

Name: \_\_\_\_\_

Student ID Number: \_\_\_\_\_

Signature: \_\_\_\_\_

## CPSC 444 2006-07 (T2) Final Exam

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### Exam Instructions (read carefully):

1. Sign the first 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**. There are **no aids permitted**, except for a **simple non-programmable calculator**.
5. There are 12 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.

Question	Points Possible	Mark
1	10	
2	4	
3	4	
4	6	
5	6	
6	12	
7	4	
8	3	
9	12	
10	12	
11	12	
12	15	
<b>Total</b>	<b>100</b>	

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### Question #1 [10 points total]: True/False

For each question, circle **one** of either true or false. You do **not** have to provide a justification for the answer you have given. [1 pt each]

- (a) When the system image closely matches the system model, conceptual mismatches are rare.  
True      False      *True*
- (b) Designing better error messages and feedback for the user helps to bridge the gulf of execution.  
True      False      *False*
- (c) Contextual inquiry is an evaluation methodology that involves interviewing users.  
True      False      *True*
- (d) The Apple Lisa was the first computer based on usability engineering that was a commercial success.  
True      False      *False*
- (e) The most effective way to reduce nervousness when giving a presentation is to memorize the presentation.  
True      False      *False*
- (f) In a Fitts' Law model, the index of performance can be calculated two different ways (through a direct division of mean scores and through linear regression), which both yield the same result.  
True      False      *False*
- (g) In an F-statistic, if for a given experiment the probability of achieving the resulting F-value came out to .079, you would be able to reject the null hypothesis assuming a confidence interval of 95%.  
True      False      *False*
- (h) With respect to McGrath's taxonomy of 8 different research strategies, McGrenere et al.'s study evaluating the prototype MSWord Personal would best be described as a "Field Study."  
True      False      *False*
- (i) According to Dmitry Nekrasovski, one of the biggest challenges of doing interaction design in industry is selling the value of this work to clients/others.  
True      False      *True*
- (j) Wendy Mackay's "Using Video to Support Interaction Design" showed that video was not particularly effective for brainstorming design ideas.  
True      False      *False*

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### Question #2 [4 points total]: Presentation Skills

- (a) Based on what you learned in preparing for and in observing other student presentations (both in the design competition and the presentation tutorial), **identify four distinct non-content-specific things that influence the effectiveness of a presentation.** [4 pts]

- 1.
- 2.
- 3.
- 4.

*presenter making frequent eye contact with the audience, i.e., not reading slides or notes; voice projection, dynamic voice or enthusiasm for presentation, good posture, no fidgeting by presenter or additional team members standing at front, not too many slides, limited/moderate amount of text, passing physical artifacts around the audience if possible rather than just holding artifacts up, use humour where possible, matching slides with what is being said*

### Question #3 [4 points total]: Empirical Laws

- (a) Explain with reference to an empirical law discussed in class why it is faster to execute a command to warm an item in the microwave for *33 seconds*, than it is to execute a command for *30 seconds*, for the given microwave touch keypad shown below. Make sure to **name the law** and **describe the law in plain language.** [4 pts]

7	8	9
4	5	6
1	2	3
0	START	

Name the relevant empirical law: \_\_\_\_\_

*Fitts' law. - 1 pts*

Describe the law in plain language (you may provide the formula, but it is not necessary and this does not negate your need to describe the law in plain language):

*The time to acquire a target is a function of the distance to and size of the target. The larger the distance the longer the time, the wider the target the less time. It is a log relationship - 1 pt*

Explain why it is faster to use 33 seconds than 30 seconds:

*The reason that a command of 33 seconds is faster is that there is no movement required to hit the second 3. Whereas to issue the command 30 requires the user to make one additional movement in between hitting the first 3 and the 0. - 2 pts*

**Question #4 [6 points total]: User Abilities**

You are redesigning the project below, involving a large-screen display, to be installed at the downtown headquarters of a bank, for the general public to experience the “joy” of real-time stock trading.

48 popular stocks and their prices are displayed on a 4 x 3 meter screen in real-time. Customers stand 2-3 meters away and use a handheld device to buy and sell stocks.

