Exam Instructions (read carefully):

1. Sign this page of the exam with your signature in the space provided on the upper left immediately.
2. Continue reading the instructions, but do not open the exam booklet until you are told to do so by a proctor.
3. Cheating is an academic offense. Your signature on the exam indicates that you understand and agree to the University’s policies regarding cheating on exams.
4. The exam is closed book. No aids are permitted, except for a simple non-programmable calculator.
5. There are 9 questions on this exam, each worth the indicated number of points. Answer as many questions as you can.
6. Keep your answers short and to the point (i.e., avoid any unnecessary details).
7. Write all of your answers on these pages. If you need more space, there is blank space at the end of the exam. Be sure to indicate when a question is continued, both on the page for that question and on the continuation page. Do not write on the back of any page.
8. Interpret the exam questions as written. No questions will be answered by the proctor(s) during the exam period. State your assumptions if you are unsure about a question.
9. You have 2.5 hours in which to work. Budget your time wisely.
10. No one will be permitted to enter the exam room after one half-hour from the start time, or to leave during the first half-hour of the exam. In addition, no one can leave the exam room during the last ten minutes of the exam.

<table>
<thead>
<tr>
<th>Question</th>
<th>Points Possible</th>
<th>Mark</th>
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Question #1 [8 points total]: Multiple Choice + Explain

For each question, circle one of the possible answers. [1 pts each]

1. With respect to ethnographic studies done in HCI, which of the following statements are true?
   (1) they are most often used early in the design process;
   (2) the ethnographer/researcher should proceed without any preconceived notions or scope;
   (3) the ethnographer/researcher can continually generate design ideas while conducting a study.
   A. (1) only
   B. (1) and (2)
   C. (1) and (3)
   D. (1), (2), and (3)

   C

2. According to the Jordan and Henderson reading, video analysis is better than other methods for collecting data (such as interviews and in-person field observations) for all but one of the following reasons. Which is the exception?
   A. video recordings capture behavioural details that are difficult to describe in words
   B. video analysis does not involve the researcher “reconstructing” past events from their notes
   C. video records allow researchers to analyze activities of several people performed at the same time
   D. video recordings have no biases in what is recorded

   D

3. Fitts’ Law:
   A. uses information theory to predict GUI response time.
   B. uses information theory to predict human movement time.
   C. uses cognitive modeling to predict GUI response time.
   D. uses cognitive modeling to predict human movement time.

   B

4. Which of the following affects the likelihood of achieving statistical significance in a t-test?
   1) The number of data points in the two samples
   2) The degrees of freedom
   3) The size of the population(s)
   4) The difference between the two sample means
   A. 1) and 4)
   B. 2) and 3)
   C. 1), 3) and 4)
   D. 1), 2) and 4)

   D
5. In a one-way ANOVA, the greater the value of the F ratio,  
   A. The less the sample distributions overlap  
   B. The more the sample distributions overlap  
   C. The larger the total variance  
   D. The smaller the total variance  
   A

6. When capturing video data during an experiment one subject reveals a particularly important but obscure problem with your system, a problem that you suspected but have not been able to document. Despite having consented to being videotaped, the subject asks that you not use the video because he feels he looks stupid.  
   Your best course of action is to:  
   A. Explain to him the importance of the video footage and hope he understands. You are covered to use the video clip because he did consent initially.  
   B. Accept his wishes and reluctantly discard the video.  
   C. Use video editing techniques to disguise the user so that he is not recognizable and continue with your plans to use the video with a small group of your fellow researchers.  
   D. All of the above are reasonable courses of action.  
   B

7. When choosing lighting sources, you should:  
   A. Try to use a mix of different lighting sources including both natural and artificial lighting, to ensure a full spectrum of light  
   B. Try to avoid using different sources, as it will make similar colours in your shot look inconsistent  
   C. Avoid having a lot of black in the scene  
   D. Both B and C  
   B

