

### Math 3310. Spring 2015. Information about the second midterm.

The second midterm will be given on Thursday, April 2nd, in class (2-3:20pm). It will cover material from Lectures 10-16, which correspond to sections 2.4, 1.6 and 3.1-3.4 of the book (in this order). As the first midterm, the second midterm will contain 5 problems. One of the problems will ask for some part (probably about half) of the proof of one of the following theorems:

- (i) Extreme Value Theorem (EVT)
- (ii) Intermediate Value Theorem (IVT)
- (iii) Main Uniform Continuity Theorem (UCT) – continuity on closed bounded intervals implies uniform continuity

**Note:** The proofs of IVT and UCT given in the book are not identical to the proofs given in class, but follow the same general approach – you can present either version of the proof on the exam. I may ask you to emphasize in the proof why certain hypothesis in the statement of the theorem is needed (e.g. why the interval is closed and bounded).

There will definitely be a problem asking to prove either continuity or uniform continuity of some function directly using  $\varepsilon$ - $\delta$  definition. There will also likely be a problem on countable/uncountable sets. One of the problems (or at least part of it) will be very similar to a homework problem. In addition, I may ask you to formulate any of the key definitions or theorems from Lectures 10-16 (e.g. definition of a Cauchy sequence or sequential characterization of continuity).

#### Additional practice problems on countable sets:

1. Let  $A$  be the set of all finite sequences of 0's and 1's (that is, sequences  $a_1, a_2, \dots, a_n$  where  $n \in \mathbb{N}$  and each  $a_i = 0$  or  $1$ ). Prove that  $A$  is countable.
2. Let  $A$  be a countable set. Prove that  $A$  can be written as a union  $A = A_1 \cup A_2$  where both  $A_1$  and  $A_2$  are countable and  $A_1 \cap A_2 = \emptyset$ .