LSU EE 4720 **Homework 3** **Due: 25 April 2005**

Problem 1: Do Problem 1 in the Spring 2004 EE 4720 final exam. Grade yourself using the solution, the grade should be out of five points. When grading yourself please explain what the mistakes were and what the correct answer should be, as a helpful grader would. Be polite in your explanations unless there was no serious attempt to solve the problem. In that case point out how final exam study time is being undermined by the need to catch up.

Problem 2: In Method 3 the commit register map is used to recover the state the ID register map was in just after the most recently committed instruction was decoded. In a system in which the ID register map is checkpointed for predicted CTIs, the commit register map won't be used very often.

(*a*) Describe how a system using Method 3 but without the commit register map could recover the ID map state before a faulting instruction. The ID map would be recovered using information in the ROB at and after the faulting instruction.

- Explain, with an example, what steps the processor takes to recover the information.

(*b*) Show new connections to the ID register map to implement this. Try to do it without adding new read and write ports (that is, use existing ports).

(*c*) Describe the impact on performance when the technique is used for exceptions.

(*d*) Describe the impact on performance when the technique is used for mispredicted branches.

Problem 3: Consider the commit mapless system from the previous problem. Suppose it were possible to sequentially read the ROB from two locations, the head (as is currently done for committing instructions) and some other place, say at a mispredicted branch.

(*a*) How might this be used to recover the ID map faster than was done in the previous problem.

(*b*) If this can be made to work for branches then there would be no need for checkpointing the register map. The impact on performance when using the mechanism for mispredicted branches depends on the following factors: how fast instructions are fetched, how many cycles it takes to resolve a branch (determine if the prediction was correct), how long it takes the fetch mechanism to bring correct-path instruction to ID, and how fast recovery can be done. Show a formula that will give the number of extra cycles needed to recover from a branch misprediction using this scheme (compared to checkpointing). For the formula, use the factors listed above and any other that is relevant.

Note that the amount of time to fetch the first correct-path instruction is a variable, it can be more than the one cycle shown in most other problems.