Foreword

Probability of an Accident Occurring

Human Factors Lab.

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Here, let's introduce a probability quiz known as "The Birthday Problem".

<Quiz>

In a class of forty students, what are the chances of at least two people having the same birthday?

Assumptions:

1. A year is assumed to have 365 days.

2. The birthdays of the students are distributed uniformly (i.e. The probability of each day being somebody's birthday is the same.)

<Answer>

About 89%

(Does this seem too great to you? If so, take a look at the explanation below...)

<Derivation>

Firstly let's calculate the probability of all the students having different birthdays. To make it easy to understand, let's start by considering a class with two students, and then increase the number.

If there are two students in the class, and if the second student's birthday must be any day in the year other than the first student's birthday, the probability of the two students' birthdays differing is:

$$(365-1)/365.$$

For a class of three students, since the probability of all three birthdays differing is equal to that of the third student's birthday differing from the previous two students, the probability is:

$$(365-1)/365 \times (365-1-1)/365.$$

Moving on, for a class of forty students, the probability is:

$$(365-1)/365 \times (365-2)/365 \times ... \times (365-39)/365.$$

Finally, since the probability of at least two of the students having the same birthday is the opposite (a complementary event) of "all the students having different birthdays," the answer is derived by subtracting the above result from one, so that the probability of at least two of the forty students having the same birthday:

$$1- (365-1)/365 \times (365-2)/365 \times ... \times (365-39)/365 = 0.89...$$

The point to learn from this example is that our intuition about the probability turned out to be wrong.

Similarly, judgment errors based on a driver believing that "there is probably no other car wanting to cross the intersection" are an example cause of traffic accidents.

Although research into active safety systems is progressing rapidly, a significant reduction in the number of road accidents will not be achieved unless these systems are take the characteristics of a driver's cognition and judgment into account.