* Assignment - 4

Aim:- write c++ program to draw 2-D object and perform following basic transformations.

(a) Scaling
(b) Translation
(c) Rotation
(d) Using operation overloading.

Theory:-

Transformation means changing some graphics into something else by applying rules, we can have various types of transformation such as translation, sliding up or down, rotation, shearing reflection etc. when a transformation takes places on a 2D place, it is called 2D transformation. Transformations play an important role in CG to reposition the graphics on the screen and change their size or orientation. Translation, scaling and Rotation are basic transformation.

Translation:-

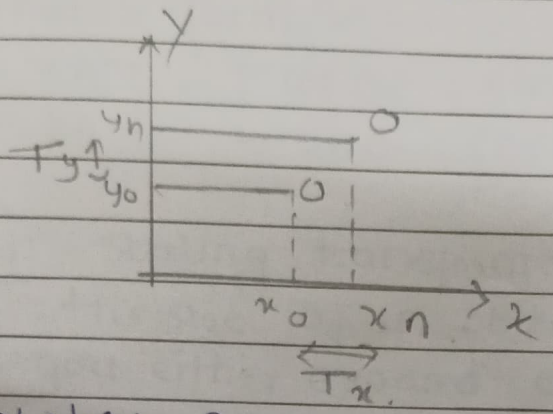
A translation moves an object to a different position on the screen, you can translate a point in 2D by adding translation co-ordinate or translation vector (Tx, Ty) to the original co-ordinate.

Consider,

Initial co-ordinates of object O = (x_0, y_0)

new co-ordinates of object O = (x_n, y_n)

Translation or shift vector = (T_x, T_y)



$x_n = x_0 + T_x$

$y_n = y_0 + T_y$

In Matrix form.

$$\begin{bmatrix} x_n \\ y_n \end{bmatrix} = \begin{bmatrix} x_0 \\ y_0 \end{bmatrix} + \begin{bmatrix} T_x \\ T_y \end{bmatrix}$$

(2) Rotation:-

In rotation we rotate object at particular angle θ from its original position.

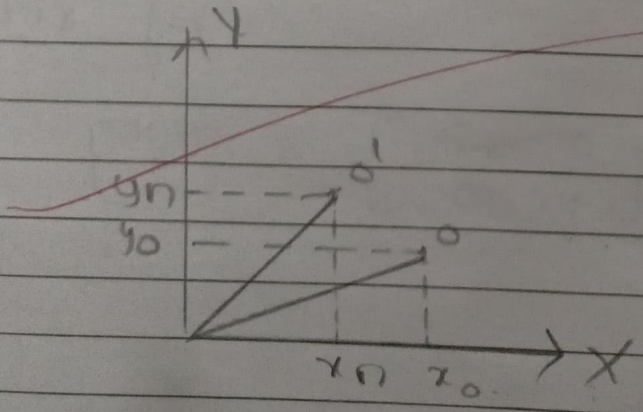
Consider:

Initial co-ordinate = (x_0, y_0)

New angle = θ

Initial angle = ϕ

New co-ordinate = (x_n, y_n)



$x_n = x_0 \cos\theta - y_0 \sin\theta$

$y_n = x_0 \sin\theta + y_0 \cos\theta$,

In matrix form:-

$$\begin{bmatrix} x_n \\ y_n \end{bmatrix} = \begin{bmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{bmatrix} \begin{bmatrix} x_0 \\ y_0 \end{bmatrix}$$

Scaling: Scaling transformation is used to change the size of an object. In the scaling process, you either expand or compress the dimensions of the object. Scaling can be achieved by multiplying the original co-ordinates of the object with the scaling factor (S_x, S_y). If scaling factor > 1, then the object size is increased and vice versa.

Consider coordinate = (x_0, y_0)

Scaling for x-axis = S_y

y-axis = S_x.

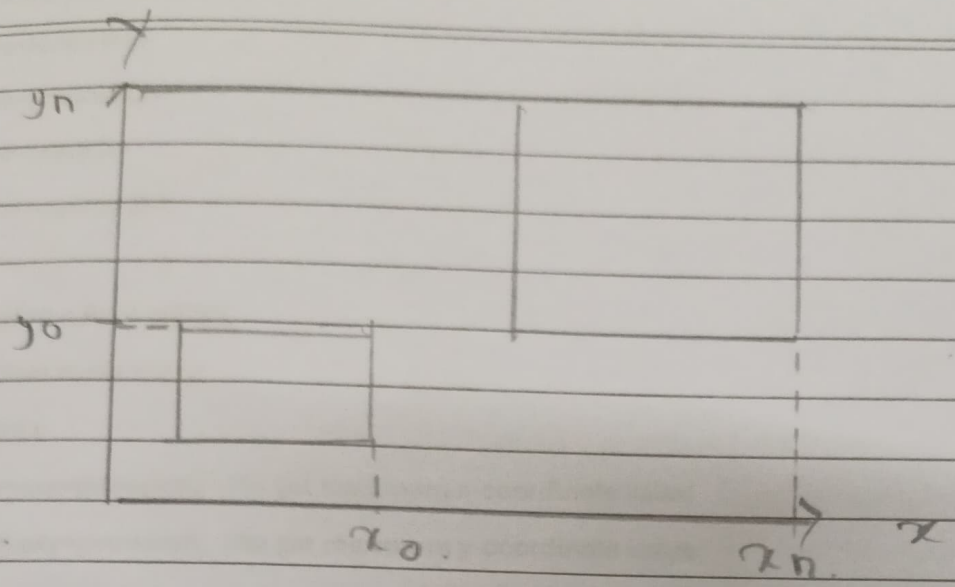
New Co-ordinate = (x_n, y_n)

$x_n = x_0 S_x$

$y_n = y_0 S_y$.

Matrix form:-

$$\begin{bmatrix} x_n \\ y_n \end{bmatrix} = \begin{bmatrix} S_x & 0 \\ 0 & S_y \end{bmatrix} \begin{bmatrix} x_0 \\ y_0 \end{bmatrix}$$



Conclusion :- Thus we have studied and implement the concept of 2D transformation.