

MMTE-004

ASSIGNMENT BOOKLET

M.Sc(Mathematics with Applications in Computer Science)
COMPUTER GRAPHICS
(Valid from 1st January, 2024 to 31st December, 2024)



School of Sciences
Indira Gandhi National Open University
Maidan Garhi, New Delhi
(For January 2024 cycle)

Dear Student,

Please read the section on assignments in the Programme Guide for elective Courses that we sent you after your enrolment. A weightage of 20%, as you are aware, has been earmarked for continuous evaluation, **which would consist of one tutor-marked assignment** for this course. The assignment is in this booklet.

Instructions for Formatting Your Assignments

Before attempting the assignment please read the following instructions carefully.

- 1) On top of the first page of your answer sheet, please write the details exactly in the following format:

ROLL NO. :.....
NAME :.....
ADDRESS :.....
.....
.....

COURSE CODE :
COURSE TITLE :
STUDY CENTRE : **DATE**.....

PLEASE FOLLOW THE ABOVE FORMAT STRICTLY TO FACILITATE EVALUATION AND TO AVOID DELAY.

- 2) Use only foolscap size writing paper (but not of very thin variety) for writing your answers.
- 3) Leave a 4 cm margin on the left, top and bottom of your answer sheet.
- 4) Your answers should be precise.
- 5) While solving problems, clearly indicate which part of which question is being solved.
- 6) This assignment is to be submitted to the Study Centre as per the schedule made by the study centre. **Answer sheets received after the due date shall not be accepted.**
- 7) This assignment is valid only up to 31st December, 2024. If you fail in this assignment or fail to submit it by 31st December, 2024, then you need to get the assignment for the year 2025 and submit it as per the instructions given in the Programme Guide.
- 8) **You cannot fill the Exam form for this course till you have submitted this assignment. So solve it and submit it to your study centre at the earliest.**
- 9) **We strongly suggest that you retain a copy of your answer sheets.**

We wish you good luck.

Assignment

Course Code: MMTE-004
Assignment Code: MMTE-004/TMA/2024
Maximum Marks: 100

- 1)
 - a) Explain what do you understand by the terms *persistence*, *refresh rate*, *resolution*, *aspect ratio*, *horizontal* and *vertical retrace*. (5)
 - b) Compute the pixel positions along the line path of the line joining the points $A(1,2)$ and $B(10,8)$. (4)
 - c) Using the midpoint method and symmetry in account, develop an efficient method for scan converting the curve $y^2 = 4x$ in the interval $[0, 10]$. (6)
- 2)
 - a) Consider a polygon with vertices at $(5, 20)$, $(12, 5)$, $(15, 15)$, $(25, 5)$, $(30, 25)$, and $(15, 30)$. Prepare a sorted edge list, and then make the active edge list for the scanlines $y = 5, 10, 15, 20, 25, 30$. (6)
 - b) Develop and implement the flood fill algorithm. (6)
 - c) Prove or disprove: "Multiplication of transformation matrices for two successive rotations is commutative." (3)
- 3)
 - a) Transform the quadrilateral $ABCD$ with vertices $A(1,0)$, $B(4, -1)$, $C(5,3)$ and $D(-1,5)$ under a translation by the point $(4, 5)$ followed by a counter-clockwise rotation by an angle of 45° . (4)
 - b) If you perform an x -direction shear transformation, and then a y -direction shear transformation, will the result be the same as the one which is obtained when it is simultaneous shear in both the directions? Justify your answer. (4)
 - c) Let W be a window with corners $(0,0)$, $(8,0)$, $(8,4)$ and $(0,4)$. Clip a triangle with vertices $(1,1)$, $(10,2)$ and $(5,9)$ against the window W by tracing Liang Barsky line clipping algorithm. (7)
- 4)
 - a) Write a boundary fill procedure to fill an 8-connected region. (5)
 - b) Let W be the window having two diagonally opposite corners at $(10, 2)$ and $(30, 15)$. Trace the Cohen-Sutherland line clipping algorithm for the line segment joining the points $(0,0)$ and $(15, 30)$. (5)
- 5)
 - a) What is the difference between a parallel projection and a perspective projection? Explain with examples. (5)
 - b) What will be the perspective projection of a unit cube on the plane $x = y$ if it is viewed from the point $(1,2,0)$? Justify your answer. (5)
 - c) Transform the scene in the world coordinate system to the viewing coordinate system with viewpoint at $(1, 1, 2)$. The view plane normal vector is $(-4, 2, 5)$ and the view up vector is $(1, 4, 0)$. (5)
- 6)
 - a) If the origin is taken as the centre of projection, then what will be the perspective projection when the projection plane passes through the point $P(4,5,3)$ and has normal vector $(1, 2, -1)$. (5)
 - b) Write a program that produces different views of a cuboid, that is, how the cuboid looks from the top, from the front or from the right. (8)

- c) Write a code to continuously rotate a pentagon about a corner point in the anti-clockwise direction. (7)
- 7) a) Devise an efficient algorithm that takes advantage of symmetry properties to display a sine function. (4)
- b) Prove that the reflection along the line $y = -x$ is equivalent to reflection along the y -axis followed by a counter-clockwise rotation by 90° . (3)
- c) Shear a square whose opposite vertices are at $(1, 1)$ and $(2, 2)$ by
 - i) 2 units along the x -axis and reference line $y = 0$.
 - ii) 4 units along the y -axis and reference line $x = 0$. (3)