Math 347: Presentation 2

October 3, 2018

Description: Studying mathematics is a collaborative process and writing proofs should be as well. In math classes after this, you will be expected to explain your solutions to your peers, or present your argument. While that can be done in a formal written proof, as in the homework, it is also important to learn to do this on the board and to be able to talk someone through your ideas to solve a particular problem. The purpose of this assignment is to work on that.

Instructions: Each problem is going to have two groups assigned to them. Wednesday (10/3) in class, we will pick one of the groups to present the problem on the board. The main point is to have a discussion with the class and understand how the presenting group tried to solve the problem, even if they still don't have a complete solution, we want to understand what they tried and how far they got into solving the problem. The second group that also thought about this problem can help the class to start the conversation, asking pertinent questions.

Groups:

Group 1: Aman Gulrajani, Andreas Ruiz-Gehrt, Bangzheng Li,Daniel Coonley, and Nishant Dalmia.

Group 2: Dongfan Li, Ismail Dayan, Jacob Elling, Ruisong Li, and Tianshu Qu.

Group 3: Adi Budithi, Bryan Ulziisaikhan, Bug Lee, Jingquan Fu, and Zhe Song.

Group 4: David Deng, Houyi Du, Jinjie Wang, Kaiwen Hu, and Vetrie Senthilkumar.

Group 5: Amr Elayyan, Danyu Sun, Jinsoo Oh, Samantha Barrera, and Thomas Varghese.

Group 6: Albert Cao, David Deng, Zhenghong Huang, Zihe Wu and Zhengsan Chang.

Problem division: Groups 1 and 2 should do problem 1), Groups 3 and 4 should do problem 2) and Groups 5 and 6 should do problem 3). While each group will only be asked to present the problem they were assigned, I encourage everyone to read all the problems and give a thought to them, so they are in better position to participate in the discussion.

Problems

1) Suppose that $f(x) = \sum_{i=0}^{n} c_i x^i$ and has zeros $\alpha_1, \ldots, \alpha_n$, such that $\alpha_i \neq 0$ for all i. Find a formula for $\sum_{i=1}^{n} \frac{1}{\alpha_i}$ in terms of $c_0, \ldots, c_n$.

2) Given finite sets A and B consider a function $f : A \to B$.

   (i) When f is injective, what is implied about the sizes of A and B?

   (ii) When f is surjective, what is implied about the sizes of A and B?

   (iii) Prove that if A and B are finite and $f : A \to B$ and $g : A \to B$ are injections, then $|A| = |B|$ and f and g are bijections.

3) Of the following sets which have the same cardinality? State and prove your result.

   (i) $\mathbb{N}$;

   (ii) $\mathbb{Q}$;

   (iii) $\bigcup_{n \geq 0} A_n$, where each A_n is countable;

   (iv) $(0, 1)$.