## MATH 203: Homework 3

Due Wednesday Oct 26

Problems are from Rudin 3rd edition.

Problem 1. Chapter 2 (p. 43): 12, 14, 22, 23, 24, 25

**Problem 2.** For a subset E of a metric space (X, d) we define the *boundary of* E called  $\partial E := \overline{E} \cap \overline{E^C}$ . Prove the following

- (i)  $\partial E$  is a closed set.
- (ii)  $x \in \partial E$  if and only if for every r > 0,  $B(x,r) \cap E \neq \emptyset$  and  $B(x,r) \cap E^C \neq \emptyset$ .
- (*iii*) By an example show that  $\partial E$  is not necessarily equal to  $\partial \overline{E}$ .

**Problem 3.** By an example show that if  $E_n$  is a nested sequence of closed sets which are non-empty the intersection  $\bigcap_{n=1}^{\infty} E_n$  may be empty.

**Problem 4.** Chapter 2 (p. 43): 19, 20, 28, 29.