Aim : To simulate the Brownian motion using Monte- Carlo technique.

Theory:

Monte-Carlo technique :

It is a technique in which we solve the problem by taking their random behavior as a tool.

Algorithm:

Take the initial points and also take the step size and number of steps , then run a loop from number of steps times , in the loop call two random number and minus 0.5 from them then multiple with step size and add into the initial point and that give the new point and repeat the loop for the new points.

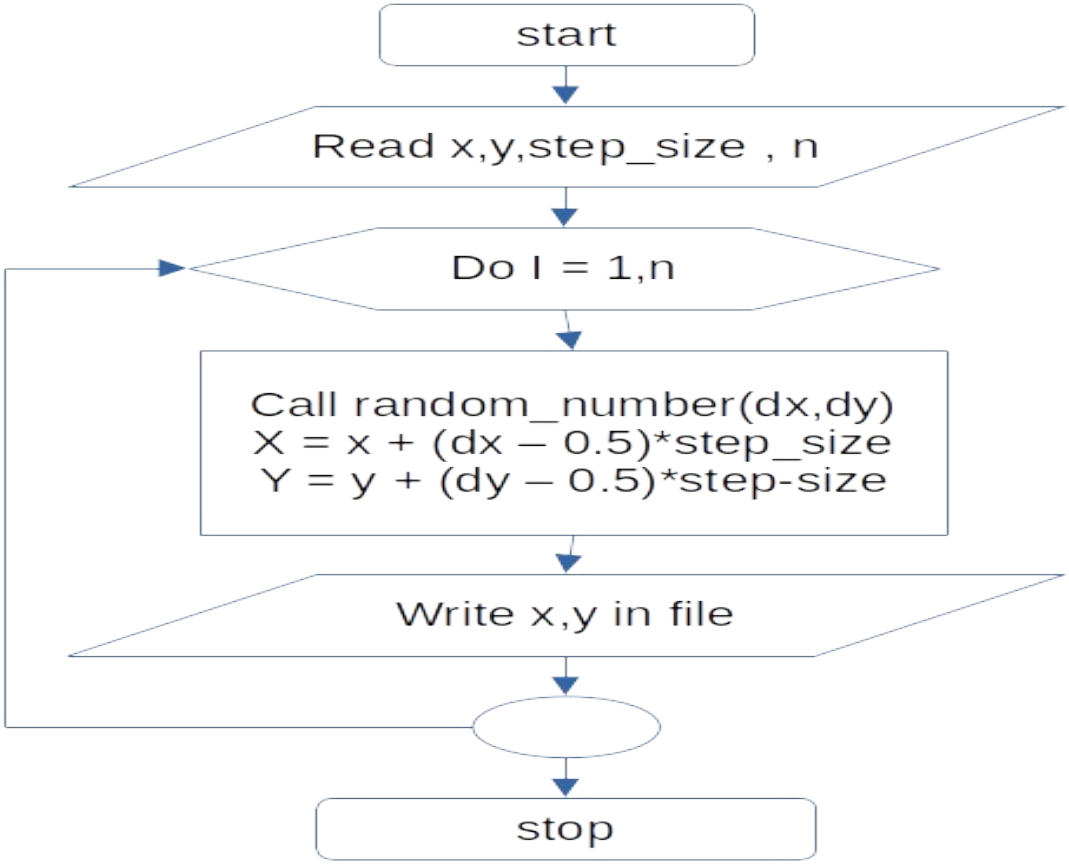
Program in FORTRAN95:

```
program main
   implicit none ! declaring the variable to use in program
   real :: dx,dy,step_size,x=0,y=0
   real , allocatable :: points(:,:,:)   ! dx and dy are change in x and y
   integer :: number_step,i , j ,snapshots , number_points , k
   logical :: f1
   number_step = 50000
   print*, "Enter number of points , step size and snapshots::"
   read*, number_points, step_size , snapshots
   allocate(points(snapshots,number_points,2))
   inquire(file="points.dat",exist=f1) !opening the for store the x and y
   if(f1)then
      open(1,file="points.dat",status="replace")
   else
      open(1,file="points.dat",status="new",action="write")
   endif
   do j = 1,snapshots
      do k = 1, number_points
         x = points(j-1,k,1)
         y = points(j-1,k,2)
         do i = 1,number_step       ! making loop generating the random dx and dy
            call random_number(dx)  ! and add into in the last position
            call random_number(dy)
            x = x + (dx - 0.5)*step_size
            y = y + (dy - 0.5)*step_size
         enddo
         points(j,k,1) = x
         points(j,k,2) = y
         write(1,*)x,y
      enddo
      write(1,*)""
   enddo
   print*, "Simulation is complete"
   stop
end program
```

Output:

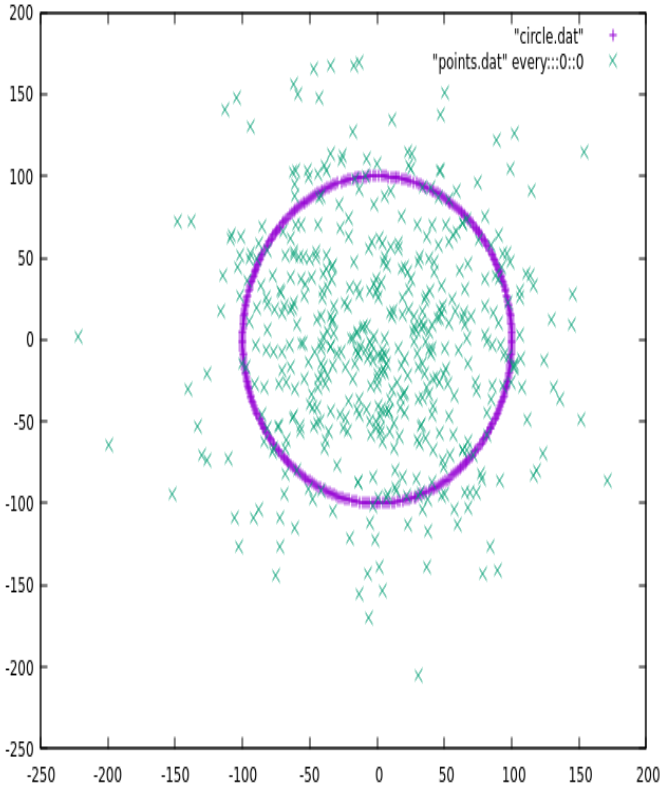
```
 Enter number of points , step size and snapshots::
500     1       20
 Simulation is complete
```

Flow Chart :



Result:

time = 0



time = 15