# Part A. Solving a “Kind” Decision Making Problem

The following data is given:

The general chance of cat allergy is .

For people who are allergic to cats, the probability that they test positive is .

For people who are not allergic to cats, the probability that they test positive is .

1. In this scenario, a “hit” is when a student is in fact allergic to cats, while also testing positive for cat allergy. A “false alarm" is when a student is not allergic to cats, but nevertheless tests positive for cat allergy anyways.
2. If this student tests positive, the probability that they have a cat allergy can be calculated using the Bayes’ Theorem:

* The general chance of cat allergy (event A) is (“prevalence”): , so .
* If this student has a cat allergy (event A), the probability that they test positive (event B) is (“hit/true positive of the test”), .
* If this student does not have a cat allergy, the probability that they nevertheless test positive anyways is (“false alarm rate of the test”), .

Given this student has a positive test result, the probability that they actually have a cat allergy is:

Therefore, the probability that this student actually has a cat allergy is .

1. There are many factors that could contribute to overestimating or underestimating the probability that a positive test is true. Dan Airely brings up some great points from his TED Talk on decision making to help explain this [1]. He states that intuition fools people in repeatable, predictable, consistent ways, and there is almost nothing that can be done about it, aside from taking a ruler and starting to measure it. Without training in Bayes’ Theorem, there is really no other mathematical way to validate how trustworthy the test really is. In addition, some people may tend to challenge results of a test, where they are skeptical of the results until they have enough sufficient evidence for them. People may overestimate that a positive test is true if they experience severe symptoms around cats, as their personal experience backs up the result, whereas they could underestimate the test if they do not experience many symptoms, as their personal experience contrasts that of the test results.

Furthermore, points from Daniel Kahneman and Gary Klein’s paper on intuitive expertise brings in some more insight on this topic [2]. People may have heuristics, which are mental shortcuts to make decisions quickly, that could lead them to overestimating or underestimating the results. They could have a skeptical attitude toward the results and may err on the side of doubt due to inconsistencies in testing and personal experience. They may have an illusion of validity, an unjustified sense of confidence that often comes with clinical judgement, that impacts their trust in the test. Lastly, loss aversion could be at play here, where people react to incorrect testing more strongly than correct testing. The true positive probability is , whereas the false alarm probability is only , so depending on their level of confidence in the tests, their ability to gauge a true positive test will vary from person to person.

# Part B. Drafting a “Wicked” Decision Making Task

# References

|  |  |
| --- | --- |
| [1] | D. Ariely, "Are we in control of our own decisions?," TED, December 2008. [Online]. Available: https://www.ted.com/talks/dan\_ariely\_are\_we\_in\_control\_of\_our\_own\_decisions/transcript. [Accessed 14 February 2021]. |
| [2] | D. Kahneman and G. Klein, "Conditions for Intuitive Expertise," American Psychological Association, September 2009. [Online]. Available: https://learn.uwaterloo.ca/content/enforced/635025-SYDE543\_y457li\_1211/Wk4.%20Decision%20Making/Kahneman%20and%20Klein%20-%202009%20-%20Conditions%20for%20intuitive%20expertise%20A%20failure%20to%20d.pdf?\_&d2lSessionVal=aFwgU648RHnSxQVfwomGhGSei&ou=635025. [Accessed 14 February 2021]. |