PhD Qualifying Examination: **Human-Computer Interaction**

University of Wisconsin–Madison, Department of Computer Sciences

Spring 2013 — Monday, February 4, 2013

General Instructions

- This exam has **7** numbered pages including this page.
- Answer each question in a separate book.
- Indicate on the cover of each book **the area** (HCI) of the exam, your **code number**, and the **question number** answered in that book. On one of your books, list the numbers of all the questions answered. Do not write your name on any answer book.
- Return all answer books in the folder provided. Additional answer books are available if needed.

Specific Instructions

- Answer all **6** questions.

Policy on Misprints and Ambiguities

The Exam Committee tries to proofread the exam as carefully as possible. Nevertheless, the exam sometimes contains misprints and ambiguities. If you are convinced that a problem has been stated incorrectly, mention this to the proctor. If necessary, the proctor can contact a representative of the area to resolve problems during the *first hour* of the exam. In any case, you should indicate your interpretation of the problem in your written answer. Your interpretation should be such that the problem is nontrivial.

Question 1. *Design Ethnography*

You work for the user research division of a large software company with a long history of using conventional methods for user research. Your manager, who is interested in introducing *design ethnography* [1] into the division's repertoire of methods, asks you to make a presentation to other user research specialists about design ethnography, focusing on the questions below.

(a) Describe the *guiding principles* of ethnography, providing examples of how each might apply to user research for software design.

(b) List three *field methods* user researchers might employ in ethnography, discussing their specific strengths and uses in user research.

(c) Describe six ways in which ethnography informs software design and development in order to motivate the user researchers in your division to adopt design ethnography.

(d) Contrast ethnography to three alternative methods, discussing its advantages over these methods in the context of your work.

[1] Blomberg, J., Giacomi, J., Mosher, A., & Swenton-Wall, P. (1993) Ethnographic field methods and their relation to design. In D. Schuler and A. Namioka (eds.), *Participatory Design: Principles and Practices*. Hillsdale, NJ: Lawrence Erlbaum, pp. 123-155.

Question 2. *Diary Studies*

The mobile app development company you work for is interested in designing a tablet computer app for cab drivers that will replace the taximeter, radio comm, point of service (POS) machine, and paper receipts in one interface. Your team leader would like your opinion on whether a diary study might be an appropriate way of studying the target user population to inform design.

(a) Describe the three common types of diaries, including examples uses, and provide your team leader with a recommendation on which type of diary might best fit along with a justification.

(b) Make recommendations to your team leader on how many users you will need to recruit and the appropriate time period for data collection, providing justifications.

(c) List three *strengths* and three *weaknesses* of using diaries over alternative data collection methods, providing your team leader with a final recommendation on whether or not to use dairies for the project.

Question 3. *Research Design*

Empirical research across many fields and disciplines—including HCI—follows common features and methods. In a short chapter in the book *Readings in Human-Computer Interaction*, McGrath[2] outlines these shared techniques and strategies for "doing" HCI research. Based on this chapter:

(a) Describe the concept of *modes of treatment* and the four methods involved.

(b) Explain three techniques for *manipulating* variables, providing example study designs for each technique.

(c) Define the three types of *validity* discussed and provide examples of violations of each type.

[2] McGrath, J. E. (1995). Methodology Matters: Doing Research in the behavioral and social sciences. In R. M. Baecker, J. Grudin, W. A. S. Buxton, S. Greenberg, (eds.), *Readings in Human-Computer Interaction: Toward the Year 2000*, pp. 152–169.

Question 4. *Quantitative Data Analysis*

You and your collaborators are writing a research proposal with detailed descriptions of the system that you will develop as well as the method for evaluating your system. Your collaborators have asked you to draft the "Measurement & Analysis" Section for the part on system evaluation. You would like to make sure that you propose appropriate methods for analyzing data from the measurements you plan to make and consider how you might control or account for different types of errors in your analysis.

(a) Briefly explain *parametric* and *nonparametric* statistical tests. List three *assumptions* in the use of parametric statistical tests. Suggest nonparametric alternatives to (1) unpaired t-test, (2) paired t-test, (3) one-factor analysis of variance, and (4) repeated-measures one-factor analysis of variance to be included in your proposal.

(b) Describe *post-hoc* and *a priori* tests, discussing their differences. Provide two common methods used for these tests and compare their uses in statistical analysis.

(c) Define the terms *systematic error*, *random error*, and *Type I, Type II, and Type III errors* and describe sources for these errors. In your proposal, recommend methods for reducing or accounting for these errors.

Question 5. *Qualitative Data Analysis*

You were asked to serve in a PhD Dissertation Committee for a student who is planning to study the practices of home healthcare specialists to inform the design of mobile computing solutions for tasks such as communication, asset tracking and ordering, and logging health data. The student has completed data collection, which involved observations of and interviews with several home healthcare specialists and their clients, and has asked you for input into her plans for data analysis.

(a) Describe *Grounded Theory* and *content analysis* approaches and the differences between the two approaches. Provide the student with a recommendation for which method she should use along with the justification for your recommendation.

(b) List five of the common types of key phenomena considered in data coding, providing examples. Define *in-vivo code* and provide an example.

(c) Define two dimensions of *reliability* in coding qualitative data. Describe two *reliability measures*, discussing their differences and how these measures might be interpreted. Provide the student with a recommendation on which measure to use and the justification for your recommendation.

Question 6. *Survey/Questionnaire Design*

You work for a company that provides a web- and smartphone-based social networking service to a large user base. Your manager has asked you to design a survey to measure users' perceptions of some of the newly redesigned features on sharing and privacy controls, measuring particularly aspects of user frustration, trust, and satisfaction with the new features. Your task is to design a set of questions, determine whom should be surveyed among the user base, and plan a procedure for ensuring validity and reliability of your survey.

(a) Describe three common problems with survey questions and how they might be avoided in question design, providing examples for each. Explain *ordered* and *unordered* responses and provide example survey questions to illustrate them.

(b) Briefly define *probability sampling*, *sample stratification*, and *non-probabilistic sampling* and discuss which one of these sampling methods might be appropriate for your task.

(c) Explain the differences between *exploratory factor analysis* and *confirmatory factor analysis,* outlining their goals and procedures. Describe three key methods used in exploratory factor analysis and what is achieved with each method.