Section A: HCI Process and Theory – answer any TWO of questions 1 through 4.

1. With over 1 trillion SMS messages sent per year, many different mobile text entry methods have been proposed to increase mobile typing speeds, and text entry has been re-invigorated as a subject of research. Experimental techniques have evolved significantly from those of desktop studies several decades ago.

One area of interest is the prompts used for typing studies. MacKenzie has proposed a standard phrase set in order to allow comparisons between text entry experiments. His two-page paper on the subject can be found at http://www.cc.gatech.edu/~thad/mackenzie-phrase-sets.pdf

In this paper, MacKenzie gives some arguments as to why his phrase set is appropriate. [One additional argument, alluded to here but made elsewhere, is that having a short phrase allows the subject to memorize the phrase before beginning to type. In this manner, MacKenzie argues, the subject can type at speeds approaching that as if he were typing without a prompt (i.e. composing the phrase in his head before typing).]
a) Argue why MacKenzie's phrase set is, or is not, appropriate for testing mobile typing speeds for the following purposes:
i) writing formal papers
ii) instant messaging (SMS)
iii) e-mail
iv) taking classroom notes

Assume that the phrase set will be used for a longitudinal study, where novices are trained to "expert" levels on several different devices over a period of 20-60 hours of training. The key result will be their learning curves, maximum typing rates, and error rates.

b) For each of these four applications, describe how you would modify the phrase set to better approximate the domain.

c) Which domain would, using your modified phrase set, lead to the largest difference in the results? How important do you think it is to use your modified phrase set over MacKenzie's for this domain? How would you convince others that your phrase set is a better predictor of performance than MacKenzie?

2. You've been hired by a company that develops networking products (such as wireless access points, routers, and so forth) for the burgeoning home user market. This company realizes that the technical complexity of their products presents a high barrier for home users, who neither know how to manage and install networks, nor want to learn.

Being a good HCI person, you come equipped with all sorts of tools for both designing and evaluating traditional desktop GUI applications, such as MS Word (ethnography, usability studies, participatory design, and so forth). The problem with this new assignment, however, is that there isn't any specific, traditional application to be designed or evaluated. Instead, you need to create the user experience for a suite of products that have limited UI capabilities themselves (most access points don't have displays, for example), must work together to provide the desired functionality (a smoothly-running home network), and yet which currently expose users "directly" to underlying concepts (IP addresses, netmasks, DNS servers) that may be more appropriate for technically sophisticated users.

a. Discuss how you might address this new assignment. Note that we’re looking for a discussion of the *process* and *methods* -- you don't have to design a new user experience for networking.

b. Discuss how you might apply traditional HCI techniques to this untraditional domain. What can you carry over from these traditional techniques, and why? What does *not* work, and why?

c. Discuss what new approaches might be useful, for both design AND evaluation of a setting such as this.
3. User-centered system design is about focusing on the needs of the user as a way to inform design. It's a broad goal about supporting the entire range of computer users. GOMS as an analysis technique helps us in evaluating a design with respect to a user. However, GOMS is not as broad as user-centered system design.

(a) Describe where GOMS is appropriate in a user-centered design process, and where it isn't appropriate.

(b) Pick another analysis method that can be used where GOMS could in a design process and which covers at least some of the situations where GOMS is inappropriate. Describe why your chosen method covers non-GOMS situations.

(c) Does your method overlap with GOMS -- can they both be used for some design situations? Does GOMS and your chosen method cover the entire space of designs which you might want to analyze in a user-centered process?

4. HCI has a long tradition of incorporating methods and techniques from other disciplines to solve problems of human computer interaction. Most recently, empirical techniques from anthropology and sociology have been adopted to elicit qualitative data about humans’ actions and interactions with technology. However, the application of these sociological and anthropological methods to problems of technology design and evaluation is not without its challenges.

What are those challenges and why do they exist? In your answer you should contrast the differences between the operationalisation of qualitative methods for sociological and anthropological outcomes with the same operationalisation of qualitative methods for HCI. You should consider study design as well as study deployment.

