MATH104: Topology **Fall 2023**

Homework 9

David Yang

Chapter 11 (The Seifert-van Kampen Theorem) Problems.

Section 70 (The Seifert-van Kampen Theorem), 70.2

Suppose that i_2 is surjective.

a) **Show that j_1 induces an epimorphism**

$$h\colon \pi_1(U, x_0) \to \pi_1(X, x_0),$$

where M is the least normal subgroup of $\pi_1(U, x_0)$ containing $i_1(\ker i_2)$. [*Hint:* Show j_1 is surjective.]

b) **Show that h is an isomorphism. [*Hint:* Use Theorem 70.1 to define a left inverse for h.]**

Hatcher

Let X be the union of n lines through the origin in $\mathbb{R}^3$. Compute the fundamental group of $R^3 - X$.