A *section* of the prototype display is shown below. When a price goes up (above start-of-day price), it is displayed in green; when it goes down (below start-of-day price), it turns red. Everything is on a vivid blue background, and all colours have the same brightness.

Stock symbol	SIRI	MSFT	INTC	CSCO	Black text
Current price	6.90	39.81	23.01	19.80	
Price change since trading opened today	dn 2.11	up 0.29	dn 0.47	up 0.07	Green text
	ORCL	SUNW	CMGI	AMAT	Red text
	13.21	5.30	2.34	17.27	
	up 0.15	dn 0.01	dn 0.34	dn 0.29	
	JDSU	SCON	BIOM	YHOO	Blue background (whole display)
	3.08	1.17	2.54	37.05	
	up 0.006	up 0.16	dn 0.48	dn 0.03	

*Actual size is an 8x6 grid (4x3 m)*

Users must be able to recognize price changes and make trades quickly. It is particularly important to know when a price is up for the day, and it suddenly goes down below the start-of-day price, and vice versa. It is also helpful to know prices that are **way** up or down compared to their start-of-day price. Unfortunately, the current design does not adequately draw the user’s attention to the price changes.

- (a) When a price changes, the text label changes between “up” and “dn”. Drawing from your knowledge of **visual perception**, give **one reason** why this change doesn’t draw the user’s attention. [1 pts]

*Text change is not preattentive.*

- (b) Price changes are also shown in different colours, and we learned that colour changes can be effective for drawing the user’s attention. However, this design suffers from several problems related to the **use of colour**. Identify **two** of them. [2 pts]

*needs luminance contrast – 1 pt*

*+ one of:*

*red/green blindness a problem – 1 pt*

*not clear why the background needs to be a colour – should make background white or black (if make black, then make the stock symbols & current prices white. – 1 pt*

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### Question #4 (continued)

- (c) Propose a better way of indicating price changes to the user, taking into account the trade-offs against obtrusiveness and annoyance to the user. Unfortunately, because the display is in a public area, sound notification isn't feasible. [3 pts]

*Hard to fix the red/green problem b/c it is so strongly encoded culturally.*

*Could use up/down arrows instead of "up" & "dn" and only use an arrow symbol for prices that are above a certain threshold above start of day (same for below). So the arrows will stand out.*

*If a price changes from up to down or vice versa, the arrow and the delta amount could flash a small number of times (maybe 10 or 12).*

### Question #5 [6 points total]: Design and Evaluation in Ubiquitous Computing

- (a) Briefly describe **three** ways in which evaluating a mobile UbiComp application (such as the one you developed in your project) in a usability lab study is **more challenging** than evaluating a desktop application (such as a word processor or spreadsheet) in the lab. [3 pts]

*Lots of possibilities:*

*a. devices are often small and mobile therefore video taping is harder to accomplish.*

*b. left hand - right hand user issue – devices often assume a right-handed user*

*c. display size and screen glare – can be difficult for some users to see the screen*

*d. input key pads on smart phones are harder to operate than a keyboard*

*e. ubicomp applications usually rely on context data, which can be difficult to "fake" or Wizard of Oz*

*f. users are not used to operating applications on small devices*

*g. the type of the mobile device has a great effect on the study since they might differ from each other a lot in terms of input/output support.*

- (b) Briefly describe **three** main challenges inherent in **designing and prototyping** an application for a smart phone as compared to a desktop application. [3 pts]

*Lots of possibilities:*

*Screen size and resolution are usually much smaller and less information can be presented at once.*

*Computer languages have only a reduce functionality set to offer on such devices (Flash - Flash Lite).*

