COURSE CODE : BIM 20603  
PROGRAMME CODE : BIM  
EXAMINATION DATE : JANUARY/ FEBRUARY 2021  
DURATION : 3 HOURS  
INSTRUCTION : 1. ANSWER ALL QUESTIONS.  
2. PLEASE MAKE SURE TO CLICK "SAVE ANSWER" BUTTON FOR ALL SUBJECTIVE QUESTIONS.  
3. THE STUDENT SHOULD UPLOAD THE ANSWER BOOKLET (PDF/WORD FORMAT) WITHIN 30 MINUTES AFTER EXAMINATIONS OVER.

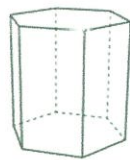
THIS QUESTION PAPER CONSISTS OF FIVE (5) PAGES

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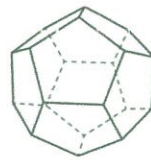
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- Q1 (a) Creating realistic digital images is one of the main goal for all professional computer graphics designers. Distinguish the foundation concepts to visually manipulate a 2D design into a realistic 3D image. (8 marks)
- (b) Model ONE (1) solid 3D geometric object that represents the combination of a hemi-sphere, cylinder and cone. (4 marks)
- (c) To provide realism and natural image, 3D object must contain information about its geometry and properties of its surface. As a programmer or developer, identify the approaches that can make images more believable, with respect to the shape and surface texture properties. (4 marks)

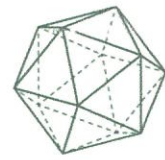
- Q2 (a) Figure Q2 shows three type of 3D geometric objects List down all 2D shapes (name and quantity of these 2D objects) that make up for each of these 3D objects. (6 marks)



Hexagonal Prism



Dodecahedron  
FIGURE Q2

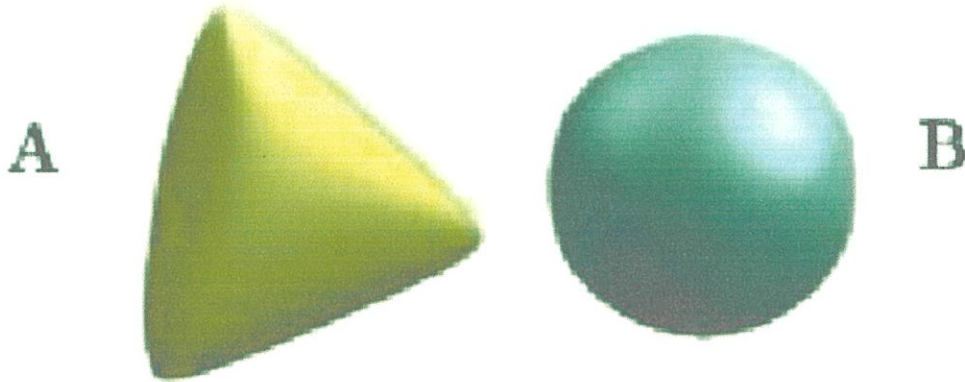


Icosahedron

- (b) Dataset of Magnetic Resonance Imaging (MRI) of human thigh muscles of patient with metabolic disorders were collected and studied to analyze for any soft or hard tissues discrepancies. These MRIs were scanned in transverse plane, each scan with a thickness of 15mm.
  - (i) Based on information above, classify the element that form the third axis of this MRI scan. (2 marks)
  - (ii) In computer graphics, what are the main elements that enable for the construction of a 3D MRI? (2 marks)
- (c) In the form of a table, compare how octree technique is different from quadtree technique. (8 marks)

Handwritten notes in blue ink, partially legible, appearing to be a student's name and ID number.

**Q3** Constructive Solid Geometry (CSG) is a technique used in solid object modelling, that enables for a formation of complex surface or object by using Boolean operators. **Figure Q3** illustrates object A (tetrahedron) and object B (sphere) in their original 3D form



**FIGURE Q3**

Construct the CSG output result of object A and B, based on Boolean operator below:

- (a)  $A \cap B$  (2 marks)
- (b)  $A - B$  (2 marks)
- (c)  $B - A$  (2 marks)
- (d)  $A \cup B$  (2 marks)

**Q4** Given two endpoints of  $E( - 1, 1)$  and  $F( - 11, 1)$ .

- (a) Write vector  $V$  in component and equation forms. (2 marks)
- (b) Compute the magnitude of vector  $V$ . (2 marks)
- (c) Calculate the direction of vector  $V$ . (2 marks)
- (d) Draw your answer in (c), with arrow to indicate its direction. (2 marks)

**Q5** Visible surface determination (VSD) is a set of procedures in computer graphics that was developed mainly to deal with displaying sophisticated objects. VSD consists of several techniques, with Z-Buffer being one of them. **Figure Q5** demonstrates three surfaces overlap at  $(x, y)$ ,  $S_1$  has the smallest depth value, followed by  $S_2$  and  $S_3$ . Draw the potential output in viewing plane.

