



**No electronic/communication devices are permitted.**

Students may take exam question paper away after the exam.

**Computer Science and Software Engineering  
EXAMINATION**

End-of-year Examinations, 2017

**COSC368-17S2 (C) Humans and computers**

**Examination Duration:** 120 minutes

**Exam Conditions:**

Closed Book exam: Students may not bring in any printed materials.

No calculators are permitted.

**Materials Permitted in the Exam Venue:**

Closed Book exam: Students may not bring in any printed materials.

**Materials to be Supplied to Students:**

1 x Standard 16-page UC answer book

**Instructions to Students:**

**Questions Start on Page 3**

1. User interface modes and Norman's model of interaction.
  - (a) (3 points) What is a user interface mode?
  - (b) (6 points) Sketch Norman's Model of Interaction and briefly explain the meaning of each of the elements in your sketch.
  - (c) (4 points) With reference to your sketch of Norman's Model of Interaction, explain the cause of mode errors.
  - (d) (4 points) With reference to your sketch of Norman's Model of Interaction, explain why designers are often blind to the usability of their designs.
2. Design and formative evaluation.
  - (a) (2 points) What is a user interface storyboard?
  - (b) (4 points) What are the key characteristics of a 'task scenario' (also known as a 'task description') in Task-Centred System Design?
  - (c) (6 points) Explain in detail, possibly with use of a clarifying figure, the process that is used to evaluate a user interface storyboard design with respect to a task scenario.
  - (d) (8 points) Imagine that you have been employed by TradeYou (a company that hosts online auctions) to help in the design of a mobile app for accessing their facilities, and that they have asked you to provide two task scenarios for the task of purchasing a car. Write the two task scenarios that you would provide to TradeYou.
3. Some HCI terminology.
  - (a) (2 points) Identify two key differences between saccadic and smooth pursuit eye movements.
  - (b) (2 points) Provide an example of a user interface activity that involves smooth pursuit eye movement.
  - (c) (2 points) What is proprioception, and provide an example user interface activity that involves proprioception.
  - (d) (3 points) In iterative user interface design, explain the key differences between *elaborative* and *reductive* design.
4. Formal evaluation.
  - (a) (2 points) Clearly describe the difference between within-subjects and between-subjects assignment to experimental conditions.
  - (b) (4 points) State two key reasons that experimenters often choose within-subjects assignment to experimental conditions rather than between-subjects.
  - (c) (1 point) Provide an example situation in which between-subjects assignment to experimental conditions is required.
  - (d) (3 points) What is the main experimental concern associated with within-subjects assignment, and how is the concern normally mitigated?
  - (e) (3 points) What is a null hypothesis?
  - (f) (3 points) As precisely as possible, state what the  $p$  value represents when calculated as part of a null-hypothesis significance test?
  - (g) (4 points) What is the 'file drawer effect' (a.k.a. 'bottom drawer effect') and how can it influence scientific knowledge?

## 5. Quantitative models of interaction.

In this question, the following  $a$  and  $b$  parameters may be useful for some of your calculations.

	$a$	$b$
Visual search time	150 ms	250 ms/item
Choice reaction time	200 ms	100 ms/bit
Pointing time	300 ms	200 ms/bit
Tunnel dragging time	200 ms	50 ms/unit

Note that  $\log_2(2) = 1$ ,  $\log_2(4) = 2$ ,  $\log_2(8) = 3$ ,  $\log_2(10) = 3.32$ ,  $\log_2(16) = 4$ ,  $\log_2(20) = 4.32$

- (1 point) Name the performance law that would normally predict the average time taken when using a mouse to move a cursor to a target of width  $W$  pixels at a distance  $A$  pixels away from the cursor's starting location.
- (3 points) Write the equation(s) predicting this pointing time. Identify all variables in the equation(s).
- (3 points) According to the values shown in the table above, on average, how long would it take a user to point to a 100 pixel wide target that has its centre 900 pixels from the cursor's starting location? Show all working.
- (1 point) Name the performance law that would normally predict the average time taken when using a mouse to drag a cursor through a tunnel of constrained amplitude and width (while keeping the cursor within the bounds of the tunnel).
- (3 points) Write the equation(s) predicting this constrained dragging time. Identify all variables in the equation(s).
- (2 points) According to the values shown in the table above, on average, how long would it take a user to drag a cursor through a tunnel that is 10 pixels wide and 300 pixels long? Show all working.
- (2 points) Name the empirical law that encapsulates the notion that some data items (commands, urls, applications, etc.) are used much more frequently than others.
- (3 points) Write the equation corresponding to this empirical law (i.e., the equation that explains what proportion of commands will be associated with the  $n$ th ranked command). Identify all variables in the equation.
- (2 points) Assuming that a command-set strictly conforms to this frequency law, and that the most frequently used command in the set occurs 1000 times, how many times would the fourth most frequently used command occur in the command-set?
- (2 points) Name the performance law that predicts the amount of time taken to make a choice between a set of options when the user is optimally prepared.
- (3 points) Write the equation(s) predicting this choice reaction time when all choices are equally probable. Identify all variables in the equation(s).
- (2 points) Write the equation(s) predicting this choice reaction time for item  $i$  with probability  $p_i$  in a set of items that are not equally probable.
- (3 points) According to the values shown in the table above, when optimally prepared, on average how long would it take a user to choose between 16 equally probable items? Show all working.
- (4 points) If a user needs to conduct a visual search to find a target item among a set of 16 candidates, on average how long will it take the user to visually identify the target? Show all working and state any assumptions.

**End of Examination**