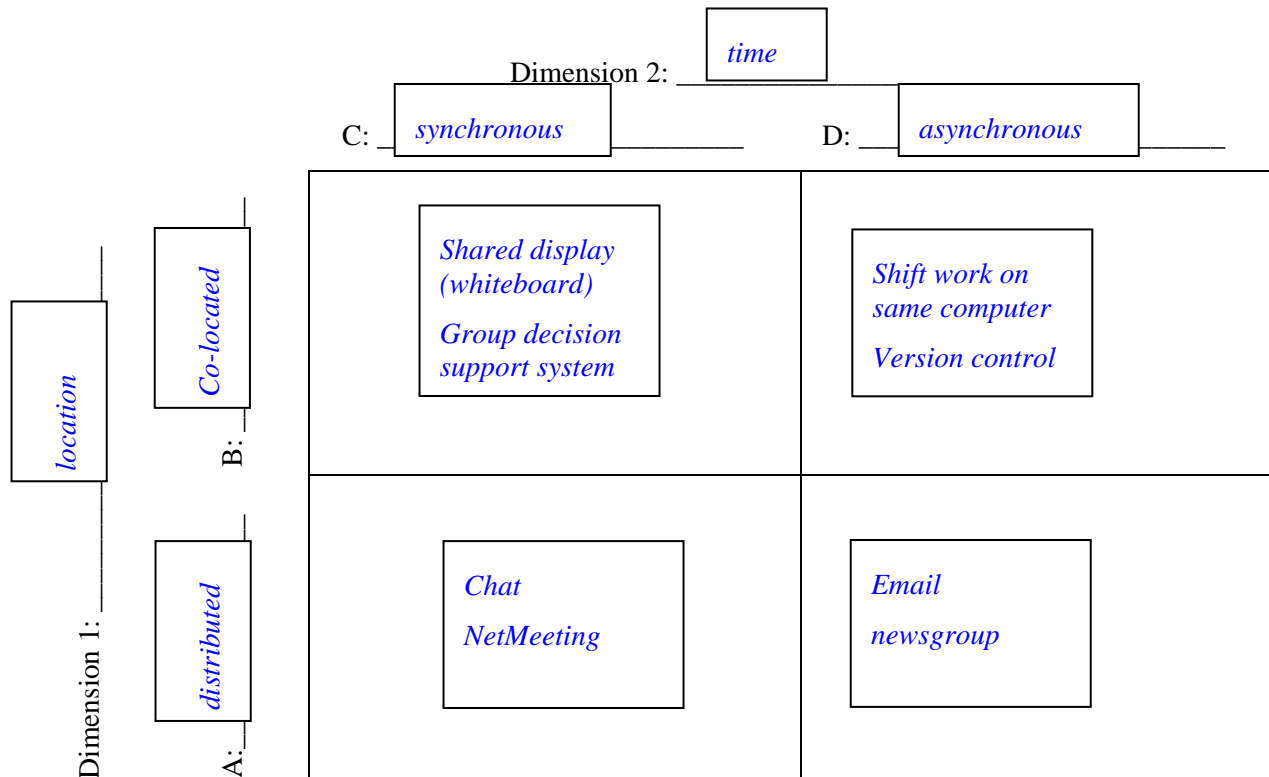
*Limited processing power and memory*

*Battery life has to be considered*

*Applications are much more device dependent, meaning an application running on a smart phone might be much different from running on HP IPAQ PDA*

**Question #6 [12 points total]: HCI Research – CSCW**

- (a) Identify the two primary dimensions of groupware and each of their subcomponents by filling out the following diagram. In each quadrant provide 1 example of a system that is appropriate to that quadrant. You may use generic system names (e.g., email) or specific system names (e.g., Microsoft Outlook). [5 pts]



- (b) Guest lecturer Kori Inkpen described a body of research that is focused on one of these quadrants. Which is it? [1 pt]

*Co-located / synchronous = face-to-face collaboration*

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### Question #6 (continued)

- (c) In "The Mechanics of Collaboration" Gutwin and Greenberg discuss several mechanics which affect collaboration. One of these is **coordination of action**.

Choose one of the technologies that your 444 team **used to support collaboration** during your group project (e.g. MSN Messenger, Google Documents, emailing Word documents back and forth, cell phone communication, etc.) and discuss how well it worked (or didn't work) for **coordination of action** in terms of **each of** the authors' three evaluation criteria (effectiveness, efficiency, satisfaction). [6 pts]

Collaboration technology used: \_\_\_\_\_

#### Coordination of action – effectiveness:

*For google docs:*

*When editing different parts of doc, not too much trouble coordinating actions, but sometimes one user's cursor goes off track. Also effective because there was one central place for storing document.*

#### Coordination of action – efficiency:

*For google docs:*

*Very efficient – b/c could work on same document at same time (no issue of version control), easy to delegate sections.*

