

# Representation Theory In and With GAP

## *Exercises*

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# Exercise 1

Find all irreducible  $\mathbb{C}$ -characters which are induced from characters of maximal subgroups for:

- (a) The sporadic group  $M_{11}$ .
- (b) The sporadic group  $M_{12}$ .
- (c) The sporadic group  $Co_2$ .

## Exercise 2

- (a) Construct the character table of the maximal subgroup  $H := 3_+^{1+2}:2A_4$  (Atlas notation) of the symplectic group  $G := \mathrm{PSp}_4(3)$ . (Note:  $\mathrm{Sp}_4(3)$  is isomorphic to the unitary group  $U_4(2)$ .)
- (b) Find the decomposition into the irreducible constituents of the characters obtained from inducing the irreducible characters of  $H$  up to  $G$ .

# Exercise 3

Construct all irreducible representations of the symmetric group  $S_8$  over the field  $\mathbb{F}_2$  with two elements.

# Exercise 4

- (a) Convert the permutation representation of degree 552 of the sporadic group  $Co_3$  into a matrix representation over the field  $\mathbb{F}_3$ .
- (b) Find all its composition factors.
- (c) How many irreducible representations of  $Co_3$  over  $\mathbb{F}_3$  can you construct?