Name: _____MARKING_KEY_____ **Student ID Number: _____**

Signature: _____ **Fire Alarm Code: _____**

CPSC 444 2000-2001 (T2) Second Midterm 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. Print your **Name** and **Student Identification Number** on **every** page in the space provided at the top of each page **before** you start the exam.
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. Please read the **entire** exam before answering any of the questions.
6. There are **four** questions on this exam, each worth the indicated number of marks. **Answer as many questions as you can.**
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.
8. Interpret the exam questions as written. **No questions** will be answered by the proctor(s) during the exam period.
9. The exam is **closed book**. There are **no aids permitted**, except for a calculator.
10. You have **70 minutes** in which to work. **Budget your time wisely.**
11. In the event of a **fire alarm** during the exam, enter the four-character code provided by the proctor(s) in the space on the upper right, then gather your belongings and exit the room, handing your exam to a proctor as you exit.
12. No one will be permitted to leave the exam room during the **last ten minutes** of the exam.

Question	Mean	SD	Max
1(a-b)	6.9	1.1	8
1(c-d)	7.5	1.0	8
2(a)	7.0	1.4	8
2(b)	8.4	1.0	9
2(c)	4.2	1.7	6
3	9.8	2.3	12
4(a-l)	21.7	2.5	24
4(m-x)	18.0	5.3	24
Name & ID	1.0	0.0	1
Total	**84.5**	**9.6**	**100**

Question #1 [16 marks total]

This questions tests your knowledge of **GOMS** techniques as discussed in Chapter 8.

In class and in the text we used GOMS to analyze the task of making text bold face in a word processor, such as MS Word. There are four parts of the **GOMS model**. In the spaces provided below and on the next page, name each of the four parts, give a description of each part, and provide an example of each part as it would be used to analyze the task of making text bold face in MS Word. Treat the cases for boldfacing a few letters within a word, one entire word, and multiple consecutive words.

(a) **Part:** Goals

Description: Goals define the end-state that the user is trying to achieve. Top-level goals are subdivided into subgoals, corresponding to the division of a task into subtasks.

Example: There is a two-level hierarchy of goals for the boldfacing task.

Main goal − turn desired text to bold
   Subgoal-1 − specification of text to turned to bold
   Subgoal-2 − change the specified text to bold

(b) **Part:** Operators

Description: Operators are the basic actions available to the user for performing a task.

Example: For the boldfacing task the basic operators are the fundamental actions with the mouse and keyboard:

click down, click up, and move the mouse, along with

type a key on the keyboard.

(Continue your answer to Question #1 here for the final two parts of GOMS.)

(c) **Part:** Methods

Description: Methods are sequences of operators (or procedures) for accomplishing a goal. Compound operations are methods.

Example: There are two sets of methods, one for specifying text and one for changing it to boldface:

The sequence double-click (click down, click up, click down, click up all in rapid succession) specifies a full word.

The sequence click down, move mouse pointer, click up specifies the text between the click-down point to the click-up point.

The sequence control-B changes the specified text to boldface, and so does move mouse to BOLD-button, click up/down. Two longer sequences are move to FORMAT menu, click down, move to FONT, click up, move to dialogue box, double-click on BOLD and a similar sequence that ends with click down/up on BOLD, move mouse pointer to OK and click down/up or with typing "ENTER" on the keyboard instead of the final click down/up.

(d) **Part:** Selection rules

Description: Selection rules are invoked when there is a choice of methods to accomplish a goal. Selection rules often have criteria to determine which method will be invoked under various circumstances.

Example: For the boldfacing task a selection rule based on a criteria of fastest is best would select double-click to specify a full work, but would use click-up/move/click-down for both of the other types of text (less than a single word and more than a single word).

Similarly, either typing control-B or moving to the BOLD-button will be faster than the other two methods. Which is fastest will depend on the homing time to switch the hands to the keyboard from the mouse, and the position-dependent movement time to reach the BOLD-button (Fitts's Law).

Question #2 [23 marks total]

This question tests your knowledge of the **requirements definition** as it pertains to interactive systems, which was discussed in Chapter 7.

(a) **[8 marks]** Identify the two main groups of stakeholders who **read** requirements. For each group, include a **list of stakeholders** in that group, and briefly describe the **reasons** that each stakeholder in the group has for reading the requirements.

Group 1: Clients are composed of:

users need to know how the system will support their activities.

managers of the users also need to know that the system will support their activities, and that their employees will be able to use it.

trainers need to know what skills will be required of users and what support features and documents will be provided with the system to assist with training.

marketeers need to know that the system will meet the needs of customers (current or future).

purchasers/buyers need to know what activities will be supported and what performance can be expected.