#### Coordination of action – satisfaction:

*For google docs:*

*High satisfaction b/c reliable, saved communication efforts required for coordination, team members could work relatively independently.*

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### Question #7 [4 points total]: HCI Research – Information Visualization

- (a) According to guest lecturer Tamara Munzner, what is the current thinking in the information visualization community on the **usability of 2D versus 3D visualization techniques**? [2 pts]

*It is contentious. There has been a lot of work done on 3D visualization, but it is not clear that 3D offers any advantage over 2D, and can actually make things worse. Community is treating 3D more cautiously than it has in the past.*

- (b) Tamara Munzner described a **tradeoff between information density and getting lost**. What is that tradeoff? [2 pts]

*There is value to having information densely packed in the screen to avoid the need for scrolling, but the problem is that when it is too densely packed it can become difficult/impossible to understand. In particular, in a node-link graph, it becomes impossible to follow the links.*

### Question #8 [3 points total]: History of HCI

Describe **Alan Kay's role** in designing what is known today as the **personal computer**. In addition, explain how **designing for children** factored into his **philosophy of design**. [3 pts]

*Alan Kay was part of the team at Xerox Parc would created the Alto. Many of the ideas in the personal computer today (e.g., desktop metaphor, direct manipulation) came from the Alto, even though it was not a commercial success.[1 pt]*

*He also created the dynabook – a prototype that showed the vision of the modern laptop/tablet PC. .[1 pt]*

*Prior to the Alto, he helped create the Flex Machine which was a personal computer of sorts, but not at all successful. His philosophy shift (inspired by Seymour Papert) that the computer should be accessible to children is in part what led him to the “ease of use” in the Alto design. .[1 pt]*

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### Question #9 [12 points total]: Design & Evaluation Theory

- (a) Which **type of validity** is best preserved and is least preserved for each of qualitative field studies and controlled experimental studies. **Justify** each of your answers in **one short sentence/phrase**. [6 pts]

Qualitative field studies:

Best preserved: \_\_\_\_\_

Least preserved: \_\_\_\_\_

Controlled experimental studies:

Best preserved: \_\_\_\_\_

Least preserved: \_\_\_\_\_

*Field studies:*

*Best: ecological or face validity – the results are likely to be more realistic if they were captured in the field where users go about their tasks in a natural environment [external validity also acceptable]*

*Least: internal validity – very difficult to detect any causal relation when you can't control the environment [could also say statistical for similar reason]*

*Experimental studies:*

*Best: internal validity – have a great degree of control over all the variables*

*Least: external validity – hard to know if the results will generalize in a real setting [can also say ecological for this]*

*1 pt for each type of validity + .5 pt for each justification*

- (b) What is the fundamental message of McGrath's article on "Methodology Matters"? You need to refer to generalizability, precision, and realism in your answer. [4 pts]

*One study is always inherently flawed, i.e., is never enough [1 pt], cannot achieve generalizability, precision & realism in one study [1 pt]*

*Triangulate methods across studies to achieve convergent evidence [1 pt]*

*Within a single study, triangulate multiple measures where possible to achieve convergent evidence [1 pt]*

- (c) What is the practical implication of this for HCI researchers? [2 pts]

*Need to work within a community, because one researcher often doesn't have sufficient training to be able to carry out multiple methods (e.g., field studies as well as lab studies).*

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### **Question #10 [12 points total]: Field Methods**

Imagine that you are consulting for a company that is designing the "electronic classroom of the future." Before designing this new technology, you have recommended that they gain a comprehensive and clear understanding of how current e-classrooms operate – both in terms of infrastructure (whiteboards, furniture, electronic projection etc.) and human interaction (teachers and students). You have been hired to conduct an **initial exploratory field study** to gather information for your client.

