There's a 70% chance of your transformer failing in the next year

That's a prediction (or forecast) which can't be wrong!

If we say there's a 70% chance of failure as an outcome and the transformer fails, then the outcome falls in the 70%, and if it doesn't fail the outcome falls in the 30%. We're covered come what may.

The *only* ways to get this type of prediction wrong are to say something will *definitely* 100% happen, and it doesn't, or say that something *definitely* 100% will NOT happen, but it does [1]. But avoid the two *definite* statements, and any other version of the prediction cannot be wrong.

How can we check the accuracy of the prediction if the event only happens once? It's not like repeated rolls of a dice, which we can predict with some statistical accuracy. If I roll a standard, fair, 6-sided dice, the chances of rolling a 4 are 1 in 6 (16.67%). If I predict I'll get a 4, say, 50% of the time, that's likely a poor prediction – which we can check through repeated rolls. We can roll the dice many times, but we can't rerun the year many times. What we can do is look at similar situations, in this case other transformers, and see how well our predictions of failure probability stand up in each case: compare

QUIZ?

a) **What is the expected value of a dice roll - the mean of many throws?**

b) **If there's a 10% chance of an event happening in any 1 year, how likely is the event occurring at least once in a ten-year period?**

c) **How many people need to gather such that two of them are *likely* to have the same birthday (day/month not year)?**

d) **How many need to gather such that 1 of them is *likely* to have the same birthday as you?**

QUESTIONS

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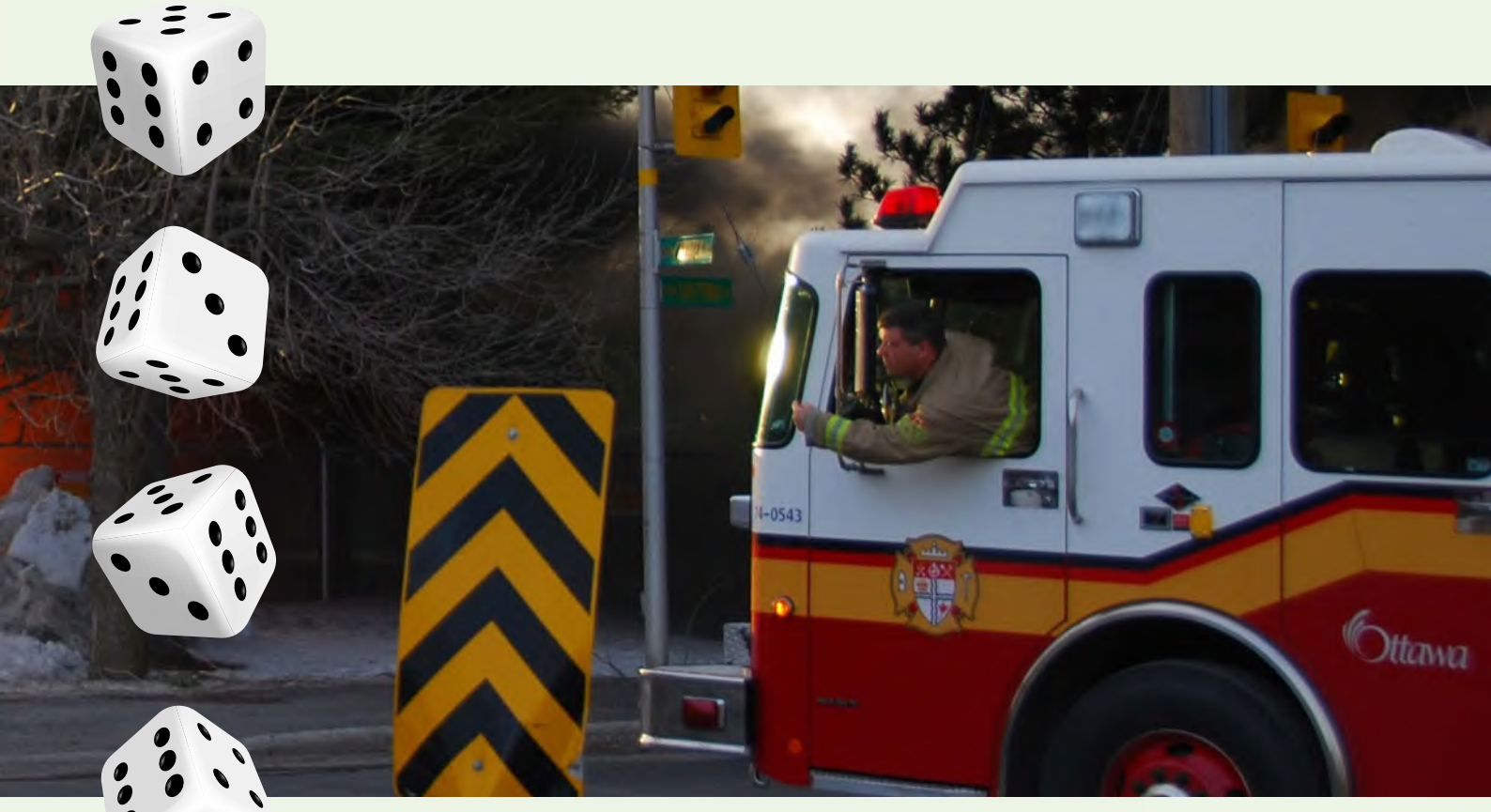
the estimated probability of failure with the actual outcome at the end of the year for each transformer. If I estimate a 5% chance of failure for a particular transformer and it does fail, I'm out by 95%. But how do we rate the overall prediction accuracy across the population? We can look to weather forecasters!

Some years ago, the weather forecasting folks put together a means to measure the accuracy of predictions or forecasts, called a Brier Score [2]. The score tells you how well your predicted forecast for rain, or failure, or whatever, across a number of locations and times relates to what actually happened. It does this through a mean square error, with the lower the Brier score the better the set of forecast [2]. The same approach would apply to transformer failure probabilities and can be used to check the accuracy of the forecast; and is something we're working on at present.

If you have an interest in this topic, please contact the author!

When working with probabilities I recommend checking results with an expert as things can get complicated and can sometimes be counter-intuitive [3]. Some quiz questions may help illustrate.



QUIZ!

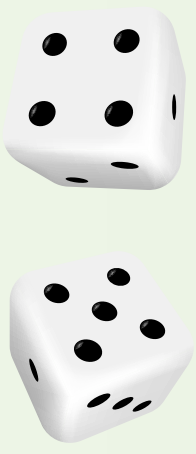
a) **3.5, but that's not going to be something you'd actually roll with a fair 6-sided dice**

b) **Just over 65% - probabilities don't just add up year-on-year, it's more complicated!**

c) **23 people - which seems a remarkably small crowd for the chance of a birthday coincidence to be greater than 50%!**

d) **253 people - for the chance to be greater than 50%, not the 183 often suggested...**

ANSWERS



References

[1] Barbara Mellers in "Rational Soothsaying", https://www.bbc.co.uk/programmes/m00132v9

[2] https://en.wikipedia.org/wiki/Brier_score

[3] How Juries are Fooled by Statistics, Peter Donnelly, TED Talk, 2007

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