Pg 7 Paulos

pop ~~#~~ US = 500 Million people

Coast to coast = 6000 miles

% chinese = 5 Billion people / world

$2/5 = .4 = 40\%$

Hair in Miles/hr. = 2 inches / 4 months $\equiv \frac{1 \text{ inch}}{\text{month}} \cdot \frac{1 \text{ months}}{30 \text{ days}} \cdot \frac{1 \text{ day}}{24 \text{ hrs}} \cdot$

$\frac{1 \text{ ft}}{12 \text{ inch}} \cdot \frac{1 \text{ mil}}{5280 \text{ ft}} = 2 \cdot 10^{-8}$ mi/hr ✓

people die each day = 3% of population

$= (.03)(5 \cdot 10^9) = 15 \cdot 10^7 = 150$ Million X

cigarets smoked per year = 10% population smokes ; 1-10 cigs/day

$= (.1)(500 \cdot 10^6)(1-10 \text{ cigs/day})(365 \text{ days/year})$

$\cong .5 \cdot 10^9 (.1)(300) = 15 \cdot 10^9 = 15$ Billion ~ close

$= .15 \cdot 10^{11}$

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28 million

$\frac{17}{28 \cdot 10^6} = \cancel{1.6 \cdot 10^{-6}}$

$\frac{1}{\frac{28}{17} \cdot 10^6} = \frac{1}{1.6 \cdot 10^6}$

12,000 die/wk = ~~12·72~~ = 12k · 72 > 700 k/year pg 9 Factos 03-28-03 1

6 colors + ≈ 8 squares / side

⇒ 64 total squares/side → 6·64 total squares

⇒ possible # of combination ≈ > 360

$$6^{360} = 1.3 \cdot 10^{280}$$

odd factor of $J_0 = \frac{3 \cdot 10^9}{4 \cdot 10^9} = .75 \cdot 10^{-10}$

size of new york = 100. million people

odd product ≈ $10^8 \cdot 10^{-10} = 10^{-2}$. X

\# McDonalds hamburgers = 1 Billion sold.

odd prod: $\underline{10^9} \; .75 \cdot 10^{-10} = .075$ X

$11.5 \text{ days} \cdot \frac{24 \text{ hrs}}{1 \text{ day}} \cdot \frac{\quad}{\quad}$

days

$11.5 (24)(3600) = 993600 \approx 1 M.$

hrs

$32 (365)(24)(3600) = 1B$

1 Billion sec = 30 yrs

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USpop = 250 M people

$$\frac{10^9}{250 \cdot 10^6} = \$4$$

$$\frac{1}{3} \cdot 10^{12}$$

families of size 4 = $\frac{250\text{ M}}{4} \approx 60$ M families.

$$\frac{1}{3} \cdot 10^{12} = \frac{1}{3} \cdot 10^3 \cdot B = \frac{1}{3}(4000) \approx 1333$$

$$\frac{\frac{1}{3} \cdot 10^{12}}{60 \cdot 10^6} = \frac{1}{3 \cdot 60}(10^6) \approx \frac{10^6}{200} = 5000 \checkmark$$

$$25 \cdot 10^3 \text{ M Tons} = 25 \cdot 10^3 \cdot 10^3 \cdot 10^3$$

$$25 \cdot 10^9 \cdot 2000 \text{ lbs}$$

$$= 50 \cdot 10^{12} \text{ lbs} \qquad 50 \cdot T \text{ lbs}$$

$$\frac{50 \cdot 10^{12}}{N_e} = 10^4$$

$$\cancel{N_e \approx 10^9} \qquad N_e = \frac{50 \cdot 10^{12}}{10^4} = 50 \cdot 10^8 = 5 \cdot 10^9$$

= 5 Billion people

10^5 = # words good sized novel

$N_p = 1\ \text{wk} \cdot N_{\text{families}} = 1 \cdot \text{wk} \cdot \frac{250 \cdot M}{4} \gtrsim 60M.$

$\text{Words}/\text{life} = 100\ \text{day} \cdot \frac{365\ \text{day}}{1y} \cdot \frac{80\ \text{yr}}{\text{life}} = 8 \cdot 10^3 \cdot 365$

