

## CS 6241 : Project Phase II

Total points : 100

Due : Friday, April 24th , 11:59 pm 2009

### Important Policies:

1. Work in teams, please direct questions regarding clarifications to the TA
2. Although some project problems may have solutions available in books, internet sources etc. you are supposed to solve them on your own without looking up such solutions. This rule will be STRICTLY enforced and any act of such lookup will be considered an act of plagiarism and will result in the strict penalty as per Georgia Tech honor code.
3. Document your solution making suitable reasonable assumptions and clearly stating them..

**Problem :** Our goal in this phase is to build array subscript based data dependence analysis in LLVM to detect parallelism in loops. In particular, our goal will be to build array data dependence analysis in LLVM using two data dependence tests : GCD Test and Banerjee Test. First you will set up the dependence system using the LLVM IR (you can tap into LLVM IR at a suitable level – even high level IR is fine). Try to leverage interprocedural constant propagation and induction variable analysis built into LLVM. The more you leverage such an analysis the more accurate the analysis will be; for example, unknown loop bounds can be problematic but constant propagation helps. Then you will build the dependence solver based on the GCD and Banerjee test and determine if the loop is parallel or not. Using OpenMP pragmas you will prototype some loops found to be parallel and show the speed-up on a dual core platform.

**Hint and assumptions :** The GCD and Banerjee test are well described in Allen and Kennedy's book. We will be dealing with rectangular loops only in this project – the loop bounds can be unknown and array subscripts are linear with compile time constant coefficients. The OpenMP details can be found at : <http://www.openmp.org/mp-documents/spec30.pdf>