University of California San Diego
Department of Computer Science
CSE165: 3D User Interfaces
Winter Quarter 2018
Midterm Examination
Thursday, March 1st, 2018

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. Universal 3D Interaction Tasks (10 Points)

a) Name the **five** universal 3D interaction tasks we cover in class, along with an example for **each** of them. (5 points)

b) Navigation can be broken down into **two** components. **Name** each of them and briefly **describe** their differences. (2 points)

c) Which **three** of the universal 3D interaction tasks do you think differ the most from their 2D interaction equivalents, and **why**? (3 points)

2. VR Application Domains (10 Points)

Which are, in your opinion the top **five** most important **application domains**, and why? Also mention a typical **example** for each of them.

Most important:

2nd most important:

3rd most important:

4th most important:

5th most important:

3. Selection (10 Points)

a) Name **two** typical examples for 3D selection. (2 points)

b) Name **two** parameters that influence how easy it is to perform a 3D selection. (2 points)

c) We can distinguish between isomorphic and non-isomorphic selection tasks. Explain what the **difference** is between them. (2 points)

d) Explain how the selection methods of "**Ray Casting**" and "**Virtual Hand**" differ from each other. Give an example for **each** of them for a scenario where it works better than the other. (4 points)

4. Manipulation (10 Points)

Assume that you are creating a 3D interior design tool. You are working on the problem that the user wants to slightly turn an object that is farther than an arm's length away, for instance a TV screen that's attached to the wall with an articulated arm.

a) Compare three manipulation methods to accomplish the above goal: **Ray Casting**, **Virtual Hand**, and **Voodoo Doll**. Describe for each manipulation method exactly what the user has to do to adjust the screen to point in a different direction. (9 points)

b) Which of the three methods would you prefer and why? (1 point)

5. Degrees of Freedom (10 Points)

a) In our world, how many **degrees of freedom** do we deal with on a daily basis? (1 point)

b) Name and briefly describe **each** of these degrees of freedom. (6 points)

c) How many degrees of freedom to position the cursor on a computer monitor does a typical **computer mouse** have? (1 point)

d) Describe the difference between **absolute** and **relative** degrees of freedom and name an **example** for an input device for **each** of them. (2 points)

6. 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)

7. Wayfinding (10 Points)

Assume you have been tasked with designing a scuba diving simulator for VR with the Oculus Rift and Touch controllers. The application is targeted towards experienced scuba divers who are going to a new coral reef location they have never been to before. The simulator is supposed to prepare them for this new environment, which besides **special corals in specific locations scattered about the area** also contains areas with **dangerous currents** and other areas with **sharp edged rocks** that are to be avoided. It is also important for the divers to keep track of the **amount of oxygen left** in their tanks because they need to get **back to the starting point** before they run out of air.

Come up with a wayfinding design which gives the users of this training system the necessary information on their virtual dive to find or avoid the things highlighted in bold face above. For each wayfinding aid, explain what it could look like, and what coordinate system it should be displayed in (e.g., controller, head, body, environment).

[Extra space for problem 7]

8. System Control (10 Points)

In a VR application you are creating, you want to allow the user to be able to place furniture in a large space, such as a computer lab.

a) You are torn between the following three system control methods to accomplish this task: a **graphical menu** anchored in the virtual world, a **virtual tool belt,** and **voice input**. Describe each of the three methods. (3 points)

b) Name **one advantage** and **one disadvantage** for each of the above three system control methods that it has over the other two. (6 points)

c) Which one of the above three methods would you choose for your interior design application **and why**? (1 point)