1. Provide **two focal points** for your initial study, and briefly **justify each one**. [6 pts]
2. Provide **three questions** related to **each** focal point (8 questions in total). [6 pts]

**focal point #1:**

**justification:**

**question 1:**

**question 2:**

**question 3:**

**focal point #2:**

**justification:**

**question 1:**

**question 2:**

**question 3:**

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*Focal point: What do instructors use to display information during lectures?*

*Justification: A classroom is where the instructor communicates to students. How instructors display information to students affects how they communicate with them.*

*Q1: What do you use to present information to the class during lectures? Can you show me?*

*Q2: What do you find is the most challenging aspect of displaying information during lectures?*

*Q3: If you could add anything to the classroom to assist in your lectures, what would it be?*

*Focal point: How do instructors communicate with students when they are not in the classroom?*

*Justification: Communication with students outside of the classroom is important. Instructors need to make announcements to the class and they need to answer questions.*

*Q1: If a student needs to ask you a question outside of class, how do they get in touch with you?*

*Q2: If you need to make a class wide announcement and you are not in the classroom what do you do currently?*

*Q3: If many students have the same question s outside of class how do you answer all of them?*

*Other answers possible...*

**Question #11 [12 points total]: Statistical Analysis**

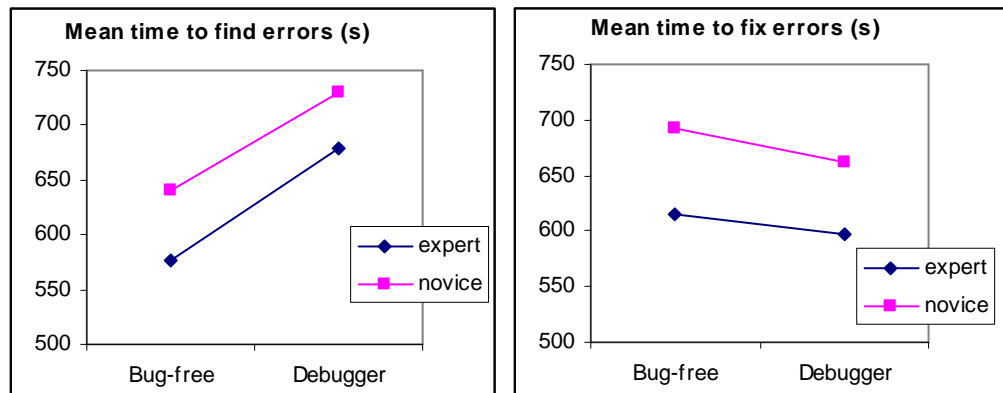
Buggy Inc. is a company that specializes in the development of visual debugging interfaces for large, complex software engineering projects. They recently developed a software package (called Bug-free) that uses an innovative scheme to highlight syntax errors in code. Because their package has the exact same functionality as a software package sold by one of their competitors (called Debugger), they **ran a controlled experiment to see which of the two software packages is more usable**. They hoped to show that their package is more usable than their competitor's for both novices and experts, but suspected it may only be the case for novices. The study compared how rapidly users can find syntactic errors in their code and how quickly their interface allows them to make corrections.

**2 Independent variables:** (1) software package (Bug-free, Debugger; within subjects); (2) user expertise (novice, expert; between subjects)

**2 Dependent variables:** (1) time to find errors; (2) time to fix errors

**Study design:** 10 novices and 10 experts each completed 5 tasks in each of the two software packages. (The order of seeing the software packages was fully counterbalanced.)

**Results:** These two graphs show the mean completion times (across all 5 tasks) for each dependent measure:



A 2-way ANOVA (software package X expertise) was run for each of the dependent measures:

ANOVA Time to find errors						
Source of Variation	SS	df	MS	F	P-value	F crit
Sample (expertise)	33524.1	1	33524.1	3.19403	0.08233	4.113165
Columns (package)	92929.6	1	92929.6	8.853928	0.005199	4.113165
Interaction	518.4	1	518.4	0.049391	0.825383	4.113165
Within	377851	36	10495.86			
Total	504823.1	39				

ANOVA Time to fix errors						
Source of Variation	SS	df	MS	F	P-value	F crit
Sample (expertise)	49773.03	1	49773.03	5.217752	0.028358	4.113165
Columns (package)	5880.625	1	5880.625	0.616471	0.437498	4.113165
Interaction	442.225	1	442.225	0.046359	0.83074	4.113165
Within	343410.1	36	9539.169			
Total	399506	39				

Provide you answer on following page.

