The University of Melbourne–Department of Mathematics and Statistics
School Mathematics Competition, 2020
JUNIOR DIVISION

Due to the COVID-19 pandemic, the 2020 competition was cancelled. Below are a pair of practice questions.

Textbooks, electronic calculators and computers are not allowed.

1. Year of the rat. Using *both* scissors and a broom on the first day of the year of the rat is taboo, as it leads to bad luck for the entire year. Some of us must have clearly ignored this ancient wisdom, ultimately causing the cancellation of the University of Melbourne School Mathematics Competition.

On January the 25th (Chinese New Year) a group of no more than 2020 Melbourne high school students all used at least one of the two forbidden tools. If 13/20th of them used scissors and 27/77th of them used a broom, how many students are responsible for the current disaster year?

2. Vaccine. Researchers from the University of Queensland have developed a potential COVID-19 vaccine using "molecular clamp" technology, and phase 1 human trials are currently being held in Brisbane.

Three separate groups of healthy volunteers, each consisting of 50 women and 50 men are being tested. People in the first group are injected with the vaccine, people in the second group are injected with a placebo, and people in the third group do not receive an injection at all. All 300 volunteers are then exposed to the Corona virus and tested for COVID-19 two weeks later. Of the first group, 2 women and 3 men are found to be positive. Of the second group, 43 women and 48 men are found to be positive. Of the third group, 45 women and 49 men are found to be positive. If Mrs Florence Nightingale and Mr Louis Pasteur both tested positive, what is the probability they were in the same group of volunteers?