Syllabus
Three Topics in Applied Algebra
Fall 17

(A) Instructor: Dr. Shamgar Gurevich.

    Office: VV317.

    Time and Location:

- MW 11-11:50am, Room VV901 - lectures.

- F 11-11:50, at 901 - working in teams.

- W 5-6pm, at 901, every two weeks (starting on Sep. 20) - presentations.

    Office Hours: MF 1-2pm.

(B) TAs: Ms. Alisha Zachariah and Mr. Lorenzo Najt.

(D) Content: We will have three mini-courses on:

1. **Channel Estimation Algorithms** (lecturer - A. Zachariah)**:**

    (a) Motivation.
    (b) Physical model.
    (c) Math model.
    (d) Digital model.
    (e) FFT the $N^2 \log(N)$ algorithm.
    (f) Heisenberg Group, representations, and chirps.
    (g) The $N \log(N)$ algorithm.
    (h) Sparse FFT and the sub-linear algorithm (if time permits).
    (i) Programming of algorithms.

2. **Wireless Communication and Shannon's Theorem** (lecturer - L. Najt)**:**

    (a) Motivation.
    (b) Physical model.
    (c) Entropy, capacity, and Shannon $C = W \log_2(1 + \frac{P}{N})$.
    (d) OFDM modulation.
    (e) Codes and capacity achieving algorithms.
    (f) Programming of algorithms.

3. **FFT and the Heisenberg group** (lecturer - S. Gurevich)**:**

    (a) Motivation.
    (b) DFT.
    (c) Classical FFT algorithm.
    (d) Heisenberg group and representation.
    (e) The Auslander–Tolimieri FFT algorithm.
    (f) Programing of the A–T algorithm.

(E) Grading: There will be three teams according to the three topics above. You will work with your team and get for this up to 50% on participation (the team leader will decide). You will do two presentations during the semester and get for this up to 50%.

(F) Prerequisite: Linear Algebra on the level of Math 340 or 341. You don't need to known any programming language.

Good Luck!