Code Foo Challenge

Question 1

How many ping pong balls would it take to fill an average-sized school bus?

by Eric Sare

A) Approach & assumptions

1. Get the general interior dimension of the school bus, we assume it is completely empty so we are NOT factoring the volume of the chairs or benches in this calculation.
2. Approximate the volume of the benches (seating volume) by using the volume of average person multiply by the passenger capacity.
3. Minus the seating volume from the interior volume of the bus to approximate real interior volume in the bus.
4. Calculate volume of ping pong ball.
5. Divide real interior volume of the bus by the volume of ping pong ball to get the number of ping pong balls in the bus.

B) Interior dimension of a school bus

1. We will be using dimensions from an average Type C school bus that seats 54 people. The dimensions from the following sources:

   http://www.dimensionsguide.com/school-bus-dimensions/
   http://faptflorida.org/2008%20Florida%20School%20Bus%20Specifications%20_Final.pdf
   http://ntl.bts.gov/lib/10000/10600/10694/MBTC1054-1.pdf

Interior Volume = l*h*w

IV = 30ft. * 8.5ft * 7.5ft*

Interior Volume = 1912.5 cubic ft.

*Full **height** of bus = 10 ft.*
We minus 1.5ft since the interior of the bus is elevated

Interior height = 10ft. - 1.5ft = 8.5ft.

*Full **width** of bus = 8ft.*
Take off 0.5 ft for thickness of body parts
Interior length = 8ft. - 0.5ft = 7.5ft.

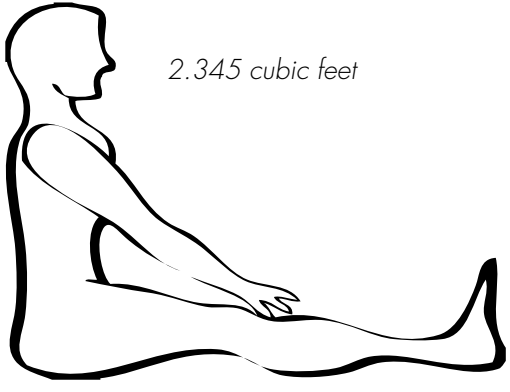
*Full **length** of bus = 35 ft.*
We minus 5ft since we're not factoring in the engine housing in the front.

Interior length = 35ft. - 5ft = 30ft.

C) Approximate volume of seats and benches

1. Since we might not know the actual dimensions of the seats, we use the volume of an average human body, multiply by the maximum number of occupents to approximate the total seating volume.
2. The volume of human body can be calculated by using water displacement, which is around 2.345 cubic feet. Source for this measurement is below:

   http://www.wolframalpha.com/input/?i=average+volume+of+human+body+in+cubic+feet



Seating Volume = 2.345 cubic ft. * seating capacity

SV = 2.345 cubic ft. * 54

Seating Volume = 126.63 cubic ft.

D) Calculate real interior volume of school bus

1. We minus seating volume from total volume of the bus

Real Interior Volume = Total interior volume - seating volume

RIV = 1912.5 cubic ft. -126.63 cubic ft.

Real Interior Volume = 1785.87 cubic ft.

$$\begin{array}{r} 1912.50 \\ -\ 126.63 \\ \hline 1785.87 \end{array}$$

E) Calculate volume of ping pong ball

1. Diameter of a ping pong ball is 40mm, which is about 1.5748 inches, with radius of 0.7874 inches or rounded up to 0.79 inches.

Volume of sphere = $4/3\pi r^3$

$V = 4/3\pi(0.79)^3$

Volume of Ping Pong Ball = 2.06523 cubic inches

or

0.17210 cubic ft.

Radius = 0.79 inches

Diameter = 1.5748 inches

F) Calculate total number of ping pong balls

1. For the last part, we simply divide the real interior volume by volume of a ping pong ball.

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Total Number of Ping Pong Balls = real interior volume / volume of a ping pong ball

Total Number = 1785.87 cubic ft. / 0.17210 cubic ft.

Total Number of Ping Pong Ball = 10376.93

or

10377 ping pong balls rounded up.