8. The Opponent Process Theory…  
   1) Is inconsistent with Trichromacy Theory.  
   2) Describes two opponent chromatic channels, and one achromatic channel.  
   3) Can explain why there is no such thing as a greeny-yellow colour.  
   4) Can explain why having a large luminance contrast between text and background makes it easier to read the text.  
   A. 1), 2) and 3)  
   B. 1) and 4)  
   C. 2), 3), and 4)  
   D. 2) and 4)  
   D
Question #2 [8 points total]: User Abilities – Memory + Visual Processing

(a) What is the Model Human Processor? And how is it relevant to Human-Computer Interaction? [2 pts]

*It is a model of the human perceptual, memory and cognitive system.* [1]

*It was generated by HCI researchers as a model to help guide design such that design will be done in accordance with human abilities.* [1]

(b) What is retrospective memory? And how does it relate to finding and reminding? [2 pts]

*It is memory for people, words, and events encountered or experienced in the past.* [1]

*It relates to finding, in that we rely on our retrospective memory to find things such as documents that we have written.* [1]

*Deduct points if also say that it is related to reminding [-1]*

(c) We discussed the TimeStore email interface in class. How was it designed to take advantage of retrospective memory? [2 pts]

*Timestore provides a grid-like layout to email (sender on y-axis, date on x-axis).* [1]

*Our retrospective memory for recent events such as email is very strong, thus we are often able to quickly find an email by remembering the sender and the approximate date is good.* [1] [Alternately, it highlights the weekends and so it is easy to tell which day of the week an email was received and our memory for the day of the week an event occurred is very strong.]

(d) Your professor noted in class that when PowerPoint was first released by Microsoft, most presentations she saw had yellow text on a blue background. Was that a good choice? Justify your answer. [2 pts]

*Good [1] b/c it has a luminance contrast and yellow and blue are opponent colours based on Opponent Process Theory.* [1]
Question #3 [5 points total]: User Abilities – Motor Processing + Empirical Laws

(a) How is Accot’s Steering Law related to Fitts’s Law, if at all? And why is Accot’s Steering Law useful for interface design? [3 pts]

| It is an empirically and mathematically derived version of Fitts’s Law [1 pt] that extends target selection to tunneling. [1 pt] |
| You can estimate the time it will take to do trajectory tasks like selecting from a menu where you cannot go out of the menu boundaries [1 pt] |

(b) The experiment in the McGuffin and Balakrishnan paper “Acquisition of Expanding Targets” was discussed in class. Name one key limitation to this study as it was conducted and briefly (in one or two sentences) provide an alternative study design that would address that limitation. [2 pts]

| User always knew that the target was going to expand [1], so randomize expansion to remove predictability [1] |
Question #4 [9 points total]: Experiment Design, Analysis, and Report Writing

(a) A company that develops 3D modeling software for the film industry is testing out a new prototype interface for its existing quick-sketch application. The application currently uses a traditional mouse-and-keyboard interface and the new prototype relies on a stylus (pen)-based interface. They hypothesized that the stylus interface would be faster than the mouse-and-keyboard interface. After conducting a well-designed two condition within-subjects experiment with 88 participants, their statistical analysis found a statistically significant difference \( p < .05 \) between the two interfaces. The stylus interface had a mean task time of 4 seconds, and the mean for the mouse-and-keyboard interface was 4.08 seconds.

i. What valid conclusions can the company come to about the difference between the two interfaces? Explain your answer. [1pt]

The company can conclude that the stylus interface is probably in fact truly faster.

ii. How should the company act on these results? Provide a detailed justification for your answer. [3pts]

This is likely a pretty small effect (given the # of participants and the small difference in means) [1].

Add to that the potential of a type I error [1].

