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A version of Gale's Nim on four heaps

Two customers go to a bookstore that has four shelves for books. The bookstore remains open as long as there are at least three shelves with books on them, and closes once there are two empty shelves. The two customers take turns buying any positive number of books that they wish from one bookshelf. The winning customer is the last customer to buy books while the Bookstore is open. This is also known as the game Gale's Nim (4,2). We show that the winning strategy for this game can be expressed as a Nim-like rule using the base 4 representation of the number of books on each shelf (rather than base 2 as in Nim).

This is preliminary work, joint work with Alyson Conover.