

## 2015/Spring Computer Architecture PhD Qualifying Exam

Student ID \_\_\_\_\_ Name \_\_\_\_\_

\* Answer each question in 10 lines or you will be given penalty points.

**1. Explain a (3,2) two-level predictor using a figure. How can correlations between branch instructions be captured in the predictor? (25 points)**

**2. Explain the roles of the reorder buffer and reservation stations in the speculative Tomasulo algorithm (25 points).**

**3. Memory hierarchy (25 points).**

**(a) What is no write allocate policy? (8 points)**

**(b) Miss penalties of replacing all cache lines in write back caches are the same (true or false) and why? Assume no write buffer is employed (8 points).**

**(c) What is a write buffer? (9 points)**

**4. Multiprocessors**

**(a) What are vector lanes in vector processors? (12 points)**

**(b) What is the E state in MESI protocol? (13 points)**