Midterm Exam

Your name (please print):

This is a closed book, individual test. You are not allowed to use your notes, texts, or any electronic devices including laptop computers, calculators or cell phones.

You have 75 minutes for this exam. There are a total of 120 points.

Use your time accordingly. Before you begin, write your name on every page! You will lose 1 point if you do not do this.

If you find a question ambiguous, document the ambiguity. Indicate the way you interpreted the question in a set of separate sentences next to the question. The questions on the exam are not intended to be ambiguous, but sometimes another meaning is interpreted by the examinee that we did not take into consideration.
Q1: Short Answers (35 pts)

1.0 Did you write your name on every sheet? (1 pt)

1.1 Name the 3 main stages of the design cycle. (3 pts)

1.2 Describe 2 advantages of using a low-fidelity sketched storyboard over carefully designed high-fidelity images in the early stages of interface design. (4 pts)

1.3 What is a mode? What is a quasi-mode? Why are quasimodes preferable to modes? (6 pts)

1.4 What is a process? What is a thread? Explain the difference between them. (6 pts)

1.5 List the four key attributes of a direct manipulation system. (4 pts)
1.5 Label the 7 major parts and sub-parts of the human processor model. (7 pts)

1.6 Suppose that for Martians $\tau_{\text{perceptual}} = 800 \text{ms}$. At what framerate would movies have to play on Mars to give the illusion of smooth motion? (2 pts)

1.9 How many evaluators does Nielsen advocate using in heuristic evaluation? Why does Nielsen recommend this number? (2 pts)
Q2: Models of Human Performance – (20 pts)

Fitts’ Law:

\[ T = a + b \cdot \log_2 \left( \frac{D}{S} + 1 \right) \]

2.1 Explain Fitts' law by drawing a picture showing what D and S are and one or two sentences describing what Fitts' law models. Make sure you describe all of the variables in the equation. (5 pts)

2.2 List all of the assumptions of Fitts' law. (5 pts)
2.3. Suppose you are interested in extending Fitts' law to model pointing a 2D targets like the oval shaped button shown below. Describe all the things you would have to consider to extend Fitt's law to model such a pointing task.

Show your thought process! We will give partial credit for the right ideas (10 pts)
Q3: Event Processing (25 pts)

The following type of dialog box is common in many Windows applications.

![SharePoint Products Configuration Wizard]

WARNING: You are installing on Windows Vista or Windows 7, which are unsupported configurations intended for use on developer workstations only. This configuration should not be used as a production environment, or host any user content.

Consider how you would build this interface using WPF components and how events would be processed in this interface. You may find the following components helpful:

```xml
<StackPanel Orientation = {"Horizontal | Vertical"}
HorizontalAlignment = {Left | Right | Center}>
<Image>
<TextBlock TextWrapping = "Wrap">
<Button>
```

3.1 Create the dialog box using the components listed above. You may write XAML code or draw a tree diagram. Do not worry about getting the syntax perfectly correct. Also do not worry about visual styling. You do not need to write the entire contents of the TextBlock or specify an image source. For each element, specify the "Name" attribute. (10 pts)
3.2 Suppose the user clicks the "OK" button. How does the click event get delivered to the application? Trace the entire process from the user pressing the mouse button to the Sharepoint application receiving the event. (5 pts)

3.3 Say the user clicks the "OK" button. How does the application choose the UI component that gets this event? If the click event on the "OK" button is a bubbling (or bottom-up) event, in what order do the components get checked for a click event handler? You can use the "Name" attribute from your components in part (3.1) to specify the components. (5 pts)

3.4 If the click event on the "OK" button is a tunneling (or top-down) event, in what order do the components get checked for a click event handler? (5 pts)
Q4: Quantitative Evaluation (20 pts)

Your company is designing a new computing device and wants to use the scientific method (i.e.,
hypothesis testing) to compare effectiveness of three different text entry methods: 1) a multitouch
keyboard (multitouch), 2) a physical keyboard (keys), and 3) handwriting recognition (writing).

4.1 State 2 different testable hypotheses. For each hypothesis state 1 independent variable and 1
dependent variable. Make sure that your independent variable has at least three levels and also
make sure the dependent variables differ between hypotheses. For each hypothesis state the
corresponding null hypothesis (10 pts).

4.2 Pick one of your hypotheses and think about an experiment you would conduct to test that
hypothesis. Describe two control and two random variables in your experiment. (6 pts)

4.3 What is the difference between measuring effect size and testing statistical significance? (4 pts)
Q5. The Fat-Finger Problem. (20 pts)

One drawback of multitouch interfaces is that small buttons can be difficult to access because of occlusion by the user's finger. In the example figure on the right, the interface contains a 3x3 grid of small buttons and the user wishes to access the center button, but because the finger is much larger than the buttons the user cannot see the button being accessed.

Brainstorm 2 different techniques to solve this so-called "fat finger" problem. Your solutions can be either software or hardware based, but they must allow the user to access on-screen buttons using their fingers. Describe each solution in a few sentences (we prefer succinct, but clear descriptions) and use drawings to help us understand your proposed techniques.

Solution #1 (10 pts)

Solution #2 (10 pts)