Jain Mathematics Tournament

Season One

A Young Jains of America Initiative

Problem 1

The shortest life span according to Jainism is 2^8 avalikas *(miniscule time unit)*, which is that of a *sadharan vanaspatikaya* (e.g. souls within root vegetables) life form. However, these souls spring up an innumerable amount of times after their life span has ended. For example, after 256 avalikas, another soul will replace the initial soul, and this "rebirth" occurs an innumerable amount of times. Now let us suppose there are three souls A, B, and C that have lifespans of 256 avalikas, 259 avalikas, and 261 avalikas, respectively. Soul B has its first birth 1 avalika after soul A and soul C has its first birth 13 avalikas after soul A. Assume these souls are reborn in the same place with the same lifespan, and also **assume that this rebirth continues infinitely for all souls** (in actuality, this cycle will eventually end, but assume infinite for the problem). As time goes on, there will be times that souls A, B, and C will be reborn at the same exact time; let us call these moments ***overlaps***.

How many overlaps are there between life forms A, B, and C before 2^{58} avalikas have elapsed?

Problem 1 Clarification

Life	t = 0	t = 1	t = 13	t = 256	t = 260	t = 274	t = ...	t = 2^{58}
A	FIRST			rebirth			. . .	
B	N/A	FIRST			rebirth		. . .	
C	N/A	N/A	FIRST			rebirth	. . .	

As you can see above, A is first born at time 0 and dies and is reborn at time 256 avalikas. Similarly, B and C have a first existences at times 1 and 13 and rebirths at times 259 and 261, respectively. You need to find how many times there are such that A, B, and C have rebirths at the same time t such that $t < 2^{58}$. **Assume the time between death and rebirth is negligible.**

Tips

- First determine the earliest time where A, B, and C have an *overlap*
- Once you have found such a time, determine the pattern that these *overlaps* follow. The rest of question should be straightforward thereafter.

Have questions or concerns?

Please contact Anish Visaria at jmt@yja.org if you have any further questions.

Problem 2

10 Yojans

Point B

30 Yojans

Point C

Point A
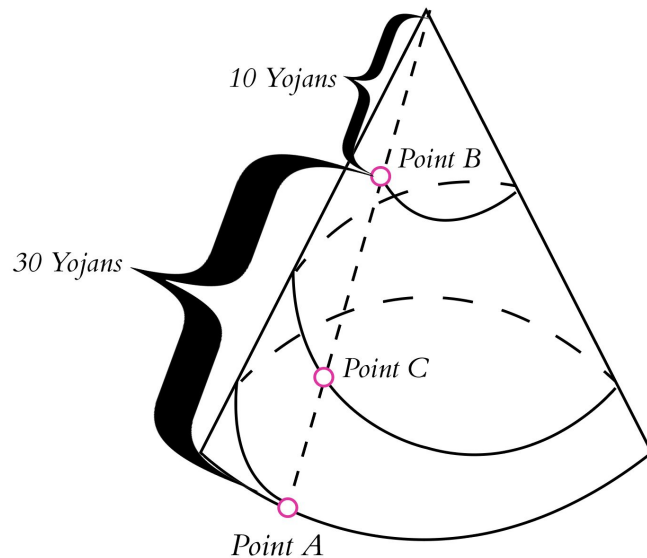
In Jain cosmology, the universe consists of three sections, the upper realm, middle realm, and lower realm. Humans live only in the middle universe on the continent known as *Jambudweep*. In the middle of the continent, there is a mountain called Mount Meru (*Meru Parvat*). On top of Mount Meru lies a cone-shaped tip known as the *Chulika*. The *Chulika* has a **base diameter of 12 Yojans** (space unit) and **slant height of 40 Yojans**. Assume the *Chulika* is perfect cone for this problem (the actual *Chulika* is a partial-cut cone where the top-end is 4 Yojans in diameter). Let's suppose there is a spiritually advanced monk named Meru Muni who starts climbing Mount Meru at point A (shown in the diagram). While he is climbing he pulls a rope with him that runs out at point B (shown) after **circling the mountain exactly twice** on his way up, so he stops at point B. Point B is 10 Yojans from the tip of the cone along the slant height. Assume this rope is extremely tight and clings to the mountain (geodesic). Now suppose a *Devi* (goddess) named Nidra Devi flies along the rope, starting at point A, but does not go past Meru Muni. Given that Nidra Devi takes one break before reaching Meru Muni, ***what is the probability that Nidra Devi takes a break before reaching point C (as shown, exactly one circling around the mountain)? Express your answer as a percent to 3 decimal places.***

Problem 2 Clarifications

- The rope is **<u>geodesic</u>** meaning it is the **shortest path** possible between point A and B with two rotations of the cone.
- The total distance travelled by Meru Muni is synonymous with the total length of the rope around the Chulika.
- Assume Nidra Devi only travels along the rope and **there is an equal likelihood of her taking a break anywhere along her journey from point A to point B.**

Have questions or concerns?

Please contact Anish Visaria at jmt@yja.org if you have any further questions.

Submission

The submission link is http://bit.ly/jmtsubmissions. **You must submit your work along with your answer for your submission to be counted. Remember, only the FIRST perfect submission will be awarded, so it is advised to submit as soon as you solve the problems.**

Submission Deadline: Sunday, January 26th @ Midnight EST

Guidelines

- You are free to use any resources, **but the thinking must be done by you.**
- Collaboration is not allowed and will result in disqualification.
- Please submit work that is legibly handwritten or typed.
- Anyone is welcome to work on the questions, but to be eligible for an award you must be between 14 and 29 years old, and not an active member on the YJA Executive Board or Convention Committee.

Scoring & Awards

- All problems are weighted equally in the tournament, unless otherwise stated.
- The FIRST person to submit a perfect submission (correct answers to both problems) will be eligible to receive a discounted ticket to the YJA 2020 convention or Amazon gift card of equal value.
- The top 3 non-zero scorers (ties broken by the time of submission) will be recognized on YJA social media channels.

References

- *That Which Is*, Umāsvāti, Nathmal Tatia (1994, HarperCollins Publishers)
- *Tattvartha Sutra,* Umāsvāti, Manu Doshi (2007, JAINA)