Name ______________________

EE 7700-1

Take-Home Pre-Final Examination

Friday, 27 April 2007 to Friday 4 May 2007

Problem 1	________	(50 pts)
Problem 2	________	(50 pts)
Exam Total	________	(100 pts)

Alias ______________________

Good Luck!

Problem 1: Consider the critical path definitions and predictor described by Fields, *et al.* (See `http://www.ece.lsu.edu/tca/papers/fields01focusing.pdf`.) [50 pts]

(*a*) In the graph model used to determine critical paths there is an edge between the execute vertex of a mispredicted branch and the decode vertex of the first correct-path instruction. Why aren't such edges included for correctly predicted branches?

(*b*) The critical path predictor predicts whether an instruction is critical based only on its PC (instruction address), whereas most branch predictors, such as gshare, use additional information such as global branch outcome history.

The instructions in the backward slice of many loads are execute critical if the load misses but are not execute critical if the load hits. If such a load has a high enough hit ratio then instructions in its backward slice will be predicted non-critical by Fields' predictor even when it misses. Given the parameters used by Fields *et al* for their predictor in the reference, above what hit ratio would predictions change from critical to non-critical? Assume that the token propagation scheme always correctly classifies an instruction (after the fact) and so the predictor is correctly trained. The solution to this problem is in the hysteresis scheme used for prediction, there is no need to understand details of the token-propagation mechanism itself.

(*c*) Fields *et al* chose value prediction to demonstrate the applicability of their critical path predictor. The value predictor chosen uses a very large table. With a smaller table predictable instructions would over-write each other's entries, reducing prediction accuracy. As noted in the paper the critical path predictor could help in this situation by only predicting critical instructions. If one were going to use critical path prediction to limit value predictions because of small table size, how should the critical path predictor be modified? *Hint: See Figure 7(a).* Explain.

Problem 2: In the Roth *et al* study of p-thread selection p-threads were chosen based on data from a profile run. Collins *et al*, describe a pre-execution scheme in which p-threads are constructed by hardware. (See `http://www.ece.lsu.edu/tca/papers/roth02quantitative.pdf` and `http://www.ece.lsu.edu/tca/papers/collins-01.pdf`.)[50 pts]

(*a*) Roth uses a cost/benefit model to find trigger instructions. How are trigger instructions found in Collins' baseline scheme?

(*b*) When the targeted (troublesome, delinquent) load is in a small loop (one in which iterations occur quickly) the p-thread's load must execute more than one iteration earlier than the targeted load in order to be effective. Roth handles this one way but Collins takes two approaches, one similar to Roth's. How does Roth handle these loads? Collins uses two techniques (called optimizations in the paper) for these loads; name them and briefly describe them.

(*c*) It only makes sense to construct p-threads that target a load on the critical path.

How does each paper determine if a load miss is on the critical path?

One paper uses a more elaborate scheme to determine if a load is critical. The other paper uses a simpler scheme which is appropriate for that paper but would not apply to the other paper. If the simpler scheme were used in the other paper then many non-critical loads would be selected. Explain why.