Group 2: developers are composed of:

Designers need to know what to specify in their designs, and how the designs will be evaluated (i.e., what performance targets have been set).

implementers need to know what to build and how it will be tested.

marketeers need to know that the system will meet the needs of customers (current or future).

testers, documenters, and quiality control engineers need to know the standards to which the system is to be built.

(b) **[9 marks]** List the three different **contexts** in which the development process can take place, identify the relative degree of **formality and detail** normally present in requirements for each of the three contexts, and identify the key **stakeholders** and their **roles** for each context.

Context 1:

Perhaps the most common context these days is the product organization (companies such as Adobe, Alias|wavefront, or Microsoft) that are developing new systems for commercial sale. Especially when the applications involve novel applications, there may be only very sketch requirements documents to start with, with much of the detail evolving as a result of experience gained with early prototypes and initial versions of the product as they are shipped to customers. The clients are often a marketing team within the company, because users and other stakeholders are not yet identified, although whenever possible the marketing team will try to work with current customers or known early adopters. The developers are a team of designers and builders (programmers). Examples are Adobe Acrobat for distributing documents, Alias|wavefront Maya for 3D animation, and Microsoft Excel for financial and accounting spreadsheets.

Context 2:

Within a user organization systems may be developed 'in house' for internal use. The requirements documents are often fairly informal and less detailed, because there is an expectation that they will evolve during the course of the project. Both the clients and the developers work in the organization. Most often the clients are a committee of management and users, and the developers are an in-house software development team. An example of this would be Air Canada's Gemini system for airline reservations, which was originally developed for use by Air Canada and its affiliates, and later sold as a product to other airlines.

Context 3:

Contract development requires the most formality and detail in requirements documents because the clients are usually a user organization and the developers are an outside contractor hired specifically to design and implement the system, primarily to write the software. The requirements are often prepared by a third- party organization, such as a management consultant, hired specifically for that task. An example is the UBC Financial Management System, which was developed by PeopleSoft under contract to UBC.

(c) **[6 marks]** Discuss the differences between **validation** and **verification** of requirements by giving definitions for each and relating them to the **problem statement**, the **requirements documents**, and the **prototypes** that may be built as part of the design process.

Validation: This is often referred to as 'building the right system', in other words a requirements document that defines a system that will resolve the situation of concern that is part of the problem statement. Both analytical and and empirical techniques, although analytical techniques are preferred because they are often faster and can be used without having to build prototypes. When purely analytical techniques cannot be used, empirical testing using prototypes may be needed. This is the case most often when performance levels are being checked and there is no predictive model to estimate performance based solely on the design. In all cases the goal is to demonstrate that the system specified in the requirements document will resolve the situation of concern.

Verification: This is often referred to as 'building the system right',in other words a system that matches the requirements document. Standard verfication and testing techniques from software engineering can be used to verify correctness of the system (functional requirements), but performance requirements usually require testing (empirical studies). Usually this are done with the specification for the system (a detailed description that reduces the implementation to routine engineering tasks), or in some cases the actual system, although prototypes can be used if there is reason to believe that the final system will have similar performance. It is always important to state requirements in such a way that they can be verified. Valid requirements that cannot be verified are of no use in the design process.

Question #3 [12 marks total]

This questions tests your knowledge of the **ethical requirements** for research involving **human subjects**.

(a) Who provides approval when Requests for Ethical Review are submitted at UBC?

A university committee of researchers administered through the Office of Research Services, which reports to the Vice President Research.

(b) How long does it typically require to obtain ethics approval once the appropriate forms and attachments have been submitted?

Four to six weeks is the normal time required. The committee meets on a regular basis, so it depends a lot on when the request is submitted relative to the meeting schedule.

(c) List two types of documents that may need to accompany the forms requesting ethical approval.

There are many documents that may need to be submitted as attachments: samples of consent forms, questionnaires advertisements for subjects, approval certificates from external agencies, special deception forms describing any information that will be withheld from subjects and the debriefing process that will take place after the study, telephone contact forms, and samples of authorization and release forms for videotaping subjects.

(d) List three specific types of information that subjects have a right to know prior to their providing informed consent to participate in a study.

The principle of informed consent holds that subjects have a right to know and understand the purpose of the study, the procedures that will be followed in the study, any payment or other consideration they will receive for participating, the degree of confidentiality of any information about them that is collected, and contact information for obtaining more information about the study or to file any complaints they may have about the conduct of the study. They also have right to know any risks or discomfort involved, and that they have the right to withdraw at any time.

