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Department of Computer Science & Engineering
University of Asia Pacific (UAP)

Final Semester Examination
Course Code: CSI-431

Fall 2018
Course Title: Computer Graphics

4th Year 1st Semester
Credits: 3

Full Marks: 150

Duration: 3 Hours

Instructions:

- There are Eight (8) Questions. Answer any Six (6). All questions are of equal value. Part marks are shown in the margins.
- Non-programmable calculators are allowed.

1. a) What are the goals of Computer Graphics? Who is known as the father of computer graphics? 4
b) What is Affine Combination? State the properties of Baricentric Coordinates. 6
c) How can we get a point from another point? Write the equation of a line. 3+2
d) The point P (x, y) is coplanar to the triangle defined by three vertices A = (1, 0), B = (0, 1), and C = (0, 0). Calculate the coordinate of P (x, y) if $\alpha = 0.3$, $\beta = 0.4$. 10

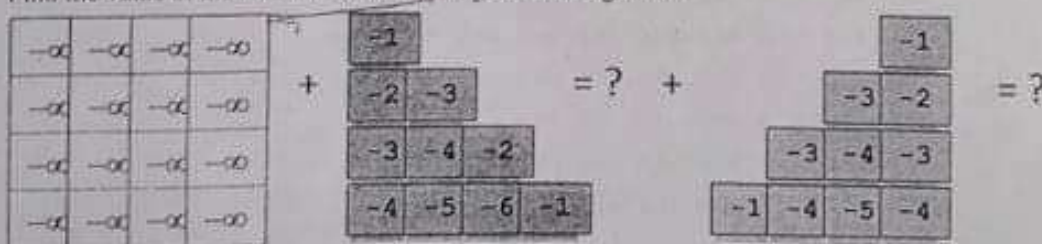
2. a) Describe the process of Scaling of an object which is not at the origin of the frame? 10
b) What are the uses of Transformations? State the Translation, Scaling and Rotation Matrix for 3D. 5+10

3. a) Describe the process of clipping a convex polygon in detail. 15
b) Describe the process of Camera Transform. 10

4. a) How the Hermite Curves, Bézier Curves, and Splines curve can be defined. 5
b) If coordinate of a point in homogeneous space is (35, 15, 12, 3), calculate the coordinate of the point in 3D space where $w = 1$. 10
c) What is Depth (Z) Buffer? How the depth buffering can be used in Open-GL with GLUT? 10

5. a) What is Ray Tracing? What are the computational issues to implement a Ray Tracer? 5+5
b) What is Back Face Culling? If the camera position, v is at (-1, 0, -1) and the surface normal of two polygons are $n_1 = (2, 1, 2)$ and $n_2 = (-3, 1, -2)$, determine which polygon is facing the camera. 5+10

6. a) What is Painter's Algorithm? What are advantages and disadvantages of the algorithm? 5+5
b) Find the value of the resultant z-buffer using z-buffer algorithm: 10



- c) What are the advantages and disadvantages of z-buffering algorithm? 5

7. a) What is RGB model and HSI model? Convert RGB coordinate of a color at (0.8, 0.5, 1) in HSI space. 5+10
b) What are the advantages of using Implicit line equation for scan conversion? Describe how to calculate the value of a and b in the implicit equation. 10

- a) Describe briefly the Bresenham's Midpoint Algorithm for line. How to initialize the value of d_x ?
- b) Describe the Phong Illumination Model.
- c) If color components of light has the value $k_a^R = 1$, $k_a^G = 0$, $k_a^B = 0$ in Phong Illumination model, what is the color of the ambient light? If $k_s^R = k_s^G = k_s^B = 1$ what is the color of the specular highlight?

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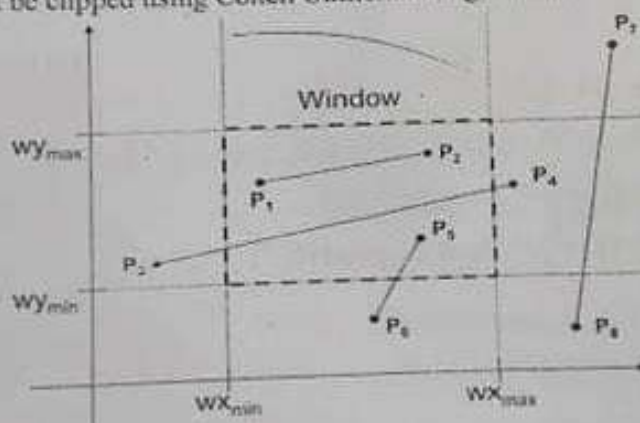
Fall 2017
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|----|----|--|----|
| 1. | a) | Derive the Midpoint Circle algorithm. | 12 |
| | b) | Compare the features of various Graphics Input Devices. | 13 |
| 2. | a) | What are the Output Primitives? Briefly discuss with figures. | 15 |
| | b) | How does Sutherland-Hodgman algorithm work? Analyze with figures. | 10 |
| 3. | a) | Discuss the Phong Specular Reflection Model with figures. | 13 |
| | b) | Label the following each end-point with region code, show which lines should be retained and which one should be clipped using Cohen-Sutherland algorithm. | 12 |



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|----|-------|--|----|
| 4. | a) | Compare the features of Parallel Projection and Perspective Projection with figures. | 10 |
| | b) | What is DDA Algorithm? How does it work? What are the issues regarding this algorithm? | 15 |
| 5. | a) | Discuss the three important components of a Basic Illumination Model with figures. | 13 |
| | b) | Define with figures: | 12 |
| | (i) | Aspect Ratio | |
| | (ii) | Field of View Angle | |
| | (iii) | Up Vector | |
| | (iv) | Look Vector. | |

7. a) Digitize the line with endpoints (22, 19) and (37, 31) using Bresenham's Line algorithm.
b) Derive the Perspective Projection Matrix, M_{pers} .
8. a) Analyze the three types of Transformations with relevant figures.
b) Determine positions along the circle octant in the first quadrant from $x = 0$ to $x = y$ for a circle centered at (0, 0) with radius $r = 19$ using Midpoint Circle algorithm.
9. a) Define with figures:
(i) Specular-Reflection Exponent
(ii) Infinitely Distant Light Source
(iii) Lambertian Reflectors
(iv) Angle of Incidence
(v) Reflected Light.
10. Using matrix multiplication, calculate:
(i) Shrinking (making smaller) of the point (5, 6) by 6 in x-axis and 4 in y-axis.
(ii) Rotation of the point (8, 9) by 60° about the origin.
(iii) Rotation of the point (3, 4) by 30° about the point (6, 7).