Name: Sample Sol'n (yours may differ!) **Student ID Number:** _____

Signature: _____

CPSC 344, 2007-08 Winter Term 1 Midterm Exam
90 minutes

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Exam Instructions (read carefully):

1. **S**ign this page in the space provided to indicate your agreement with these instructions. (You ***must*** sign to write the exam.)
2. Continue reading these instructions, but **do not open the exam booklet** until you are told to do so by a proctor.
3. Print your **initials** at the top of each page in the booklet **before you start working.**
4. **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.
5. The exam is **closed book**. There are **no aids permitted** (this includes calculators).
6. **Interpret the exam questions as written**. When in doubt, take a strict, literal interpretation of the question and write down any necessary assumptions.
7. You have **90 minutes** in which to work (~1 min/mark). **Budget your time wisely**.
8. When **continuing your work** on a blank page at the end, please **indicate this clearly** at the initial location and on the blank page.
9. No one will be permitted to leave the exam room during the **last ten minutes** of the exam.

Question	Points	Received
1	18	
2	12	
3	15	
4	14	
5	6	
6	8	
7	7	
Total	80	

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Question #1 [18 points total]: True/False

For each of the 6 statements below, indicate whether the statement is true or false by **circling** either **True** or **False**. Briefly **explain** your T/F response in one or two sentences, and illustrate with an example where appropriate. [3 pts each, 1 pt for T/F + 2 pts for explanation]

(a) **Statement:** Because they emphasize natural mappings, mapping models are the most appropriate type of mental model to aim for in interface design.

True ***False***

Explain:

Mapping models are one of a variety of models, any of which (or any combination of which) may be appropriate depending on the nature of the design scenario and design. For example, a file system lends itself naturally to an object-action model, since users conceive of themselves as managing a collection of individual objects. File systems have also traditionally used metaphors to strengthen their models.

(b) **Statement:** When designing a graphical user interface, the primary purpose of a low-fidelity paper prototype is typically to capture and assess the interface's appearance.

True ***False***

Explain:

Low-fidelity prototyping generally does not capture either the final appearance or functionality of a system. Rather, the intention of a lo-fi prototype is generally to communicate design ideas or evaluate workflow and gross design ideas. Indeed, one of the **strengths** of a paper prototype is that its rough appearance telegraphs the unpolished state of the design, inviting comment from users.

(c) **Statement:** Seven is a reasonable number of items to expect interface users to hold in short-term memory because the average number of chunks people can hold in short-term memory is 7.

True ***False***

Explain:

It is true that people can generally hold about 7 ± 2 "chunks" in memory at a time. However, that means that a substantial fraction of our user population (perhaps roughly half) will at any given time find it difficult to hold 7 chunks in short-term memory, which is not really acceptable for design purposes. It might be more appropriate to expect users to hold 5 chunks in short-term memory to accommodate the vast majority of users.

(d) **Statement:** The CS344/444/543/544 ethics protocol submitted to the Behavioral Research Ethics Board at UBC allows 344 students to use people they know personally as subjects.

True **False**

Explain:

In fact, the ethics protocol not only allows but **requires** students to use acquaintances (such as people they personally know).

(e) **Statement:** A password entry system that shows a warning when CAPS LOCK appears to be unintentionally active is an example of a "visible constraint".

True ***False***

Explain:

This interaction illustrates feedback, not a visible constraint. A constraint might somehow **prevent** the user from entering an unintentionally capitalized word (though it's not clear how that would be done).

(f) **Statement:** Contextual inquiry is generally a better choice over plain ethnography when gathering information for UI design because contextual inquiry is structured specifically with the needs of UI design in mind.

True **False**

Explain:

One way to think about contextual inquiry is as a variation of ethnography structured specifically around a design problem in a workplace context. Various features of CI (such as explicit design discussions and a focus on a design question) support this intent.

Initials: _____

Question #2 [12 points total]: Design Concepts

This question describes four flawed vending machine designs. Assume all vended items cost the same amount, and that cost is known to the user (so only selection is a stake). Match each of the design concepts **affordance**, **feedback**, **mapping**, and **visibility** with the ***single*** design that best illustrates a violation of the concept and explain why the design violates the concept. [3 pts each: 1 for matching term and 2 for explanation]

(a) The vending machine is a large, glass-fronted case with multiple trays of snack items. Each item has a label beneath it that lists a letter and number combination like "B7". Users must insert their payment and then type the letter and number combination of the item they want on a keypad divided into a set of 10 letter keys and 10 number keys (sufficient to type every possible label in the case).