**NO CREDIT GIVEN FOR ANYTHING WRITTEN ON THIS PAGE.**

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### Question #11 (continued)

- (a) Your job is to explain and interpret these results. For each dependent measure state all the **effects tested** and which resulted in a **significant** finding. You must state your assumed **confidence level**. [6 pts]

*time to find errors: main effect of system ( $p < .05$ ), main effect of expertise ( $p < .10$ ), no interaction  
time to fix errors: main effect of expertise ( $p < .05$ ), no effect of system, no interaction  
6 pts: 1 for each of the 6 possible effects, subtract .5 for each if confidence level not clear*

- (b) Next, **interpret** these results by explaining what Buggy Inc. can conclude from this study, both about the software packages and about user expertise? [6 pts]

*Buggy Inc can conclude that:  
for both novices and experts, Bug-free does improve the time to find errors compared to Debugger [2pts],  
but Bug-free doesn't improve the time to fix errors for either novices or experts [2pts].  
  
Not surprisingly,  
experts are faster finding errors than novices in general (if accept  $p < .10$ ) and  
they are faster fixing errors (regardless of software package). [2pts]*

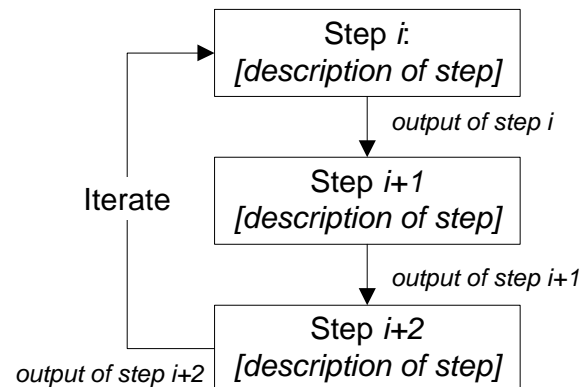
**Question #12 [15 points total]: Design Process**

Together with a few friends, you've come up with what you believe is a really neat and novel design idea, namely a public electronic message board. Current message boards (in places like the UBC sub and bus loop) are a mess, and you think it would be easier if people could post to them in person, perhaps using a cellphone or PDA as an input device, and/or remotely through a web interface. The goal is to design an easy to use large screen public message board.

You need to plan the **process** you will take, to get from the general design idea (just described) to a fully functional prototype approved by all critical stakeholders. Given that you have approximately 3 months for this task and a small team who are all trained in HCI techniques, you decide to take a user-centered design approach.

On the following page, diagram 6-10 steps of a possible design process that encompasses the following:

- Include the points at which you propose to include users, a justification for doing so, and how;
- Indicate with arrows where you are likely to iterate on stages in the design, as demonstrated in diagram at right.
- For each step, state the primary activity of that step (e.g. “prototype functional flow” or “evaluate appearance prototype”), AND describe the activity and its objectives in more detail (one sentence), AND state the output of that step.
- For prototyping and evaluation steps, the activity description should include the general type of prototype you would expect to build or the type of study you'd conduct, based on the information you expect to need at that point.



There is no single correct answer to this question, although there are some key steps that should not be omitted. Sequencing and to some degree which steps are included can vary (and does, in the real world), depending on constraints and the nature of the problem. Credit will be given for reasonable and well-justified answers; and for completeness of the overall process. [15 pts]

**Provide your answer on following page.**

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### Question #12 (continued)

Diagram your design process on this page.

*Answer should include the following elements:*

- [1 pt] Identification of stakeholders
- [1 pt] Near the beginning, some form of pre-design observation and data gathering
- [1 pt] Clearly identify system validation occurring early
- [1 pt] System brainstorming
- [2 pts] Multiple prototyping / evaluation pairs (at least 2), in reference to formative approach
- [4 pts] Mention of different and appropriate types of prototypes (e.g. low-fi, medium-fi, and hi-fi) and evaluation methods (e.g. informal – such as questionnaires, focus groups, interview; observation methods; and formal - controlled.) - at least types of prototypes and 2 eval methods
- [2 pts] Iteration, demonstrated by arrows as above, and probably following the outcome of an evaluation step
- [2 pts] Overall completeness
- [1 pt] Overall sensibility of approach

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