Names in ~~the~~ New York times per year

$= \cancel{200\ 10\ 20\ \frac{\text{names}}{\text{page}}} \cdot \_\_\_$

$= \left[1-100\ \frac{\text{names}}{\text{page}}\right]\left[10-100\ \frac{\text{pages}}{\text{issue}}\right]\left[365\ \frac{\text{issues}}{\text{year}}\right]$

watermelons in Capitol Building

$\cancel{1-10\ m^3}$

$\left[1-10\ \frac{m^3}{\text{mellon}}\right]^{-1} \left[\text{Volume of Capitol Building}\right]$

pairs of people in world $= \frac{5 \cdot 10^9}{2}$

~~sex~~ ~~other~~ ~~ea~~ ~~we~~

people of wont age $\approx \frac{60}{80} = \frac{3}{4}$

$\therefore$ # people elighble to have sex $\frac{15}{8} \cdot 10^9$

sex 1 a week

$= \frac{1}{7}$ per day

~~ss~~ $= \frac{15}{8} 10^9 \cdot \frac{1}{7}$ sex/day $\approx$ ~~3~~ ~~4~~ $\approx \frac{10^9}{4}$

- - - -

Vol human blood ~~6 quarts, 5 women~~

6 quarts blood male, 5 quarts women, 4

$5 \cdot 10^9$.

$\frac{15}{3} \approx 5$.

estimate 4 quarts Blood/person = 1 gallon

~~20 B~~ 5 B gallons blood

7.5 gallons/ft^3

$= \frac{5 \cdot 10^9}{7.5} =$ $\frac{2}{3} \cdot 10^9$ ft^3 of blood

$\sqrt[3]{[\quad]} = \sqrt[3]{.66} \cdot 10^3$ ft $= 873$ ft

Central park 840 acres = 1.3 square miles

depth of Blood in central park $= \frac{.66 \cdot 10^9 \; ft^3}{1.3 \, (5280 \; ft)^2} = 18$ ft dead sea blood depth $\frac{\cancel{2}/3 \cdot 10^9 \text{ ft}^3}{10^{10} \text{ ft}^2} =$ 03-28-03 6

$= .66 \cdot 10^{-1} = .06 \text{ ft}$

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concord 2000 mi/hr

snail $v = 25 \text{ ft/hr} = \frac{25}{\cancel{5280}\,5280} \frac{mi}{hr} < \frac{25}{5000} \frac{mi}{hr} = \frac{1}{200} \frac{mi}{hr}$

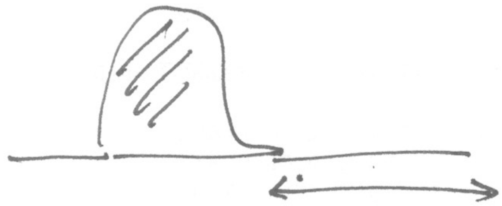
$= \cancel{.002}\ \cancel{.02}\ \cancel{m}\ \cancel{.05}\ \cancel{mi/hr}\ .005 \frac{mi}{hr}$

$\frac{?}{speed}$ $\frac{2000}{.005} = 4 \cdot 10^5 = 400{,}000$

Computer speed $\sim 1 \cdot ns$

human $\sim 1\text{-}10$ min $= [1-10]\ 60\ s$

speed ratio $\frac{10^{-9}}{60} \cong 10^{-10}$



$T = 15$ min

$\#$ trucks/day $= 24 \cdot 4 \lessapprox 100$ trucks/day.

capacity/truck $= 4$ tons $\Rightarrow$ capacity/day $= 100 \cdot 4$ tons/day

$V_{Fuji} = 10^5 - 10^6$ tons

$$\text{time (days)} = \frac{10^5 - 10^6}{400} \text{ days} = \frac{1}{4}\left[10^3 - 10^4\right] \text{ days}$$