Design concept violated: Mapping

Explanation:

There is no natural connection between a snack (like Cheetos) and a letter number combination (like "B7"). So, users must memorize, albeit briefly and in short-term memory, a meaningless mapping to purchase their snack. Furthermore, users may have difficulty identifying whether a given snack goes with the number above or below it.

NOTE: on none of these questions do we request a design **solution**! Be careful about proposing a solution when an explanation is requested; they are not the same thing and not always interchangeable!

(b) The vending machine looks like the one from (a) — a large, glass-fronted case with multiple trays of snack items — except the items are unlabeled. The glass face of the case doubles as a touch screen. Users enter appropriate change and then press the glass over the item they want.

Design concept violated: Affordance

Explanation:

Users are not used to touching glass, and nothing about a plain glass-fronted case suggests pressing or touching. Indeed, fears of dirtying/smudging or even breaking glass mean that the glass case will likely **suppress** intent to touch it!

(c) The vending machine is a large, opaque case. Below the payment slot on the right is a column of buttons, each one flanked by an image of the item vended. The user enters payment and then presses the button next to the image of the item they want. If the user selects an item that is sold out, the machine returns the user's change and shows a message saying that the item is out and to please select another.

Design concept violated: Visibility

Explanation:

A crucial element of the system state (availability of an item) is not visible in the system image at the time when the user needs it.

Note: "visibility" as used here does not necessarily relate to vision. For example, a telephone system can have good visibility through careful management of the state revealed to users via speech and other sounds as long as that system image (what the user hears) communicates the key elements and functionality of the system itself.

(d) The vending machine looks like the one from (c) — a large, opaque case with a column of buttons and images— except there is also a "SOLD OUT" light next to each button. The light turns on for items that are out. Users enter their payment and press the button of the item they want. If they press the button of an item that is sold out, the machine simply waits for them to press a different button instead.

Design concept violated: Feedback

Explanation:

Although this machine fixes the visibility problem from the previous section, users may still request items that are sold out because the overlook or misunderstand the SOLD OUT indicator. If they do, this machine provides no visible or audio feedback to indicate that a problem occurred. Because it silently ignores the error, users are apt to repeat their mistake or conclude that the machine is broken.

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Question #3 [15 points total]: Discussion Questions

(a) In a few sentences, describe Heuristic Evaluation: **what it consists of**, and (briefly) its **goals,** its **limitations,** and **when** in the design process it is most useful. [6 pts]

In HE, a design team provides a prototype of their design to a group of 3-5 usability experts for review in order to identify classic usability problems according to a set of ~10 design heuristics.

The experts individually review the prototype, noting violations of the heuristics and their severity and perhaps design recommendations. The individual reviews are then aggregated into a final report.

Because HE requires a prototype (or clear specification), it best used after some initial design work. Because it does not use real users, it may be best early on when "cheap" feedback is most helpful.

Since HE is focused on criticism, it generally does **not** lead to new design ideas or directions.

(b) List and justify 3 important characteristics of a good task example or set of task examples. [9 pts]

NOTE: there are many possibilities, here are three. Also, note the requirement to **justify**!

(1) Characteristic: Good task examples should say what the user does not how they do it.

Justification: such examples are "design neutral" in the sense that they can be used with any design (any process for accomplishing the task). This is crucial during the early stages when task examples are developed to avoid prematurely committing designers to a particular design.

(2) Characteristic: Good task examples describe a complete task that accomplishes an important goal for the user.

Justification: task examples that represent only a part of a task may clearly illustrate a portion of a design from the designer's perspective (i.e., "fit" within some component of the design structure), but they are divorced from users' intentions. A complete task example aimed at a user's goal forces the designer to consider users' needs and to recognize the entire design problem.

(3) Characteristic: Good task example sets cover a range of tasks including common, critical, and rare but interesting or important cases.

Justification: as in (2), designers need a wholistic view of the design scenario to create a design that addresses users' needs. Creating a broad task set encourages this wholistic view of the scenario early on. Later, designers might justifiably divide these task examples into those that they will focus on and those that they will de-emphasize or even not support.

Questions 4-6 are based on the following design brief.

