

## Mathematics 1550H – Probability I: Introduction to Probability

TRENT UNIVERSITY, Summer 2020 (S62)

### Assignment e

[The make-up for Assignment #2]

### Alea iacta est!\*

Due on Monday, 13 July.

*This optional assignment, should you choose to do it and do better than you did on Assignment #2, would replace your Assignment #2 in the marking scheme.*

*Please submit your solutions using Blackboard's assignment module. If that fails, please email your solutions to the instructor (sbilaniuk@trentu.ca). Scans or photos of handwritten solutions are perfectly acceptable, so long as they are legible and in some common format. (Combined into a single pdf, for preference.)*

An unscrupulous gambler has modified a standard six-sided die so that the faces numbered 1 and 6 are each half as likely to come up as each of the other four faces when the die is rolled. Your task is to design experiments that let you use this die in place of

1. A fair coin. [1]
2. A biased coin with  $P(H) = \frac{2}{3}$  and  $P(T) = \frac{1}{3}$ . [2]
3. A fair standard die. [3]

and, finally,

4. Design an experiment to use the modified die to pick an integer  $n \geq 0$  such that the probability of choosing  $n$  is  $\frac{1}{2^{n+1}}$ . [4]

In each question, make sure to fully explain why your experiment meets the given requirements.

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\* “The die is cast.” Supposedly spoken by Gaius Julius Caesar on crossing the Rubicon river into Italy, setting off the civil wars that ended the Roman Republic and eventually led to the establishment of the Roman Empire.