

## Geometric and Asymptotic Group Theory II

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<http://www.mat.univie.ac.at/~dosaj/GGTWien/Course.html>

Dienstag, 11:00–12:00, Raum D1.07 UZA 4

Blatt 5

### Applications of the Seifert-van Kampen Theorem

- (1) Using Seifert-van Kampen Theorem, show that the fundamental group of a wedge of circles is free.
- (2) Let  $\Sigma_2$  be a closed surface of genus 2. Show that

$$\pi_1(\Sigma_2) = \langle a_1, b_1, a_2, b_2 \mid [a_1, b_1][a_2, b_2] \rangle.$$

Hint: View  $\Sigma_2$  as an octagon with some identifications of edges. Take an open disc inside the octagon as one piece and an open neighbourhood of the complement as the other one, and use the Seifert-van Kampen Theorem.

- (3) Show that  $\pi_1(\Sigma_2)$  is a free product with amalgamation of two free groups.