10 Exercises on Vectors and Functions

1. Using a vector to store the month-lengths, write code to take month and day as integers and print out which day of the year it is. Assume not leap year. For example, input of 2 and 28 should produce 59 while input of 7 and 18 should print out 199.

2. Write code for a function that takes an array of the coefficients of a polynomial and returns the array of the coefficients of the derivative of that polynomial. For example, the function called with \([ 1 0 0 -3 0]\) should return \([4 0 0 -3]\).

3. Call a vector bivalued if the vector contains exactly two distinct elements. For example, \([1 3 1 3 3]\) is bivalued, but neither \([2 2 3 3 4]\) nor \([5 5 5]\) is. Write code for a function to determine whether a vector is bivalued or not.

4. Create a function interleaved that takes two equal-length strings and returns the result of interleaving them; that is, the string formed from the first char from the first string, then the first char from the second string, then the second char from the first string and so on. For example, interleaved('Tiger', 'sloth') should return Tsilgoetrh. If the two strings are not the same length, your function should return the empty string.

5. Create a function with parameter a 3 \(\times\) 3 matrix that returns whether or not the matrix is a magic square (all row and column sums equal).

6. A matrix is a 2-dimensional array of numbers. The main diagonal of a square matrix runs from NW to SE. A square matrix is said to be boring if (a) every entry on the main diagonal is the same; and (b) every other entry is zero. Create a function that is passed a square and returns whether it is boring.