So they need to proceed cautiously (i.e., they shouldn’t just jump in and spend the money to implement the new stylus-based UI.) Perhaps decide against it outright, or do further studies (to try and improve the stylus technique), or do an economic analysis (cost to implement vs cost saved over some period of time, like year) [1]

(b) Your 444 assignment consisted of writing a report about a soft keyboard typing experiment. The following statements are related to that experiment. In which report section should each statement be found: Conditions, Measures, Discussion, Procedure, Design, Results, or Tasks? [5 pts]

i. “When the participants arrived at the experiment location, they were directed to sit down in front of the computer. They were told the goals and background of the experiment, and were shown how to mouse-type on each of the soft-keyboard prototypes.”

Procedure

ii. “The participants entered three sentences using one layout, and then again using the alternate layout. They were required to read each sentence aloud and then press the ‘Press here to start’ button then enter the sentence, and finish by pressing the ‘Press here when done’ button.”

Tasks

iii. “We performed a 2x2 factorial ANOVA.”

Results

iv. “An overwhelming number of participants preferred the alphabetic keyboard. This may be due to the fact that the participants found it faster to use.”

Discussion

v. “Next, the participants were asked to state which keyboard they preferred.”

Procedure
Question #5 [10 points total]: Field Study

It is well known that knowledge workers are multi-tasking more than ever before. What’s less well understood, however, is the cause for the increase in multi-tasking. Speculations include increased workload, explicit technological support (e.g., having multiple windows open), technological interruptions (e.g., email notifications), non-technological interruptions (e.g., people just interrupting other people more). Your interaction design consulting company suspects that if the causes are technological in nature, that there may be a technological solution (e.g., some forms of interruptions could be blocked). Before your company can move in this design direction, however, you need to better understand the nature of interruptions on knowledge workers. Your goal is to conduct an initial exploratory field study to gather information to clarify how interruptions (both technological and non-technological) are occurring and their impact on the workers. Imagine that you need to come up with 5 focal points and several questions for each focal point for your initial study design.

1. Give two of those focal points, and briefly justify each one. [6 pts]

2. Provide two interview questions related to each focal point (4 questions in total). [4 pts]

focal point #1:

justification:

question 1:

question 2:

focal point #2:

justification:

question 1:

question 2:
UPDATE
Focal point: 2
Justification: 1
Q1: 1
Q2: 1

Focal point: 2
Justification: 1
Q1: 1
Q2: 1

Other answers possible...
Question #6 [6 points total]: Field Experiment

(a) Was the study described in Malone’s paper “How do People Organize Their Desks” a field study OR a field experiment. Justify your answer? [2 pts]

Field study [1 pt]
- for the most part it was observational, qualitative, descriptive [1] OR
- even though there was a small intervention, i.e., prob documents were used, they were not used for everyone (check) and they were not properly controlled (for level of difficulty) [1]

(b) What is the Hawthorne Effect, how was it discovered, and how is it relevant to designing field experiments? [3 pts]

1. HE – people’s behavior changes when they know they are being observed. [1]
2. It was discovered in a famous field experiment on lighting conditions (will lighting change workers productivity?) [1]
3. You want to mitigate it as much as possible in your field experiment design, e.g., by not making it too obvious what you are hoping/expecting to learn in your experiment[1]

(c) What is the relationship between the independent variable and dependent variable when the Hawthorne Effect is at play? [1 pt]

Not causal
Question #7 [5 points total]: Using Video

(a) List 6 things that make a good HCI class project video, such as the one you did in CS444 this term. [3 pts]

<table>
<thead>
<tr>
<th>Motivating the project idea – ½ pt each</th>
</tr>
</thead>
<tbody>
<tr>
<td>Describing the methodology use to develop and evaluate the prototype</td>
</tr>
<tr>
<td>Good sound quality (voice over where necessary)</td>
</tr>
<tr>
<td>Clear description of the prototype</td>
</tr>
<tr>
<td>Results presented at a high-level (not lots of details)</td>
</tr>
<tr>
<td>Appropriate use of music</td>
</tr>
<tr>
<td>Well-timed transitions</td>
</tr>
<tr>
<td>&lt;Other answers possible&gt;</td>
</tr>
</tbody>
</table>

(b) According to Jordan & Henderson in their paper “Interaction analysis: Foundations and practice”, what are two key ways in which video differs from reality? Explain each way with one brief sentence. [2 pts]

- Limits of the operator who needs to decide what to capture and what to leave out.
- Limits of the technology, which is more restricted than the human sensory system.