You've been hired by a company that produces bicycling products to design a "ride muse": a device that record ideas cyclists have during their rides. The device is inspired by the company CEO's habit of thinking deep thoughts during his rides and frustration with having no easy way to jot these ideas down.

On his own time, the CEO put together four physical form-factor prototypes of "ride muses" based on different recording formats (voice-activated audio, lever-activated audio using an extra "gear" lever, always-on audio with continuous compression for silent stretches, and one-handed "chorded" handlebar keypad input). After trial runs with each one, he much preferred the voice-activated audio system and has decided to go with it.

The company expects to design, market, and sell the product itself, but the actual production will be handled by another firm with the necessary expertise (e.g., a firm that produces dictation devices). Successful marketing in the cycling world requires word-of-mouth from influential users; fortunately, the company has a well-established partnership with a local bike club and a national bicycling magazine.

Your team is about to begin. While you are excited about the product idea, you are also concerned about the state of the design process as it was "handed" to you.

Question #4 [14 points total]: Pre-Design Activities

(a) The company CEO has already made some key errors in user-centred design, but it's touchy to give that kind of feedback to your boss. **Briefly** explain two things that he did **very well** from a user-centred design perspective and two things that he did **very poorly**. [4 pts]

NOTE: there are many possibilities, here are the ones we found most compelling.

Good job, boss:

You prototyped a variety of approaches to explore their strengths and weaknesses.

You tested your systems under realistic circumstances.

But maybe we shouldn't have…

…focused your design efforts on the available technology rather than the problems, needs, and practices of users.

…settled so quickly based only on your own input (and not a broad range of representative users) on a particular design.

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(b) Now that your boss is convinced of the need for more **early stage user-centred design** work, list two useful and **experimentally valid** activities which you, as a trained HCI designer, could do to learn more to about how this product should work (or even if it's a good idea). In each case, describe the **goal** of the activity, the **subject group's makeup**, how you'd **contact** them and **what/how you'd ask them**. [5 pts each]

Example response: *To explore typical enthusiastic cyclists' willingness to add an extra device to the set of devices they already use on rides, team up with the local bike club to solicit a series of focus group sessions (divided into commuters, hobbyists, and racers). Contact the users by the most standard mass distribution means the bike club uses, e.g., an e-mail newsletter if they have one.*

Questions might centre on the equipment that riders currently own and use and their fears, tolerance, and demand for new devices, but the focus group facilitator would allow discussion to roam freely as long as the topic continued to be ride "accessories".

NOTE: there are many possibilities, here are two interesting ones based on student responses.

(1) To assess the potential benefit of the device among "influential" potential users (those who will help other end users make their purchase decisions, particularly tour leaders and bike store owners/operators), in terms of the number and importance of ideas that occur to them on rides, we will equip subjects with a clicker device they can use to record each time they have an idea during a ride that they would "regret not remembering later". We will recruit influential users using an exhaustive list of tour leaders/cycle shops in the city (or a tighter region if funding is too tight) and contacting each one via telephone. We will send the clicker device to the subject to use on a training or pleasure ride along with diarying/submission instructions (to get info on type, length, and environment of the ride they made and basic demographics). We will compensate participants in cash.

(2) To explore the broader market for the device beyond cyclists, we will conduct a broad-ranging survey of "mobile thinkers": anyone who might have (and lose!) ideas in situations where it's difficult to record them. Questions will focus on whether individuals "lose" ideas that seem important to them because of inadequate recording (we will need to include examples to help them understand the concept) and what their environment/context is during this process. Because this is an exploratory process, we're looking less for complete representativeness within groups and more for a broad range of groups; so, we will try to canvass a variety of interest groups through venues like university clubs or professional organizations. We will send a limited set of questionnaires to each organization's representatives with monetary compensation tied to completion of as many of the surveys as possible by different organization members, up to the limit provided.

Question #5 [6 points total]: Stakeholders

List what you consider to be the 3 most important stakeholders, given the constraints and resources from the design brief. (Many relevant stakeholders exist!) Be specific in your answer: e.g. if describing an end-user stakeholder, clearly identify demographic characteristics.

