Computer Applications (029511-1) Fall 2008 Final Exam
Dankook University, College of Engineering, Computer Division, Multimedia Engineering

The final exam will be a take-home exam, handed out on Monday December 8th in class, and due by Monday December 15th by 6:00 PM. Please, turn-in via electronic mail by emailing MS Word doc or Adobe Acrobat pdf file to the instructor, kpark@dankook.ac.kr. Please put your name and student ID on the exam you turn in.

This is an individual exam, to be completed without the aid of other students in the classroom. All of your answers should be in your own words using complete sentences, NOT just spitting back quotes from publications, books, lecture notes, or web pages. Answers that are direct copies of sentences from the book will NOT receive full credit. In answering the exam questions, it is crucial that you use citations of readings and outside publications that are relevant to your arguments (except the lecture notes from this class).

The question 1-6 will require short written responses (approximately 2~3 pages). The question 7-9 will require longer (approximately 3~5 pages) written responses. The questions will ask you to go into detail on a particular topic, and also to make some argument or new application of your knowledge.

1. The position tracking system, which is a key component to provide immersion in VR, measures the real-time 3D position and orientation of user in a virtual environment. Compare and Contrast the characteristics of the following tracking methods: electromagnetic, mechanical, ultrasound, optical, and inertial. (5 points)
2. Describe the characteristics of the following 3D displays: hologram, volumetric, stereoscopic (optics, passive polarization, active shuttering, and auto-stereoscopic). Give an example of each type of display. What are the advantages and disadvantages of each system? (5 points)
3. Define the terms ‘accommodation (focus)’ and ‘convergence’. Explain why ‘accommodation-convergence mismatch’ is happened in stereoscopic-based virtual reality displays (such as HMD and CAVE). Explain the safety and usability issue of using such displays. (5 points) Explain the principles of volumetric displays and holographic displays which enable true 3D image visualization. (5 points)

4. Describe the ‘dead reckoning’ algorithm that is widely used in distributed virtual environments. What are the advantages and limitations of this algorithm? (5 points). Describe the detail implementation of this algorithm and three convergence methods (snap convergence, linear convergence, spline convergence) to correct inexact prediction in dead-reckoning algorithm. (5 points)
5. What is the registration problem in augmented reality? Describe why it is important and yet difficult to achieve. (5 points) Compare and contrast the optical see-through HMD and video see-through HMD in augmented reality. What display should be used in the manufacturing AR application and the medical AR application? (5 points)
6. Describe the mechanoreceptor, thermoreceptor, and nociceptor tactile cues. Give a few representative examples of haptic interfaces for each tactile cue. (5 points) Explain ‘active touch (a subject feels the object)’ and ‘passive touch (an object is placed onto the subject’s skin)’ in human perception. What are the advantages and disadvantages of active vs. passive touch for haptic simulation in virtual environments? (5 points)
7. Read LaViola’s paper “Case Studies in Building Custom Input Devices for Virtual Environment Interaction”, and summarize it in 1-page (5 points). Then, compare and contrast these custom input devices to Wiimote with 3D user interaction techniques (like ‘Virtual hand’, ‘Ray-casting’, ‘Go-Go’, and ‘HOMER’) used in virtual environments. (5 points)
8. **Location Based Game (LBG)** is a means of playing a game using technologies like Global Positioning System, motion tracking, and Bluetooth networking that combines player’s real world context with a virtual world on the handheld devices. Some examples include Geocaching, Shroud, BotFighters, Undercover, Mogi, Uncle Roy All Around You, Pac-Mahattan, Sword Fish, and so on. LBGs are similar to board games in design but are played across city blocks instead of in living rooms. The physical location becomes part of the game world, and the players’ locations and actions in the real world affect the game states and the environment. However, the challenge for the LBG developers remains how to milk the location phenomenon to enhance the gaming experience. Will gamers want to play this game? Research a subject of your interest on LBG and then write a report about work(s) shown there. The answer should be a 3~5 page summary, including pictures and references. Please describe in detail about your general feeling (such as fun or bored), critique (such as its strengths and

weaknesses), compare and contrast it with other standalone video game or online MMORPG games. (20 points)

9. Suppose that you are designing the user interface for a **mixed reality museum tour guide system**. This system allows on-site visitors to receive AR-based interactive tour guides for a special exhibition 'Memories through the Years a Farmer's story' in The National Folk Museum of Korea, take a picture of items, query a specific item of interest (such as, 쟁기, 풍구, 홀태), get a recommendation for the next items to visit, and track ones' navigational path. In addition, this system allows online users from all over the world to interact with other online users as well as on-site museum visitors. Assume that the precise indoor location tracking system is already installed in the museum. Specify a handset (or a wearable device) that you wish to design, and then describe the user interface you would recommend for this mixed reality museum tour-guide system, including input and output devices, interaction techniques for travel, selection, and system control, as well as wayfinding aids. Compare and contrast your design with two other interactive museum guide systems. Please attach the references (in pdf) you used. (20 points)