**Section B: Special Topics in HCI**

**User Interface Software** – answer ONE of questions 5 and 6.

5. Moore's Law impacts almost all aspects of computing, and user interfaces are no exception. For a long time the increase in computational power described by Moore's Law primarily allowed us to bring our vision of a responsive interactive system to life. However, we're reaching the point where a 4 GHz processor is more than fast enough to render our interface visions, and we are faced with the task of determining how to effectively leverage the 256 GHz processors that will arrive within the next 10 years. Possible uses of that processing power include:

- speculatively executing possible actions or chains of actions that the user might take
- shifting to interfaces that rely more on recognition of likely actions rather than certain actions
- modeling the user's behavior and allowing the system to proactively assist the user, for example by modifying the user interface to increase efficiency or by taking actions on the user's behalf

a) Choose one of these uses and present an argument for how the architecture of our user interface software will have to evolve to support it.

b) Developing user interface tools to support creating interfaces for that user will require the ability to Wizard of Oz representative applications. Present an argument for an approach we could take to simulate those applications before actually running them is computationally feasible.
6. Constraint systems have long been a staple for layout in GUI toolkits from the research community.

a) Compare and contrast the use of constraint-based systems for layout with more traditional (and commercially accepted) approaches, such as Swing's LayoutManagers. What are constraint systems better at? What are traditional systems better at? Why?

b) There are a number of broad dimensions along which constraint algorithms can be classified. These include one-way versus multi-way, incremental versus non-incremental, and cyclic versus acyclic. For these dimensions, what aspects of them make them more useful (or less useful) for layout in GUI toolkits.

c) Despite their long history in the research community, constraint-based systems have not been widely adopted. Explore two reasons why constraints have not caught on outside the research community.

d) Given the reasons you outlined in (c) above, suggest algorithms, tools, or approaches that might address these reasons, and widen the adoption of constraint-based techniques.

**Information Visualization** – answer ONE of questions 7 and 8.

7. Why were new variations of the treemap algorithm created after the original Johnson and Shneiderman '91 version? Describe the different variations of the algorithm, the problem each was addressing, and how it attempted to overcome those problems.

What other space-filling visualizations have been developed, ones that do not follow the strict rectangular containment methodology of the treemap? What were the limitations these systems addressed and how did they attempt to overcome those limitations?

8. Why is evaluation of information visualization systems so difficult?

Select two evaluation studies from the field (not your own work). In one, you should identify a major shortcoming or limitation of the study. In the other, identify some reason why it is characteristic of being a "better" study.

Provide a brief commentary on how you think evaluation research should evolve in this area. What should evaluations of systems/techniques stress? Consider the spectrum of systems in the field, those ranging from pseudo-scientific visualizations to more ambient/peripheral style displays.

**CSCW** – answer ONE of questions 9 and 10.

9. Do categories have politics? This is a question that has long been debated within the CSCW community. For example, when Winograd proposed a workflow system called the Coordinator that categorised interactions between people using speech act theory, Suchman responded that this system would be unsuccessful because it was attempting to categorise human action in ways that
did not capture the details of everyday interactions. It's also come up in other settings, such as the work of disease classification as studied by Star and Bowker.

What does it mean for categories to have politics? In your answer you should begin by explaining what these authors mean by categorisation (or classification). Next, you should, drawing on examples from CSCW research, as well as other examples that you are personally familiar with, explain why categories might contain politics. Be careful, politics in this case does not just mean "Political affiliation in the voting sense, but is much broader to include organisational politics. Finally, you should weigh the disadvantages of potentially political categories with the utility of workflow systems. Again, draw on examples from the CSCW literature and your own experiences to explain why there might be occasions when the advantages of workflow systems outweigh potential political problems.

10. One of your friends is a TA who decides to build a chat system for the class he's teaching. "It's really easy! I have this Web page that automatically reloads itself every three minutes. When you post something to the chat, your posting goes at the end of the Web page. Your page will get reloaded automatically, and everyone else will see your posting when their page refreshes. It's a cakewalk!" Knowing what you know about how Instant Messaging systems work and about how HTTP works, critique this system. What might go wrong? What do you predict will go wrong?

**Ubiquitous Computing** – answer ONE of questions 11 and 12.

11. Mobile phones increasingly are becoming the preferred platform for exploring the ubiquitous computing experience.

a) In what ways can the mobile phone be treated as a proxy for an individual? Specifically, how can the mobile phone be used as a sensor that reflects properties of its owner?

b) What risks are exposed in this "phone as individual proxy" approach? Provide specific examples of these risks, as well as potential solutions.

Do not talk exclusively about location in your answer.

12. Many of the visions of ubiquitous computing rely on context aware systems that can sense and model the states of their users, and proactively take action to relieve their users of the burden of explicit action.

a) Describe under what circumstances it might be appropriate for a system to take action autonomously. Are there situations in which taking action might not be appropriate? What guidelines would you provide to interaction designers of ubicomp applications on how to approach this problem?

b) Simply taking or not taking action represents two extreme endpoints in the design space. Are there other options available? When might these be appropriate?
c) What are the implications of the design guidelines you created above for the design of sensors to be used in ubicomp applications? How should your guidelines influence the creation of sensor technology?