

# CS 560: Homework 4: FME

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The goal of this assignment is to develop the skill for “compiling” equations to programs. In particular, we want you to practice and understand the Fourier-Motzkin elimination (FME) algorithm to produce a set of loops that visit the points in a polyhedron. We also want you to start playing with AlphaZ on your own.

## **Problem I: Fourier-Motzkin Elimination** **[70 pts]**

Systematically derive nested loop programs to visit the points in each of the following polyhedra ( $N$  is a parameter, assume that it's non-negative). Show your work in order to receive partial credit.

1.  $\{i, j \mid 0 \leq i \leq j \wedge i + j \leq 2N\}$ . [20 pts]
2.  $\{t, i, j \mid 0 \leq t \leq (i, j) < N\}$ . [25 pts]
3. The same as (2) above, but now the loop order is permuted:  $t$  is the innermost loop and  $j$  is the outermost,  $i$  remains the middle loop [25 pts]

## **Problem II: (Exploring AlphaZ)** **30 pts]**

This is an open ended question. We would like you to explore AlphaZ and report back (two short paragraphs) on what you learnt. There is a large number of topics and paths through the system, so there is no “single correct expected answer.” Some suggestions: (i) in Alphabets package are some tutorials and examples of command scripts; the wiki page points to the AlphaZ manual, and also has links to individual tutorials. We are especially interested if you find that something is broken and/or not working as you expect, or is poorly documented.

## **Extra Credit** **due Saturday, Oct 3 @ noon]**

Provide sample problems, similar to those you have seen in the HW exercises so far, that we can include in the midterm. You must submit a problem statement, like those in the HWs, and a neat, worked out solution. If there is any special feature of your problem, please let us know. The extra credit for you is two-fold. First, it helps you prepare for the midterm. The second huge credit it provides is that if you see your problem on the midterm, then all you have to do is to say that you were the one who submitted it, and you will receive full credit on the midterm.