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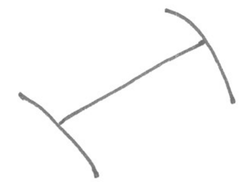
900 ft long robe would be much too long

highest hills ~ $O(10\ km) = O(30\ kft)$



$1m = 3ft \Rightarrow (4\pi R_e^2)(30 \cdot 10^3\ ft)$

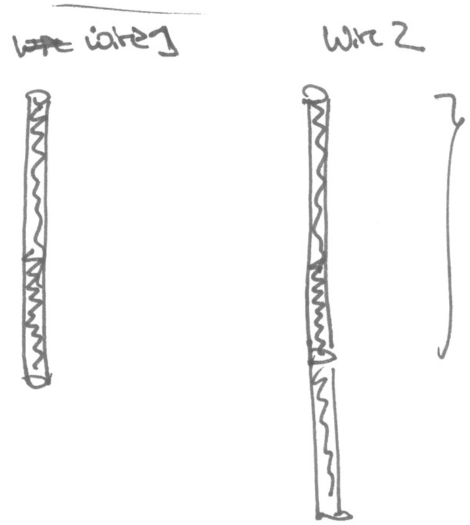
$= 4\pi(\quad)^2 (3 \cdot 10^4\ ft) = V$ of $H_2O. = 10^9\ miles^3$

? get

40 days & nights $= 40 \cdot 24$ hrs $= 960$ hrs

$\Rightarrow 10^9 (5280\ ft)^3 = (960\ hr)\, r$

$\Rightarrow r = 10^6 (5 \cdot 10^3)^3$



6 ft

δ weight $\Rightarrow$ δ^3 weight increase

support of weight $= 2^\delta$

19 14 Factors

$400\ M = 400 \cdot 10^6$

$$\frac{25{,}000}{400 \cdot 10^6} = \frac{2.5 \cdot 10^4}{4 \cdot 10^8} = 6 \cdot 10^{-4}$$

$25(16 \cdot 10^3) =$

$40 \cdot 10^9$ light years

$$40 \cdot 10^9 \cdot 3 \cdot 10^8 \ \tfrac{m}{s} \cdot (365 \cdot 24 \cdot 3600) = 3.78 \cdot 10^{26} \text{ m to a side}$$

$$V_{universe} = 8.41 \cdot 10^{79} \ m^3$$

$$\# \text{ atoms} = \frac{V_{universe}}{(10^{-13} \cdot 10^2)^3} = \frac{8.41 \cdot 10^{79}}{(10^{-11})^3}$$

$$= 8.41 \cdot 10^{79+33} = 8.4 \cdot 10^{112}$$

$$\text{time} = \frac{10^{-11} \ m}{3 \cdot 10^8 \ m/s} = \frac{1}{3} \cdot 10^{-19} \ s$$

$$15 \text{ Billion years old} = 15 \cdot 10^9 \ (365 \cdot 24 \cdot 3600)\ s$$

$$= 4.7 \cdot 10^{17} \ s$$

$$= 3(4.7) \cdot 10^{36} \text{ time units}$$

$\binom{25}{9} = 2.04 \cdot 10^6$ games to play

$\approx$ 1 hr per game.

$\Rightarrow$ 8 games / day

$= \frac{2.04 \cdot 10^6}{8}$ days of games $= 2.5 \cdot 10^5$ days

$= 699.6$ years.

— — — —

26,

$6! = 6 \cdot 5 \cdot 4 \cdot 6$

$30 \cdot 4 \cdot 6 = 120 \cdot 6 = 720.$

ways to get 4 aces = 48 i.e. 1's are not aces + we can get any

$52 - 4 = 48$ one of these

at least 1 6 in 4 roles of die $\Rightarrow$ $\overline{\text{don't role a 6}}$ $\overline{\text{in all 4 roles of die}}$

$P_{\text{don't role } 6} = \frac{5}{6}$

$P_{\text{don't role a 6 4 times}} = \left(\frac{5}{6}\right)^4$

Prob role a 6 in 4 roles $= 1 -$ Prob don't role a 6 $= 1 - \left(\frac{5}{6}\right)^4 = .517$

