**Classically, logic has been thought of as the study of *deductive proof* or *derivations*. In the last few decades, however, a more dynamic view of logical reasoning has emerged. Rational agents perform many cognitive reasoning tasks other than making deductions from a given set of premises. Common sense reasoning includes reasoning about the beliefs, knowledge, and logical reasoning of other agents. Reasoning is not just the construction of static derivations but dynamical events involving the flow of information based on public statements and inferences that can be made on the basis of what others know or don’t know. The following puzzle illustrates this usefulness of this kind of dynamic meta-epistemological reasoning.**

***Sachertorte* at Café Reichsrat**

**A sign on a building

Description automatically generated with low confidenceThe date was August 26, 1930. Rudolf Carnap, Herbert Feigl and Friedrich Waismann met with Gödel for *Sachertore* and Viennese coffee at Café Reichsrat. Gödel was excited to share with his friends his discovery. This meeting a the café was about one month before the Second *Tagung for Erkentnishlehre der exackten Wissenschaften* to be held in Konigsberg in September, where Gödel would make the first public announcement of his revolutionary result, the (First) Incompleteness Theorem.**

**Although his associates from the Vienna Circle—Rudolf, Herbert, and Friedrich—could sense an undercurrent of excitement in Kurt’s manner, his cautious and measured remarks were deeper than they could, or were willing, to grasp, at that time. Rudolf decided to change the subject. “When is your birthday, Kurt?” he inquired.** **Gödel thought for a moment and wrote down a napkin a list of 10 dates for all to see:**

**January 14, January 15, January 18,**

**March 14, March 23,**

**April 18, April 28,**

**May 15, May 22, May 28**

**Kurt said, “My birthday is one of these.” Then taking a couple more napkins, he jotted down the *month* of his birthday and gave it to Herbert. On the other he jotted down the *date* of his birthday and gave it to Friedrich. Neither Herbert nor Friedrich could see what was written on each other’s napkin.**

**“Can you prove when my birthday is?” Kurt asked Herbert. The following conversation ensued.**

**Herbert: I *don’t* *know* when your birthday is, but I *know* Friedrich *doesn’t know* either.**

**Friedrich: I *didn’t know* at first, but now I *do know*!**

**Herbert: Then I also *know* when Kurt’s birthday is!**

**Rudolf, who heard the exchange, correctly deduced Kurt’s birthday. How did he do this? You may assume everyone is an *ideal logician*: they are not lying or confused and are capable of making logically accurate inferences on the basis of the information disclosed.**

Solution to the ***Sachertore* at Café Reichsrat Puzzle**

**First arrange the list of possible birthdays in a matrix by month and by day:**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Herbert |  | Friedrich | | | | | |
| January | 14 | 15 | 18 |  |  |  |
| March | 14 |  |  |  | 23 |  |
| April |  |  | 18 |  |  | 28 |
| May |  | 15 |  | 22 |  | 28 |

**Our first clue is that:**

**Herbert said, “I don’t know when your birthday is, but I know Friedrich doesn’t know either.”**

**Herbert, of course, doesn’t know since he’s only been given the month. However, Hebert’s *publicly announcing* that he *knows* that Friedrich doesn’t *know* gives everyone some new information.**

**Rudolf *deduces* that Hebert has been given neither the months of March nor May. Why? Because each those months have unique dates, namely, 22 and 23. If Friedrich had been given either of these dates, he would have been able immediately to deduce Kurt’s birthday. Since Herbert says he *knows* this is not the case, Rudolf can deduce that Herbert has *not* been given either March or May.**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Herbert |  | Friedrich | | | | | |
| January | 14 | 15 | 18 |  |  |  |
| March | 14 |  |  |  | 23 |  |
| April |  |  | 18 |  |  | 28 |
| May |  | 15 |  | 22 |  | 28 |

Our second clue is that:

**Friedrich said, “I didn’t know originally, but now I do!”**

Since Friedrich says he now *knows* Kurt’s birthday, Rudolf may deduce that Friedrich has *not* been given the date of the 18th, the date is common to the months not yet been eliminated—January and April.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Herbert |  | Friedrich | | | | | |
| January | 14 | 15 | 18 |  |  |  |
| March | 14 |  |  |  | 23 |  |
| April |  |  | 18 |  |  | 28 |
| May |  | 15 |  | 22 |  | 28 |

The last clue is that:

**Herbert said, “Then I also know when Kurt’s birthday is!”**

**Since Herbert now *knows* when Kurt’s birthday is too, the month given to Herbert cannot be January since in that case, *two* possible dates would been remaining *after* the 18th was eliminated.**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Herbert |  | Friedrich | | | | | |
| January | 14 | 15 | 18 |  |  |  |
| March | 14 |  |  |  | 23 |  |
| April |  |  | 18 |  |  | 28 |
| May |  | 15 |  | 22 |  | 28 |

**Having eliminated the months of May and June, and then the date of the 18th and then the month of January, Rudolf deduces that Kurt’s birthday is April 28th.**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Herbert |  | Friedrich | | | | | |
| January | 14 | 15 | 18 |  |  |  |
| March | 14 |  |  |  | 23 |  |
| April |  |  | 18 |  |  | 28 |
| May |  | 15 |  | 22 |  | 28 |

N. B. Gödel’s birthday is actually April 28th (1906), and the date of his death is January 14th (1978). Einstein’s birthday is on March 14th (1879), a date which will be important for the beginning of the public recognition of Gödel’s achievements, and the date of his death is April 18th (1955), a date that will mark the beginning of Gödel’s increasing intellectual isolation at IAS. **This puzzle is based on one published in the *New York Times*:** <http://www.nytimes.com/2015/04/15/science/a-math-problem-from-singapore-goes-viral-when-is-cheryls-birthday.html>.