(6 marks)

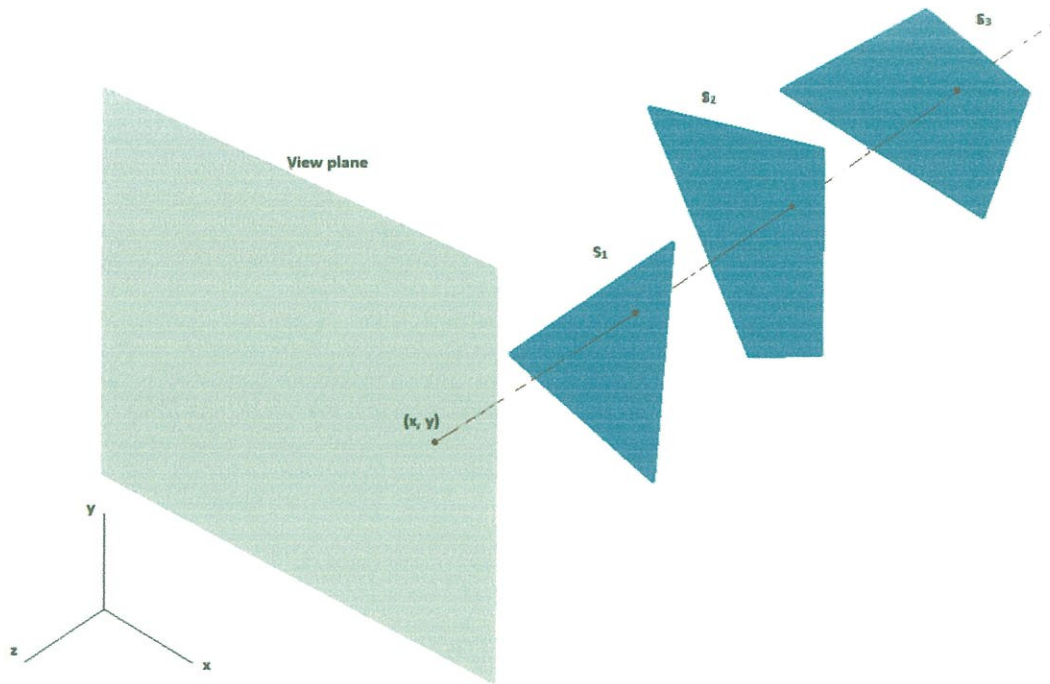


FIGURE Q5

**Q6** **Figure Q6** shows three objects ( $R$ ,  $G$ , and  $B$ ) with  $Z$ -values of the coordinate. Determine the output result when  $Z$ -Buffer method is applied to these objects.

(6 marks)

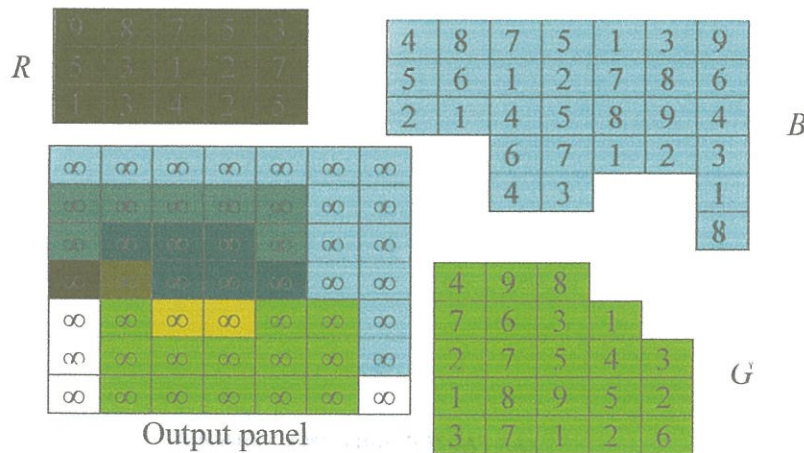


FIGURE Q6

**Q7** There are two types of illumination models, local and global models. In your own terms, discuss Phong Reflection Model. You may use diagrams, figures and equations to support your answer.

(12 marks)

**Q8** Discuss how Gouraud shading is different from Phong shading. You may use diagrams, figures and equations to support your answer.

(8 marks)

**Q9** Explain the differences between shadings and shadows. You **MUST** use diagrams or figures to support your answer.

(8 marks)

**Q10** Based on the following scenario:

You are working with Walt Disney Animation Studios, a California-based animation corporation that has produced some of the highest-grossing animated films of all time. You are responsible for designing realistic facial expressions for all characters (human, animals, robots or inanimate objects) in the studio's next project - Wreck-It Ralph 3.

Describe your job scope, with respect to theory of computer graphics and what are the necessary components in your quest for designing visual realism in your artwork.

(10 marks)

**- END OF QUESTION -**

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