(e) What are the two types of release/authorization that may have to be obtained when videotaping of subjects is performed?

Permission must be obtained to record video information about subjects, which includes the use of the video for purposes of analysis in the study.

Separate permission is usually required to present the video either for purposes of training (such as in courses) or dissemination of the results of the research (such as at academic or professional conferences), and this must include a right to approve any editting.

(f) Do experiments conducted by students in a course using other students in the course as their subjects require submission of an ethics request?

No, ethics approval is not required in this case, although the instructor for the course does need to file an annual summary of the instructions provided to students.

Question #4 [48 marks − 2 marks each]

This question tests your general knowledge of the concepts and terminology introduced in the course.

The following terms or people's names are possible answers for the questions on subsequent pages. Use the number corresponding to a term or name below as an answer in the space provided if you think it is the **best** match for one of the concepts or definitions on subsequent pages. Each answer may be used once, more than once, or not at all.

(1) Chi Omega
(2) Chi-square test
(3) cognitive breakdown
(4) cognitive unit
(5) cognitive walkthrough
(6) construct
(7) draw straight-line segments
(8) ecological
(9) experimental hypothesis
(10) exploratory learning
(11) external
(12) face
(13) functional
(14) heuristic evaluation
(15) home hands
(16) internal
(17) key press
(18) keystroke level analysis
(19) mental preparation
(20) null hypothesis
(21) participatory
(22) performance
(23) point with mouse
(24) prototype
(25) response by the system
(26) statistical
(27) system model
(28) t-test
(29) type I
(30) type II
(31) WIMP
(32) Xanadu

For each statement below, write the **number** of the term listed on the previous page that **best** fits into the missing space marked by _____ in the sentence.

[2 marks each]

_14_ (a) A team of evaluators, usually three to five people, is employed in **heuristic evaluation** using a process of aggregation to produce a comprehensive list of problems.

_10_ (b) The theory of **exploratory learning** has four components: goal setting, exploration, selection, and assessment.

__5_ (c) **cognitive walkthrough** is a usability analysis method based on this four-component theory (goal setting, exploration, selection, and assessment).

_18_ (d) **keystroke level analysis** is a usability analysis method based on GOMS.

_13_ (e) Requirements that specify the activities or tasks that the system is supposed to support are **functional** requirements.

_22_ (f) Requirements that set targets for levels of user activity (such as speed, error rate, error recovery) that the system is supposed to enable are **performance** requirements.

_18_ (g) **keystroke level analysis** is a special case of GOMS that was devised by Card, Moran and Newell (1983).

_17_ (h) The symbol **K** was used by Card, Moran and Newell for their **key press** operator.

_25_ (i) The symbol **R***(t)* was used by Card, Moran and Newell for their **response by the system** operator.

_19_ (j) The symbol **M** was used by Card, Moran and Newell for their **mental preparation** operator.

__4_ (k) Card, Moran and Newell proposed that all but the first **M** in a string of **MK** operators be deleted if the string is a **cognitive unit**.

_24_ (l) Because many aspects of usability are hard to define in words, we sometimes include a **prototype** in the requirements document, even though it may have been built using totally different software than what will be used for the finals system.

[2 marks each]

_11_ (m) In an empirical study **external** validity asks whether the results generalize.

_26_ (n) In an empirical study **statistical** validity asks whether the results might be just a fluke.

__6_ (o) In an empirical study **construct** validity asks whether we are measuring what we think we are measuring.

_16_ (p) In an empirical study **internal** validity asks whether there are logical or causal relationships among what we are measuring.

__8_ (q) In an empirical study **ecological** validity asks whether the results are realistic.

_12_ (r) In an empirical study **face** validity is another name for asking whether the results are realistic.

_20_ (s) When we conduct an experiment and measure a dependent variable, we almost always see differences in measurements across experimental conditions. The **null hypothesis** is that any such differences are due entirely to variations among the population, and not to our deliberate change in the experimental conditions.

__9_ (t) The **experimental hypothesis** is that our change in the experimental conditions has had an effect, which is reflected in our measurements.

_30_ (u) A **type II** error occurs when we fail to observe a difference in the means when sampling from two distinct populations that have population means that differ − we don't find something that really **is** there.

_29_ (v) **type I** error occurs when we observe a difference in the sample means even though we are sampling from the same population − we find something that **is not** there.

_28_ (w) A **t-test** is a statistical test that can be used to determine how likely it is that two samples with different sample means are actually different.

__2_ (x) A **Chi-square test** is a statistical test that can be used to determine how likely it is that a questionnaire or survey has correctly identified people's preferences among a set of design options.