



THE UNIVERSITY OF BRITISH COLUMBIA

Mathematics  
Faculty of Science



Pacific Institute *for the*  
Mathematical Sciences

# 2021 Niven Lecture

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## Mathematics of Shuffling

June 1, 2021 | 5:00pm Pacific, Zoom

The crux of a card trick performed with a deck of cards usually depends on understanding how shuffles of the deck change the order of the cards. By understanding which permutations are possible, one knows if a given card may be brought into a certain position. The mathematics of shuffling a deck of  $2n$  cards with two “perfect shuffles” was studied thoroughly by Diaconis, Graham and Kantor in 1983. I will report on our efforts to understand a generalisation of this problem, with a so-called “many handed dealer” shuffling  $kn$  cards by cutting into  $k$  piles with  $n$  cards in each pile and using  $k!$  possible shuffles.

A conjecture of Medvedoff and Morrison suggests that all possible permutations of the deck of cards are achieved, as long as  $k$  is not 4 and  $n$  is not a power of  $k$ . We confirm this conjecture for three doubly infinite families of integers, but the conjecture remains open. We initiate a more general study of shuffle groups, which admit an arbitrary subgroup of shuffles. This is joint work with Carmen Amarra and Luke Morgan.

For more details please visit the PIMS Webpage at:

<https://www.pims.math.ca/scientific-event/210601-nlcep>

The meeting link can be found through the UBC Math Department:

<http://www.math.ubc.ca/Dept/Events/index.shtml?period=future&series=all>

### ABOUT THE NIVEN LECTURES

Ivan Niven was a famous number theorist and expositor; his textbooks won numerous awards, have been translated into many languages and are widely used to this day. Niven was born in Vancouver in 1915, earned his Bachelor's and Master's degrees at UBC in 1934 and 1936 and his Ph.D. at the University of Chicago in 1938. He was a faculty member at the University of Oregon from 1947 until his retirement in 1982. The annual Niven Lecture Series, held at UBC since 2005, is funded in part through a generous bequest from Ivan and Betty Niven to the UBC Mathematics Department.