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UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER I
SESSION 2019/2020**

COURSE NAME : COMPUTER GRAPHICS AND ANIMATION
COURSE CODE : BIM 20303
PROGRAMME CODE : BIM
EXAMINATION DATE : DECEMBER 2019 / JANUARY 2020
DURATION : 3 HOURS
INSTRUCTION : ANSWER ALL QUESTIONS

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THIS QUESTION PAPER CONSISTS OF **SIX (6)** PAGES

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Q1 For **Q1(a) – (j)**, answer **True** or **False**.

- (a) Grey levels will contribute to better image quality.
- (b) Combination of these three features (such as surface, texture and color) will add realism to the object.
- (c) Most 3D graphics use a double point perspective, where viewer can see things converge to a point in the distance.
- (d) Depth of field is required to give realism to object, where it gives clues to weight and solidness through shading and shadows.
- (e) Object surface is important to determine whether certain object can be considered as 3D or not.
- (f) Approximating a curved surface by polygons is called tessellation.
- (g) Voxels is a technique of modelling an object, which includes its surface and volume.
- (h) The quality of approximation of a 3D object by voxels depends on the size of the voxels. The larger the voxels, the better the computation due to its low memory costs.
- (i) Sweeping is one of the 3D modelling technique.
- (j) Back facing polygons can be found by taking the dot product of the normal surface of each polygon. If the dot product is less than 0, the polygon is viewed on edge.

(10 marks)

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Q2 Figure Q2 shows a circle of unit radius with the center of the circle is at the origin, O .

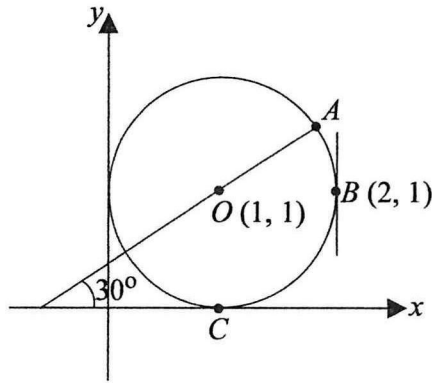


Figure Q2

- (a) What is the equation of the circle? (3 marks)
- (b) What are the coordinates of point C ? (1 mark)
- (c) What is the equation of the tangent to the circle at B ? (1 marks)
- (d) What is the length of the short arc of the circle from A to B ? (6 marks)
- (e) What are the coordinates of point A ? (6 mark)
- (f) If the circle is moved (without turning) so that its center lies at $(-3, -4)$, where then does point B lie? (4 marks)
- (g) Suppose another circle is drawn with center at A and passing through O . The two circles intersect in two points. Draw both circles c_1 and c_2 and what angles do their tangents make at these points (which, of course, is the same as the angles the circles make with each other)? (9 marks)

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

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

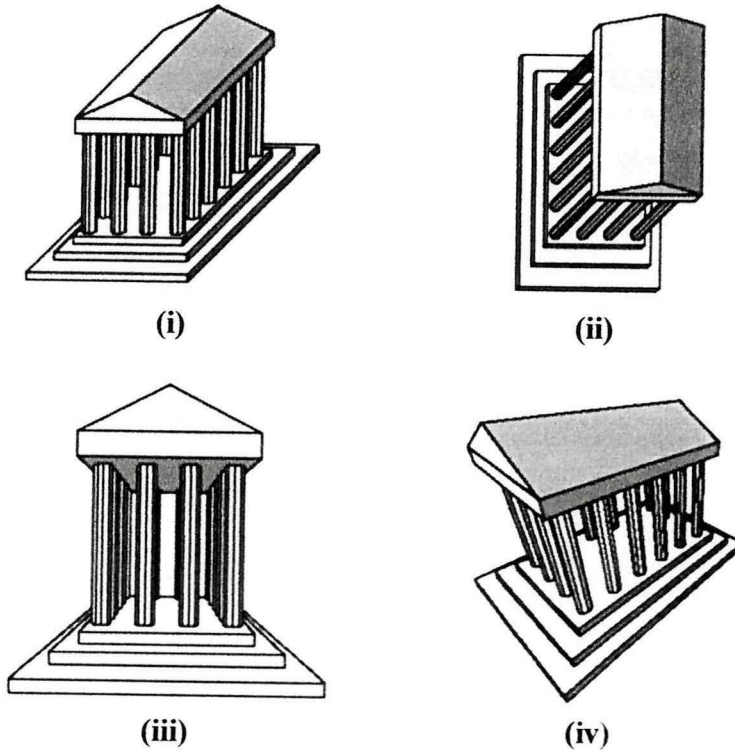


Figure Q3

(c) Differentiate between parallel and perspective projections. (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)

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- Q4** (a) Define 3D modeling. (2 marks)
- (b) Distinguish between the polygonal-based and volumetric-based modeling techniques. (4 marks)
- (c) **Figure Q4** illustrates a sample of tetrahedron. Describe the surfaces that make up the faces of this polygon. (4 marks)

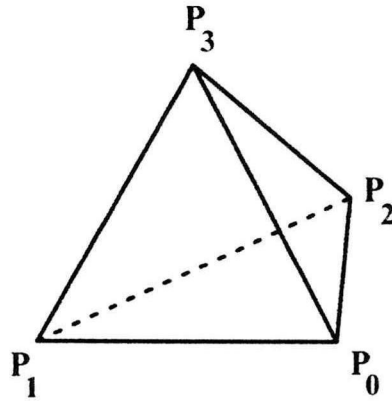


Figure Q4

- (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)

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- Q5** (a) Explain about the object-space and image-space methods used in determining the visible surfaces in computer graphics. (4 marks)
- (b) Describe how the z-buffering works. (8 marks)
- (c) Taking advantage of area coherence in a scene is one way of implementing an 'Area-Subdivision' in computer graphics. Draw and label **FOUR (4)** possible relationships between polygon surfaces and a rectangular section of the viewing plane. (8 marks)

- END OF QUESTION -

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