ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)
Department of Computer Science and Engineering (CSE)

MID SEMESTER EXAMINATION **WINTER SEMESTER, 2019-2020**

DURATION: 1 Hour 30 Minutes **FULL MARKS: 75**

CSE 4551: Computer Graphics and Multimedia Systems

Programmable calculators are not allowed. Do not write anything on the question paper.

There are **4 (four)** questions. Answer any **3 (three)** of them.

Figures in the right margin indicate marks.

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1. a) A widescreen Full HD TV having a resolution of 1080p and aspect ratio of 16:9 is showing a 1 hour and 30 minutes duration color movie (24 bit color depth) at 60 fps. Calculate the size of that video file assuming that no video compression takes place. 8

   b) i. Derive the Rotation Matrix required to perform rotation in a 2D space. Draw necessary figures. 6+3

   ii. What properties of this rotation matrix can you directly identify?

   c) Explain C0, G1, C1 and C2 continuity using their properties. In case of connecting two Bezier curves, how should the control points be placed to guarantee C1 continuity? 4+4

2. a) What is the main idea for a Spline? What are the properties of Bezier curves? 3+5

   b) Derive Bresenham's Line generation algorithm and show how the decision parameter P_k is updated in each step. Provide necessary illustrations. 9

   c) What is meant by a Linear operation? Is Translation a linear operation? Give mathematical reasoning for your answer. 4+4

3. a) Suppose v_{os} and n_{os} are respectively the original tangent and normal vectors, and v_{ws} and n_{ws} are respectively the transformed tangent and normal vectors. If M is the transformation matrix, then show mathematically how this is applied on the original tangent and normal vectors to get the transformed ones. 7

   b) How is Transformation handled during Scene Graph Traversal? Why is it a bad idea to undo transformation by multiplying with inverse matrix? Suggest a solution for this with proper instructions on how to implement it. 4+3+3

   c) Suppose the clipping window is defined from $(x_{min}, y_{min}) = (0, 0)$ to $(x_{max}, y_{max}) = (10,10)$ and a line is drawn from (1, -1) to (11, 2) in the world coordinate system. Use the Cohen-Sutherland Algorithm to determine how the line will be clipped. Show the result of each step in separate figures. 8

4. a) Write short notes on the following: 3×3

   i. Tessellation

   ii. Basis vectors

   iii. Hierarchical Modeling

   b) What is clipping? Why do we need to perform clipping? 3+3

   c) What are the different ways of representing surfaces? What are the pros and cons of surface representation using Triangle Meshes? 3+3

   d) What are the motivations behind the use of Matrix notation in Linear Transformations? 4