University of California San Diego
Department of Computer Science
CSE165: 3D User Interfaces
Winter Quarter 2017
Midterm Examination
Thursday, March 2nd, 2017

Name:_____

This is closed book exam. You may not use electronic devices, notes, books or other written materials.

Good luck!

Do not write below this line

Exercise	Max.	Points
1	10	
2	10	
3	10	
4	10	
5	10	
6	10	
7	10	
8	10	
Total	80	

1. Input Devices (10 Points)

a) Name one advantage and one disadvantage electro-magnetic tracking has over optical tracking. (2 points)

b) Name one special purpose or application-specific 3D input device and explain what it was designed to be used for. (1 points)

c) The Nintendo Wii Remote and the Microsoft Kinect can be considered the first big successes for 3D user input devices in the gaming industry. Name three fundamental differences between them. (3 points)

d) The Oculus Touch controllers and the Leap Motion are popular 3D input devices for virtual reality applications. Name two advantages and two disadvantages the Touch controllers have compared to the Leap. (4 points)

2. Selection and Manipulation (10 Points)

a) Circle the following technique(s) which are/is categorized as egocentric metaphor(s)? (2 points)

Go-Go
World-in-miniature
Scaled-world grab
Image plane

b) Circle the technique(s) which work(s) about equally well to select objects that are less than and more than an arm's reach from the user? (2 points)

Go-Go
Two-Handed Pointing
Virtual Hand
Ray-Casting

c) Which three of the following selection methods are best suited for selecting an almost entirely occluded object without manipulating other objects in front of it or shifting the user's position? Circle them. (3 points)

Ray-Casting
Go-Go
World-in-miniature
Image plane
Two-Handed Pointing
Flashlight
Virtual Hand

d) How would you design the interaction of opening a door with a door handle using an Oculus Touch controller in terms of which of the controller's degrees of freedom are being processed? Distinguish three phases: selection of the door handle, pushing the handle down, pulling on the handle to open the door. (3 points)

3. Wayfinding (10 Points)

Chell made a game in which the user has to find seven shiny eyeballs on a virtual planet called Namek. Planet Namek has some trees, houses, and roads. When the user “travels” a road, footsteps are made on that road. The user has a portable radar on which the user is represented as a red dot in the dead center and the eyeballs as yellow dots with relative distances. The user can also choose between first-person mode and third-person mode.

a) Name two wayfinding methods that Chell implemented in this game. What does each of them help the user do? (4 points)

b) The trees and houses on Planet Namek are life-sized. Explain why these life-sized objects can be helpful for wayfinding. (2 points)

c) Chell invites her friend Wheatley to play her game. Wheatley has never played this game before so it’s his first time exploring Planet Namek. Between egocentric and exocentric reference frames, which should Chill recommend to Wheatley and why? Name at least two reasons. (4 points)

4. Pokemon VR (10 Points)

a) In class, we discussed the following categories of travel techniques:

- Physical locomotion (“natural” metaphors)
- Steering techniques
- Route planning
- Target-based techniques
- Manual manipulation
- Viewpoint orientation techniques

It’s Pokémon’s 21st birthday and you, as a trainer, are on a hunt for the special edition Pikachu. You are in a 3D virtual world, where the nearest Poke Stops within a 200-meter radius are visible on the map. Pokémon could randomly spawn anywhere. You are playing the game with Oculus Rift and either Leap Motion or Oculus Touch (too poor to afford locomotion devices). For each of the following, identify one good and one bad travel technique and specify why it is good/bad for that specific task.

1) Approach a targeted Poke Stop in shortest path. (2 points)

2) Visit all reachable Poke Stops along library walk. (2 points)

3) Look out for festive Pikachu on the road (during active travel). (2 points)

4) Walk around the giant Snorlax to select and catch the festive Pikachu. (2 points)

b) For each scenario below, circle the search task which is MOST suitable for it. (0.5 points each)

1) A trainer walks around the virtual world, looking for a festive Pikachu that could randomly spawn anywhere.

    a. Exploration
    b. Naiive search
    c. Maneuvering
    d. Primed search

2) A trainer decides to walk to the closest Starbucks poke stop, which is shown on the map.

    a. Exploration
    b. Naiive search
    c. Maneuvering
    d. Primed search

3) It’s the trainer’s first time to visit virtual Japan, so she spends the whole afternoon seeing new streets, Poke Stops and Pokémon.

    a. Exploration
    b. Naiive search
    c. Maneuvering
    d. Primed search

4) A trainer realizes he is a few steps away from activating the Poke Stop for items, so he must move forward a little.

    a. Exploration
    b. Naiive search
    c. Maneuvering
    d. Primed search

5. System Control (10 Points)

a) You want to switch between different modes within an application. For example, you want to be able to switch between traveling, selecting, or manipulating. Describe one advantage and one disadvantage when using a virtual tool belt or gestures to implement this task. (Describe for both tool belt and gestures.) (4 points)

b) With the exceptions of tool belt and gestures, give two different methods for system control and then for each one give a brief explanation on how they are used to implement system control for an example of your choice. (4 points)

c) Graphical menus for system control can be displayed in a number of different coordinate spaces. Come up with an example for a graphical menu (describe what it would be used for) that would best be placed in the coordinate space of an object in the scene, and one that would best be placed in the coordinate space of the 3D controller. (2 points)

6. Symbolic Input (10 Points)

a) Name four examples of what a 3D application may need symbolic input for. (4 points)

b) Name three different ways of allowing symbolic input in a 3D application. For each of them give one advantage it has over the two other methods. (6 points)

7. 3D UI Design (10 Points)

a) Name and explain an example for Feedback Substitution and describe what feedback is substituted for what. (3 points)

b) Describe a 3D UI application in which two-handed interaction is preferable over one-handed interaction. (3 points)

c) Name two disadvantages of two-handed controller-based applications compared to using a single controller. (4 points)

8. Virtual Reality (10 Points)

a) Come up with and describe one application for which a virtual reality system with 6 DOF 3D input (for instance, an Oculus Rift with Touch controllers) is significantly better suited than a traditional PC with mouse and keyboard. (5 points)

b) List three specific elements of the above described application which benefit from the VR hardware and explain why 3D input is superior to mouse and keyboard in these cases. (3 points)

c) For the application described in part a), based on your experience with the homework projects, would you recommend using the Oculus Touch controllers, or rather the Leap Motion? Explain why. (2 points)