

MATLAB HOMEWORK

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- P1 We want to numerically compute π in various ways. Utilize the following equations to write m-codes. For your reference, the website (<http://en.wikipedia.org/wiki/Pi>) provides thoughtful backgrounds of how to compute π .

$$1) \int_{-\infty}^{\infty} \frac{1}{1+x^2} dx = \pi$$

$$2) \frac{2}{\pi} = \frac{\sqrt{2}}{2} \cdot \frac{\sqrt{2+\sqrt{2}}}{2} \cdot \frac{\sqrt{2+\sqrt{2+\sqrt{2}}}}{2} \dots$$

$$3) \pi = \frac{4}{1} - \frac{4}{3} + \frac{4}{5} - \frac{4}{7} + \frac{4}{9} - \frac{4}{11} + \dots$$

- P2 In this problem, we still want to calculate π , but it will be a totally different approach, Monte Carlo (MC) methods (probabilistic interpretation). Read the section of the introduction part in the Wikipedia (http://en.wikipedia.org/wiki/Monte_Carlo_method) to understand a fundamental concept of Monte Carlo. Try to understand MC with the given m-code.
- 1) Draw a square on the ground, then inscribe a circle within it.
 - 2) Uniformly scatter some objects of uniform size (grains of rice or sand) over the square.
 - 3) Count the number of objects inside the circle and the total number of objects. The ratio of the two counts is an estimate of the ratio of the two areas, which is $\pi/4$.
 - 4) Multiply the result by 4 to estimate π .

```
clear all
n = 1000;
x = -1 + 2*rand(n,2);          % help rand
count = 0;
for j = 1:n
    if norm(x(j,:)) <= 1       % help norm
        count = count + 1;
    end
end

pi_est = (count/n)*4;
disp(pi_est)

% visualize
w = 0:0.01:2*pi;
z = cos(w) + 1i*sin(w);

figure(1); cla; hold on
plot(x(:,1),x(:,2),'.');
plot(real(z),imag(z),'r','linewidth',3); hold off
axis equal
```