Excercise 1

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Basics if Monte Carlo -simulations
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January 20, 2012

1. problem

$$P_{hit} = P_1 * P_2,$$

where P_1 is the probability that center of needle is less than $l/2$ away from line and P_2 is the the probability that the needle is in a right angle to cross the line. Probabilities P_1 and P_2 are depending on each other so they have to be multiplied. Because P_1 can fall to eather side of line

$$P_1 = \frac{l/2 + l/2}{d} = \frac{l}{d}.$$

Probability that needle crosses the line when center falls x away is a function of x. The probability P_2 when needle drops somewhere can be obtained by integrating and setting $l = 2$ (unit circle)

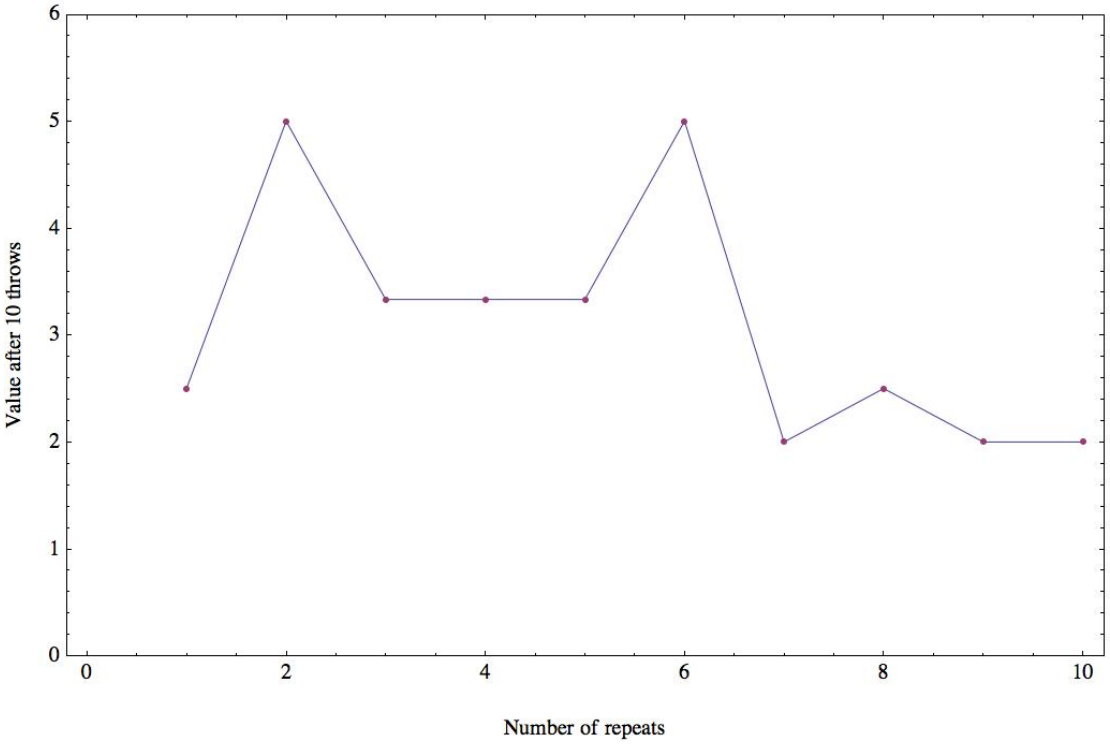
$$P_2 = 4 \int_0^1 \frac{cos^{-1}(x)}{2\pi} dx = \frac{2}{\pi}.$$

Therefore

$$P_{hit} = P_1 * P_2 = \frac{2l}{\pi d}.$$

a)

Figure shows that when you throw only 10 times the predicted value for π is bad.



a)

You can see from figure that after approximately 5000 throws result starts to converge.