On Vampire Insurgences and the Birthday Paradox.

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<u>April 1650.</u>

Turda, Romania.

Dracula's having a ball.

There's wine, there's heart-fondling music, and there's sparkly bubbly chatter that glimmers in the warm yellow light streaming from the ornate chandeliers.

The hall is generous with its space, its walls strong and reassuring as they perspire with centuries of lush verdant Romanian history.

The time is six 'o' clock.

A smartly dressed courtier walks by, stopping to offer wine.

"No thank you."

No wine. Not yet. No wine just yet. You're here on a mission.

The VMD[1] base in Bucharest expects a report.

Based on recent events, the agency has had cause to believe a vampire insurgence is imminent. Agents have been dutifully monitoring the trends of events, and mapping out strategy to preempt a major upheaval.

Hence your mission.

Intel is direly needed. On the size of the threat, and on the extent of their progress. The conspiring vampire families have been extremely scrupulous at ensuring the clandestine-ness of their meetings, and so very little information has seeped through to the agency.

You have managed to sneak in as a vampire in disguise.

Right now, your mission is to find out how many vampire families are present.

Is this trivial? Not exactly. The guest list was very well protected. The only way you can educe this information is by immersing yourself in the crowd, and figuring this out.

You have ten minutes.

09:59

The Birthday Paradox:

Outline:

Given a group of N people in a room, what is the probability that at least two of them have the same birthday?

The Paradox:

There are 365 days in a year, and so 365 possible birthdays. How do you derive an estimate of said probability?

Results have shown that human intuition very dependably overestimates the required number.

In actual fact, only 23 people are needed to have a 50% chance. With 70 people, the chance becomes 99.9%.

The significant discrepancy exists as a result of the ineptitude of the human intuition at working with exponentials. In this case, exponential probabilities, mathematical entities which this problem happens to employ.

An equation to estimate this probability is given by:

$$p(n;d) \approx 1 - \left(\frac{d-1}{d}\right)^{n(n-1)/2}$$

[Equation 0][0].

where d: number of days in the year, and
n: number of people in the room.

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<u>Inversion:</u>

Consider the flip question: Given that of N (N being unknown) total people in a room, the first instance of a shared birthday is seen to occur on the observation of the nth individual.

What is a reliable estimate of the N total people in the room?

Appropriately inverting equation 0 gives:

$$d = \frac{n^2}{2} . \frac{1}{ln(\frac{1}{1-p})}$$

[Equation 1]

The mathematical relationship encouched in the above equation, proffers a tool to aid the accomplishment of your task.

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References:

0. Birthday Problem. Wikipedia. *https://en.wikipedia.org/wiki/Birthday_problem*

1. VMD: *Vampire Monitoring Division*.