For each stakeholder, say in 1 sentence **what makes this role important**. You do not need to identify their potential needs and concerns. [2 pts each]

> *Example: Enthusiastic but non-professional cyclists (i.e., amateurs who join bike clubs and ride groups), who constitute the largest pool of likely purchasers for the product.*

NOTE: there are many possibilities although there are also many responses that are clearly **not** among the three **most important**. Here are three plausible "most important" stakeholders. Yes, we stole (1) from Question #4… that's a great way to save time and effort on the exam!

(1) Cyclists in positions of direct, face-to-face influence such as tour leaders and bike store owners/operators will help many (and perhaps **most**) other end users make their purchase decisions.

(2) The CEO had the initial idea and impetus for this project and has shown a clear, personal interest in it. Thus, he seems likely to *at least* have an effective "veto" over the design.

(3) The members of the local bike club will likely play a central role in the evaluation process as available, friendly users. Thus, we will probably want to keep them engaged in and informed about the design process from the start both for the value of their feedback and to maintain goodwill so we can rely on their help in various formal evaluations.

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Question #6 [8 points total]: Threats to Validity

Following pre-design evaluation, the UI group builds a functional prototype of a proposed UI. The prototype is tethered, requiring power and data connections to a computer that runs the system back-end. The interface for downloading, viewing, and organizing ride notes has not yet been prototyped.

You set up a testing lab in a wind-tunnel. A bicycle frame — minus the wheels but with freely spinning pedals — is bolted to the centre of the tunnel. Before an experiment, the subject receives a list of topics to think about and has the frame adjusted to their own normal riding configuration. They then put on the prototype, mount the frame, and begin pedaling. A "natural cycling sound-track" recorded from a ride in the area plays as background. They pedal for 20 minutes, recording ideas they have on the chosen topics.

Through use of the lab setup and an off-site retroactive interview, you plan to learn whether potential users *feel comfortable with the physical prototype while in riding position*, and *how much use (in "muses" per unit time) the device receives*.

Your recruiters solicit randomly selected passing riders as participants at a stop sign along a well-used commuter bike path. You offer modest compensation in exchange for taking part in the two-session experiment. You end up with 25 participants from a range of backgrounds.

This example, *if the sole source of user input at this stage*, violates multiple kinds of experiment validity as discussed in 344. For each of the validity types listed below, describe **a way in which it is violated** and **a way in which it is respected**.
[4 pts each]

NOTE: there are many possibilities. Here are a few plausible ones.

(a) External OR face validity.

VIOLATED:

External: this setup generalizes poorly to real potential users' rides. For most rides, musing would instead be secondary to the ride's primary goal (commuting or even pleasure).

RESPECTED:

External/face: the key factor of realistic ambient noise, which may lead to "muses" or interfere with recording, is replicated reasonably faithfully, which strengthens the generalizability of claims from the experiment to the noisy environments real cyclists face.

(b) Construct validity:

VIOLATED:

When we **supply** a list of topics to think about, we end up measuring muses on our provided threads rather than the rider's "intrinsic" muses per unit time.

RESPECTED:

The lab setup seems well-designed to actually measure riders' comfort in cycling position since care is taken to ensure that cyclists conform to a reasonable riding position.

Question #7 [7 points total]: Matching Exercise

The terms listed immediately below are possible answers for the definitions listed lower on the page. Use the number corresponding to a term in the first list as an answer in the space provided next to the following questions if you think it is the ***best*** match for that concept or definition. Each term in the first list is used either once or not at all.

(1) Affinity diagram
(2) Camera
(3) System image
(4) Modular input processing
(5) Negative transfer
(6) Stimulus/response compatibility
(7) Recognition vs. recall
(8) Norman's "Gulfs"
(9) Task examples
(10) Likert scale responses on a questionnaire
(11) Sensory buffers
(12) Videotaped, semi-structured interview
(13) Cognitive Walkthrough
(14) Cultural idiom
(15) Exploratory vs. confirmatory research
(16) Keyboard logs
(17) Affordance
(18) Perceptual fusion

For each statement below, write the number of the term from the list above that **best** fits into the missing space. [1 pt each]

__3__ (a) What the users sees of an interface

__10__ (b) Numeric ratings of agreement/disagreement

__1__ (c) A way to turn unprocessed qualitative data into coherent arguments

__2__ (d) A poor model of how human vision works

__8__ (e) An overall metaphor for what makes understanding an interface challenging for users

__13__ (f) A "discount" usability method

__15__ (g) One way of comparing qualitative and quantitative methods

Extra page to continue work.

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