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KIRIRI WOMENS' UNIVERSITY OF SCIENCE AND TECHNOLOGY
UNIVERSITY EXAMINATIONS, 2024/2025 ACADEMIC YEAR
THIRD YEAR, SECOND SEMESTER EXAMINATION
FOR THE DEGREE OF BACHELOR OF SCIENCE (MATHEMATICS)

KCS 2310: COMPUTER GRAPHICS

DATE: 11TH DECEMBER, 2024
TIME: 2:30PM-4:30PM

INSTRUCTIONS TO CANDIDATES

ANSWER QUESTION ONE (COMPULSORY) AND ANY OTHER TWO QUESTIONS

QUESTION ONE: COMPULSORY (30 MARKS)

a) Multimed Digital Corp is considering to invest in Computer Generated Imagery (CGI) and video games. As a consultant in graphics and animation, give your opinion to the Multimed Digital Corp management on the suitability of the following approaches:

i. Rasterization **(4 Marks)**

ii. Ray tracing **(4 Marks)**

b) In an animated 3D scene, objects undergo multiple transformations over time.

i. Explain how **translation**, **rotation**, and **scaling** are used to animate a character's movement. **(3 Marks)**

ii. How do **composite transformations** work in this context? **(4 Marks)**

iii. Explain possible application of composite transformation in this context **(4 Marks)**

c) A museum is developing a virtual reality (VR) exhibit to showcase its collection of ancient artifacts. The exhibit aims to provide visitors with an immersive and interactive experience, allowing them to explore the artifacts in a 3D environment. Explain the various projection techniques that could be used to create the virtual reality experience for this museum exhibit. **(5 Marks)**

d) In engineering design and CAD software, **parallel projection** is often used to maintain the true dimensions of objects. Explain the types of parallel projection and their importance in technical drawings. How does it differ from perspective projection in terms of depth representation and object scaling? **(5 Marks)**

e) In an animation project, the camera needs to simulate a realistic view of a city. Explain how **perspective projection** is used to achieve this effect. How would changing the **field of view (FOV)** of the camera affect the projection, and what are the potential pitfalls of using extreme FOV values? **(5 Marks)**

QUESTION TWO:20 MARKS

In a modern 3D video game, real-time rendering is crucial for smooth gameplay.

a) Explain how the rendering pipeline is structured in a modern 3D video game **(10 Marks)**

b) Explain how the rendering pipeline in (a) above ensures real-time performance in a modern 3D video game. **(6 Marks)**

c) Explain the suitability of rendering pipeline in (a) above on video game applications. **(4 Marks)**

QUESTION THREE: 20 MARKS

a) A team of architects have approached you seeking to know the suitability of Bresenham's Line Drawing Algorithm. With reasons, explain why they should consider this algorithm in their drafting applications. **(5 Marks)**

b) With clear steps, describe to this team how the algorithm works **(6 Marks)**

c) Using Bresenham's Line Drawing Algorithm described above in (a), draw a line from point (2, 3) to (8, 6). Show the step-by-step process and the values of the decision parameter at each step. **(9 Marks)**

QUESTION FOUR:20 MARKS

a) GenZ Studio Animators ltd is engaged in a project involving normalizing out of range drawings to fit in a viewport. Explain to the studio management the suitability of Cohen-Sutherland line clipping Algorithm to this project. **(6 Marks)**

b) Using well defined steps, explain to the GenZ Studio Animators how the algorithm works. **(8 Marks)**

c) In a real-time rendering application (such as a video game), explain how clipping is integrated into the graphics pipeline and why is clipping crucial for real-time performance **(6 Marks)**

QUESTION FIVE: 20 MARKS

a) In a graphics hardware system, the **Midpoint Circle Algorithm** is used to generate circular shapes for rendering. Discuss the advantages of using this algorithm in hardware over using floating-point algorithms, especially in terms of computational efficiency and pixel plotting accuracy. **(8 Marks)**

b) In a CAD application for designing mechanical parts, **oblique projection** is used to give a clear view of the parts. Explain how **oblique projection** differs from orthographic projection and how it helps in visualizing objects in CAD. Provide an example where oblique projection is preferable. **(12 Marks)**