'Plausible Estimation' Estimating for Amazing Facts Tasks - Set #3 (solutions)

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The aim of this assessment is to provide the opportunity for you to:

- develop a chain of reasoning that will enable you to estimate quantities to an appropriate degree of accuracy
- choose suitable units for your estimate
- communicate the assumptions upon which your estimate is based.

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1. High stack

Suppose you have a very large sheet of paper. You tear it in half and put one half on top of the other. You now have a stack of two sheets.

You now tear the whole stack in half and place one half on top of the other to make a new stack. You repeat this process, tearing 50 times. (Yes I know its impossible - just imagine you could).

How high would the stack be? 50 feet? 100 feet? A mile? or more...?
Make a sensible estimate, based on careful reasoning.

Assumptions

- A ream of paper (500 sheets) is about 2 inches thick

Reasoning

Each sheet is therefore approx 1/250th of an inch thick.

After 50 tears, the stack will contain 250 sheets of paper.
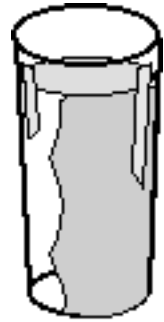
This is equal to approximately

1.1259 x 10^{15} sheets or 4.5 x 10^{12} inches = 71million miles.

Answer: 71 million miles!

2. The swimming pool and the glass.

How long would it take you to empty an olympic size swimming pool with a glass?

Assumptions

- Dimensions of swimming pool = 50 meters x 20 meters
- Depth of water = 6 feet (2 meters)
- The glass holds half a pint.
- You empty the pool at one glass per second.

Reasoning

This gives volume of pool as 2000 cubic meters or 2 x 10^6 liters.

One half pint glass has a volume of about 25 x 10^{-5} cubic meters.

Thus approximately 8 million glasses will empty the pool.
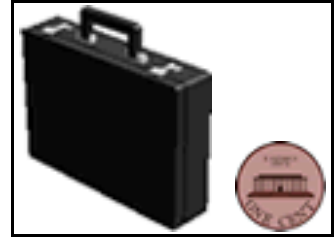
This would take 2,215 hours or about 90 days.

Answer: 92 days or about 3 months, working day and night!

3. The briefcase of cents

Suppose you filled a briefcase with one cent coins.

How much would the money be worth?

Assumptions

- A cent coin has a diameter of 20 mm (0.75 inches) and a thickness of 1.5 mm
- The briefcase is approx 100mm x 350mm x 500mm

Reasoning

The volume of the coin is therefore given by

$$\pi r^2 h = 3.14 \times (^{20}/_2)^2 \times 1.5 \quad 470 \text{ mm}^3$$

The volume of the case is approx 500 x 100 x 350 = 17,500,000 mm^3

Thus the number of coins that will fit in (assuming no gaps) will be about 17,500,000 ÷ 470 = 37,000 (approx).

There would be some gaps between coins, so

Answer: The money will be worth around $350.

(Note that the total weight of the case would be almost 100 kilograms - far too heavy!)