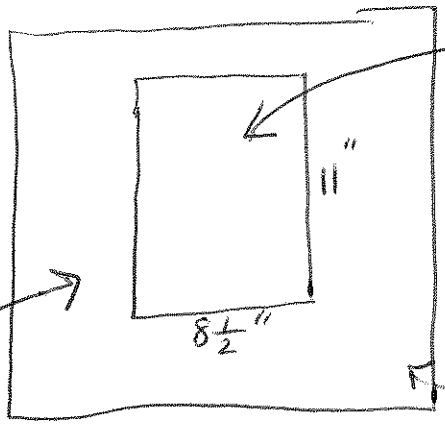
(AAA)

Suppose a Monte Carlo fruit treat bag tossing session was performed with a $8\frac{1}{2}$" by 11" sheet of paper sitting on a larger sheet of construction paper and we obtained the following results:



14 darts landed on the sheet of $8\frac{1}{2}$" by 11" standard paper.

red construction paper, unknown size.

86 darts (fruit bags) landed outside the sheet of paper but on the colored construction paper.

Estimate the area in square inches of the colored construction paper.

What do we <u>know</u>?

① $86 + 14 = 100$ darts or fruit snacks thrown.

② $0.14 = \frac{14}{100}$ = proportion on sheet of paper.

③ $8\frac{1}{2} \times 11 = 8.5 \times 10 + 8.5 = 85 + 8.5 = 93.5$

93.5 square inches is <u>area of paper</u>.

BBB

4 Formula we have used for Monte Carlo

$$\text{Area of part of larger region} = \left(\frac{\text{darts in that part}}{\text{total darts thrown}}\right)\left(\text{Area of entire region}\right)$$

Goal – need to find

– unknown

– this is the new twist –

– we KNOW area of the part –

– we don't know area of entire region where random darts were generated

$$93.5 = \left(\frac{14}{100}\right)\left(\text{Area of colored construction paper}\right)$$

$$93.5 = (0.14)\left(\text{Area of colored construction paper}\right)$$

$$\frac{93.5}{0.14} = \text{Area of construction paper}$$

667.86 square inches

(cc) So the formula for Monte Carlo has 4 parts:

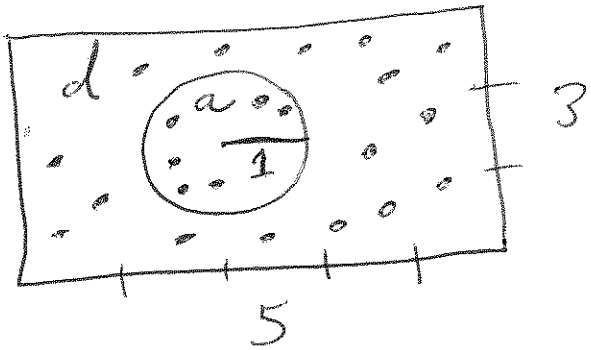
$$a = \frac{b}{c}(d)$$

a = area of <u>part</u> of a larger region where we generated random (x, y) points (random darts)

b = count of number of points inside the smaller partial area (circle or oval, for example)

c = count of <u>all</u> the darts, points that were used

d = area of the entire region



$\boxed{a = 3.14159}$

since radius = 1

$a = \pi r^2 = \pi 1^2$
$= \pi$

$\boxed{d = 5 \times 3 = 15}$

$\boxed{b = 6}$

$\boxed{c = 22}$

DDD

$$a = \left(\frac{6}{22}\right)(15) = (0.2727)(15) = 4.09$$

Monte Carlo estimate for area of the circle inside the 5 unit wide and 3 unit tall rectangle (3 by 5 card, perhaps).

What if 25 darts landed inside the circle on the 3 by 5 card — and the Monte Carlo estimate for the area was 3.5??

How many darts total were thrown?

$$a = \frac{6}{c} d$$

the unknown is c.

ALGEBRA

$$3.5 = \frac{25}{c}(15)$$

$$3.5c = (25)(15)$$

$$c = \frac{(25)(15)}{3.5} = 107 \text{ darts}$$

Note: 3.5047 was rounded to 3.5