Department of Computer Science & Engineering
University of Asia Pacific (UAP)
Program: B.Sc. in Computer Science and Engineering

Mid Semester Examination | **Fall 2021** | **4th Year 2nd Semester**

Course Code: CSE 425 | **Course Title: Computer Graphics** | **Credits: 3**

Full Marks: 60 | **Duration: 1 Hour + 20 minutes (submission time)**

Instructions:
There are Four Questions. Answer three questions including Q-1 and Q-2.

1. a) Identify if the following equations are Affine Combination or not. Justify your answer by stating the reason. 5*2 =10

i. $Q_1 = (1 - t)^2 P_1 + 2t (1 - t) P_2 + t^2 P_3$
ii. $Q_2 = P_1 + t^3 P_2$

Convert the above equations in to matrix format.

b) Consider a Bezier curve with the control points $P_0 = (1, 2)$, $P_1 = (3, 8)$, $P_2 = (12, 13)$, and $P_3 = (16, 4)$. Calculate the coordinate (x and y) of three points Q1, Q2, and Q3 on the curve for 10

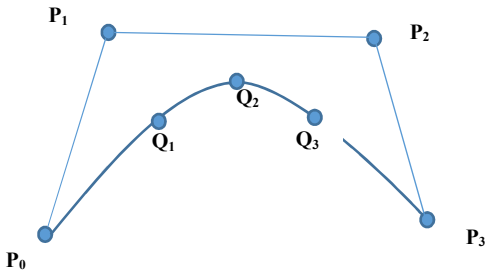
t1 = v

t2 = v + 0.1

t3 = t2 + 0.2

Where

v = (Last 2 digits of your id) / 200



Note that, / refers to the **division** operation.
For example, if the last 2 digits of someone's id is 45. Then,

v = 45 / 200 = 0.225

t1 = 0.225

t2 = 0.325

t3 = 0.525

2. a) Briefly describe how perspective can be achieved during Camera Transformation. 7

b) What happened to parallel lines in Perspective Projection and in Parallel Projection. 3

c) Consider the following polygon in 4D homogeneous space where $P_1(75, 90, 150, w)$, $P_2(100, 110, 150, w)$, $P_3(110, 110, 200, w)$, $P_4(110, 100, 200, w)$ are the four vertices of the polygon where **w = [(Last 2 digits of your id) % 10] + 9** . Calculate the coordinate of the polygon in 3D space where w = 1. Note that, % refers to the mod operation. 10

3. **a)** Rotate the following triangle ABC (coordinates of A, B, C are given in the fig. 1) with θ = 45^o about a point P(-a, b). Find the matrices needed for the operation and the new coordinates of the triangle after the operation. 15

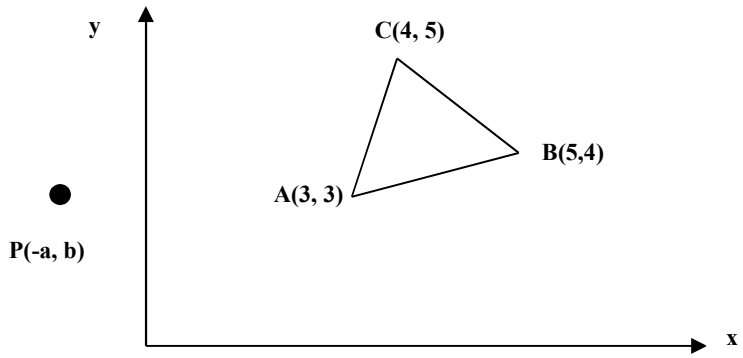


Fig. 1

Where
a = (Last 2 digits of your id) % 4 +2
b = (Last 2 digits of your id) % 6 + 1
Note that, % refers to the mod operation.

For example, if the last 2 digits of someone's id is 56. Then,
a = 56%4 + 2 = 0 + 2 = 2
b = 56%6 + 1 = 2 + 1 = 3

Then P (-2, 3)

b) Show that a Scaling and a Translation is not a commutative operations 5

4. **a)** Convert the HSI coordinate of a color at (a^o, b, c) in to RGB color space where 15
$a = 360^0 - (\text{Last 2 digits of your id})^0$
b = (Last 2 digits of your id) / (Last 2 digits of your id + 10)
c = (Last 2 digits of your id) / (Last 2 digits of your id + 5)

For example, if the last 2 digits of someone's id is 56. Then,
$a = 360^0 - 56^0 = 304^0$
b = 56 / (56 +10) = 56 / 66 = 0.84
c = 56 / (56 + 3) = 56 / 61 = 0.91

therefore, $H = 304^0$
S = 0.84
I = 0.91
Convert it into RGB.

b) Explain why HSI color model is useful in Computer Vision? 5