03-28-03 Y

$P_{\text{dont role a 12 in 1 } \cancel{\text{toss}} \cancel{\text{tosh}} \text{ toss of 2 die}} = 1 -$

$P_{\text{role a 12 in 1 toss of 2 die}} = \frac{1}{6} \cdot \frac{1}{6} = \frac{1}{36}$

$P_{\text{don't role a 12 in 1 } \cancel{\text{two}} \text{ toss of 2 die}} = 1 - \frac{1}{36} = \frac{35}{36}$

$P_{\text{dont role a 12 in 24 roles of 2 pairs of die}} = \left(\frac{35}{36}\right)^{24}$

$P_{\text{role at least 1 12}} = 1 - \left(\frac{35}{36}\right)^{24} = .49$

$P_{\text{get AIDS}} = \frac{1}{500}$

$P_{\text{dont get AIDS}} = \frac{499}{500}$

$P_{\text{but}} =$

$\left(\frac{499}{800}\right)^{346} =$

$\frac{1}{5000}$ $P_{\text{dont get}} = \frac{4999}{5000}$

$P_{\text{dont get n encounters}} = \left(\frac{4999}{5000}\right)^{N} = \frac{1}{2}$

$N = 3465$ days

≈ 9.5 years

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03-28-03 1

$P_{\text{given person knows one of your friends}} = \frac{1500}{200 \cdot 10^6} = \frac{15 \cdot 10^{-6}}{2}$

$P_{\text{person does not know one of my friends}} = \frac{200 \cdot 10^6 - 1500}{200 \cdot 10^6} = .999$

$P_{\text{dont know all of my friends}} = (.999\ldots)^{1500} = .98$

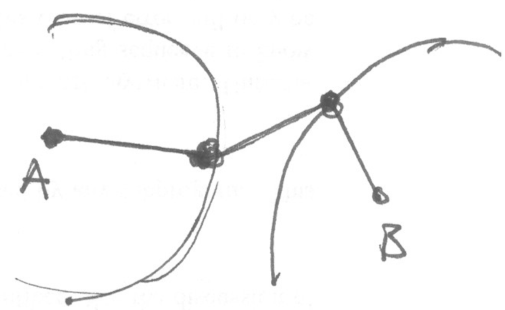
$P_{\text{know at least one person}} = 1 - .98 = .0118 \cong 1/100$

How get $\frac{99}{100}$?

$P_{\text{not linked by 2 people}} =$

$P_{\text{linked by 2 people}} =$

link of 2 people



P man i does not get his own hat $> \frac{i-1}{i}$

since man i's hat may have been taken by someone before him & may not be in the pile at all

$\therefore$ Prob all N men do not get their own hats $> \prod_{i=2}^{N} \frac{i-1}{i}$

$$= \prod_{i=2}^{N} \left(1-\frac{1}{i}\right)$$

Prob at least 1 man gets his own hat $= 1 - P_{all}$

$$= 1 - \prod_{i=2}^{N}\left(1-\frac{1}{i}\right)$$

$N=2$ $\quad P_1 = \frac{1}{2}$ $\quad \bar{P}_1 = \frac{1}{2}$

$N=3$ $\quad P_1 = \frac{2}{3}$ $\quad P_2 = \frac{1}{2}$ $\quad \bar{P}_{All} = \frac{1}{3}$

sim $\prod_{i=2}^{N} \frac{i-1}{i} = \frac{1}{2}\cdot\frac{2}{3}\cdot\frac{3}{4}\cdots\frac{N-1}{N} = \frac{1}{N}$

$\approx$ P at least 1 man gets his own hat $= 1 - \frac{1}{N} \approx 1$ for large N.

for cards
$N = 52$

P at least 1 match $= 1 - \frac{1}{52} = \frac{51}{52} = .98$

1936 Pelos

03-29-03

$$\text{Expected payout} = 3\left(\tfrac{1}{6}\right)^3 + 2\left(\tfrac{1}{6}\right)^2 + 1\left(\tfrac{1}{6}\right)$$

$$-1\left[\left(\tfrac{5}{6}\right)^3\right] = -34 \quad 4$$

$$= 3\left(\tfrac{1}{6}\right)^3 + 2\left(\tfrac{1}{6}\right)^2\left(\tfrac{5}{6}\right)\left(\tfrac{3}{2}\right)$$

$$+ 1\left(\tfrac{1}{6}\right)\left(\tfrac{5}{6}\right)^2\left(\tfrac{3}{2}\right)$$