<video can be slowed down and replayed also acceptable>

Question #8 [0 points total]: Research Lectures

You will be pleased to know that there are no questions on guest lecturer material this year. ☺
Question #9 [14 points total]: Statistical Analysis

A graphics company is trying out two new interactive techniques for one of its 3D software packages. The company hopes that one (or both) of the new techniques will improve performance (time and accuracy) for doing 3D manipulation tasks (tasks that are known to be time intensive and error prone). The company ran a controlled experiment to see if their new techniques do in fact offer performance improvements. Given that there is some evidence that females and males differ in their visual-spatial abilities, gender was controlled for.

2 Independent variables: (1) technique (new-A, new-B, status-quo; within subjects); (2) gender (male, female; between subjects)

2 Dependent variables: (1) time (in seconds, lower is better); (2) accuracy (1-10 scale, higher is better)

Study design: 10 males and 10 females each completed 5 tasks using each of the three techniques. (The order of seeing the three techniques was properly counterbalanced.)

Results: These two graphs show the means (across all 5 tasks) for each dependent measure:

A 2-way ANOVA (technique X gender) was run for each of the dependent variables:

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>P-value</th>
<th>F crit</th>
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</thead>
<tbody>
<tr>
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<td>0.695083</td>
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<tr>
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<td>29565.22</td>
<td>3.298214</td>
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<tr>
<td>Interaction</td>
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<td>2</td>
<td>79828.62</td>
<td>8.905459</td>
<td>0.000454</td>
<td>3.168246</td>
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<tr>
<td>Within</td>
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<td>8964.009</td>
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<th>F</th>
<th>P-value</th>
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<td>5.156148</td>
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<tr>
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<td>3.316667</td>
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Provide you answer on following page.

NO CREDIT GIVEN FOR ANYTHING WRITTEN ON THIS PAGE.
Question #9 (continued)

Your job is to explain and interpret these results.

(a) For each dependent measure state all the effects tested and state which of those effects resulted in a significant finding. You must state your assumed confidence level. [6 pts]

| time: main effect of technique (p<.05), no main effect of gender (p<.05), interaction of technique and gender (p<.05).  
| accuracy: main effect of technique (p<.05), main effect of gender (p<.05), no interaction  
| 6 pts: 1 for each of the 6 possible effects, subtract 1 if confidence level not clear |

(b) Next, interpret these results by explaining what the graphics company can conclude from this study, both about the 3D manipulation techniques and about gender? Note: the results of posthoc tests are not given to you, so please state your assumptions clearly. [6 pts]

While there are no posthocs given, what follows is quite clear from the graphs.

Time:
New-A is the fastest technique overall based on means (collapsing across gender). [1 pt] Given the interaction, we know that status-quo is fast for males, but not for females. [1 pt] The reverse is true for new-B. [1 pt]

Accuracy:
Given that there is a main effect of technique, and that new-A is the most accurate overall based on means (collapsing gender), it must be more accurate than status quo, which has the lowest mean. [2] The mean accuracy for new-B is lower than for new-A but not likely statistically different. It is not clear how it compares statistically to status-quo but is not likely statistically significantly different. [1]

(c) Assuming performance is the main determinant, should the company adopt one (or both) of the new techniques? If only one, which one? Explain your answer. [2 pts]

Yes – should adopt new-A. [1 pt] (if say to also adopt new-B [-1])
It represents a time improvement for females (and no detriment for males) and an accuracy improvement for both. [1 pt]
Blank page for extra work