**Topology**

**Homework #9.** Due Wednesday, November 29, before the lecture.

1. Show that each of the following is a retract of the disk $D$:

(a) any diameter of $D$;

(b) any closed interval in $D$.

2. What is the fundamental group of each of the following spaces? (You don't have to justify your answer.)

- a point;
- an open interval;
- the annulus $\{z \in \mathbb{C} | 1 \leq |z| \leq 2\}$;
- $\{(x, y) \in \mathbb{R}^2 | -3 < x + y < 3 \text{ and } (x, y) \neq (0, 0)\}$;
- the space $\{(z_1, z_2) \in \mathbb{C}^2 | z_1 z_2 \neq 0\}$;
- an open disk.

3. Show that if $A \subset X$ is a retract of $X$ and $B \subset A$ a retract of $A$, then $B \subset X$ is a retract of $X$. Give an example of such chain of retracts $B \subset A \subset X$ (try to find an interesting example).

Exercises 3, 5, 6 on pages 347-348.

Exercise 1 on page 353.