Numerical Solution of Diffusion equation

1-D Eq. & Solution

```
    ( δP(x, t) / δt ) = D ( δ2 P(x, t) / δx2 )
```

Solving above diffusion equation computationally Constraint:

(-L <= x <= L) & (0 <= t <= T)

P(x, 0) = 1 for x=0 but 0 otherwise

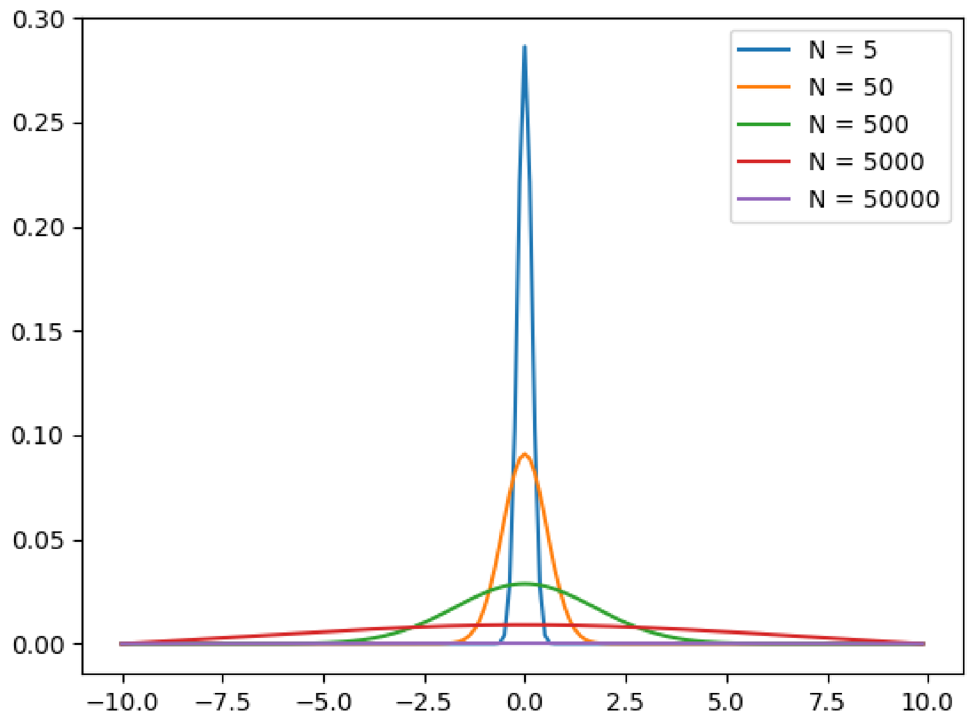
P(-L, t) = P(L, t) = 0

dt => time_step & dx => step_length

Using Formula:-

```
    P(i, n+1) = P(i, n) + ( D*Δt/(Δx)*(Δx) )[ P(i+1, n) - 2P(i, n) + P(i-1, n) ]
```

Graph:-



2-D Eq. & Solution

```
    ( δP(x, y, t) / δt ) = Dx ( δ2 P(x, y, t) / δx2 ) + Dy ( δ2 P(x, y, t) / δy2 )
```

Solving above diffusion equation computationally Constraint:

(-L <= x <= L) & (-L <= y <= L) & (0 <= t <= T)

P(x, y, 0) = 1 for x=y=0 but 0 otherwise

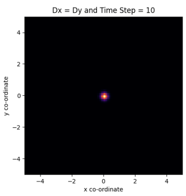
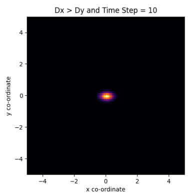
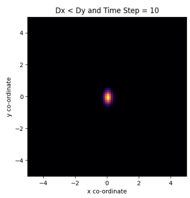
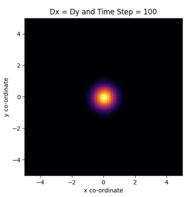
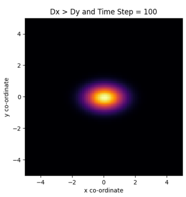
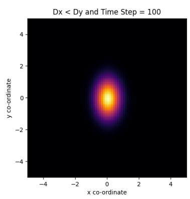
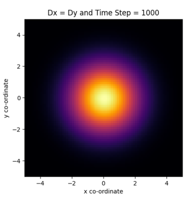
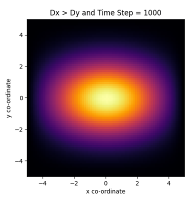
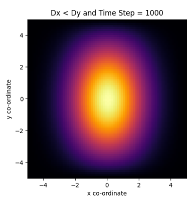
P(-L, 0, t) = P(L, 0, t) = P(0, -L, t) = P(0, L, t) = 0

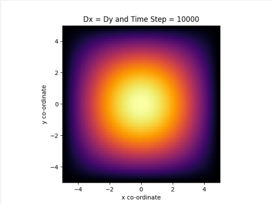
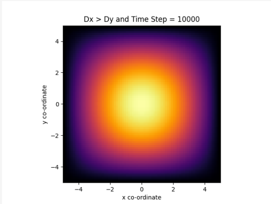
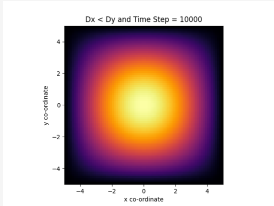
dt => time_step & dx => x_step_length & dy => y_step_length

Using Formula:-

```
a = ( Dx*Δt/(Δx)*(Δx) )[ P(i+1,j, n) - 2P(i,j, n) + P(i-1,j, n) ]
b = ( Dy*Δt/(Δy)*(Δy) )[ P(i,j+1, n) - 2P(i,j, n) + P(i,j-1, n) ]
c = ( Dy*Δt/(Δx)*(Δx)*(Δy)*(Δy) )[
    P(i+1,j+1, n)  +
    P(i-1,j-1, n)  +
    P(i-1,j+1, n)  +
    P(i+1,j-1, n)  -
    4*P(i,j, n)
    ]
P(i, n+1) = P(i, n) + a + b + c
```

2D density plots

N (timestep)	**Dx = 1 & Dy = 1**	**Dx = 3 & Dy = 1**	**Dx = 1 & Dy = 3**
10			
100			
1000			
10000			

	Dx = Dy and Time Step = 10000 y co-ordinate x co-ordinate	Dx > Dy and Time Step = 10000 y co-ordinate x co-ordinate	Dx < Dy and Time Step = 10000 y co-ordinate x co-ordinate