Pg 86 Problems

03-30-03 /

route 1 Expected # ~~at~~ serving = 200

route 2 Expected # serving = $\frac{1}{3}(600) + \frac{2}{3}(0) = 200$

take route 1 guarantee that 200 live

---

route 1 : ~~200~~ # serving = 200

route 2 : # serving = $\frac{1}{3}(600) + \frac{2}{3}(0) = 200$

take route ~~2~~ 1 guarantee that 200 live

---

30 k v.s. $\bar{E} = (.8)(40\,k) + .2(0)$

$= 32\,k$

Social Security # _ _ _ - _ _ - _ _ _ _ 9 digits

$= 10^9$ possible unique ~~sets~~ combin = 1 Billion #'s

Pg 92

~~Man 1~~ ~~Man 2~~

	# wins
Man 1	5
Man 2	3

$\cancel{\frac{5}{6}(100)} + \cancel{\frac{3}{6}(100)}$

Amt to award

$\frac{5}{8}(100)$ + ; $\frac{3}{8}(100)$

How ÷ up pot?

(1) All to man 1. he was winning

(2) $\frac{5}{8}(100)$ to man 1, $\frac{3}{8}(100)$ to man 2

(3) prob man 1 wins = ? p

coin flip H

T

prob man 2 wins = 1-p

But man 2 can win w/ probability $\cdot\left(\frac{1}{2}\right)^3$ (he must at

some point get 3 Heads/Tails in a row

— — — —

$\frac{1}{5000}$ 1 cameraman dies ∀

$si = \log_{10}(5300) = 3.7$ lower "safety index" more dangerous something is

~~$\log_{10}(100) = 10$~~

si

	si
smoking	2.9
driving	3.7
kidnapping	6.7

$\frac{50}{250 \cdot 10^6} = \frac{1}{5 \cdot 10^6}$

$\log_{10}(6) = .77$

Pg 96 Problems

$$\frac{(12{,}000)(52)}{280 \cdot 10^6} = \cancel{287.3} \quad \frac{1}{400}$$

Pg 100 Problems

A: 4 on 4 faces ; 0 on 2 faces

B: 3 on all 6 faces

C: 2 on 4 faces ; 6 on 2 faces

D: 5 on 3 faces ; 1 on 3 faces

A $\gtrsim$ B $\quad \frac{4}{6} = \frac{2}{3}$ of time

B $\gtrsim$ C $\quad \frac{4}{6} = \frac{2}{3}$ of time

C $\gtrsim$ D

	2	2	2	2	6	6
5, 5, 5, 1, 1, 1						

$$\cancel{\frac{2 \cdot 6}{36}} \cancel{=} \cancel{\frac{2}{6}} = \cancel{\frac{1}{3}}$$

$$\frac{3+3+3+3+6+6}{36} = \frac{24}{36} = \frac{4}{6} = \frac{2}{3} \checkmark$$

03-30-03 4

$D \gtrsim A$:   5 | 5   5   1   1   1

444400

$$P_{D\gtrsim A} = \cancel{\frac{2\cdot 3 + 2\cdot 3}{36}} = \cancel{\frac{2}{6}} \qquad \frac{3\cdot 6 + 3\cdot 2}{36} = \frac{3+1}{6} = \frac{2}{3} \checkmark$$

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pg 105

		prisinor #2 Confess	prisinor #2 Don't confess
Prisinor #1	Confess	3 / 3	0 / 5
Prisinor #1	Don't confess	5 / 0	1 / 1

Prisinor #1

	C	DC
C	3	0
DC	5	1

Prisinor #2

	C	DC
C	3	5
DC	0	1

Both prisinors should confess.