University of Canberra

Faculty of Science and Technology

END-OF-SEMESTER TEST

SEMESTER 2, 2023

UNIT NAME: AR/VR Data Analysis and Communication

UNIT NUMBER: 11464 & 11524G

TIME ALLOWED: 12 hours

This End-of-Semester Test is an alternative assessment item to the originally planned final exam. This test is an untimed, open-book test delivered via Canvas. The test will primarily test your ability to integrate what you have learnt and, hence, most of the questions are open text questions. Please answer these in a concise manner.

Instructions

- Any work submitted should be your own individual thoughts and should not have been submitted for credit in another course unless you have prior written permission to re-use it in this course from your lecturer.
- The code is the complete original work of the students.
- Submit your answers individually (<mark>do not submit a .zip file – 20% penalty</mark>), name all your files accordingly e.g., studentname_id.doc, studentname_id_Q3.r, or studentname_id.html.
- **For any code:**
    - Each answer should be provided in a single file.
    - A short description of how your program works (e.g., expected inputs, outputs) as comments should be provided at the beginning of each file.
    - Consistent indentation.
    - Your code should not include hard-coded directory paths (e.g., C:\Raul\MyFolder\Code\).
    - If needed, add a separated HTML file in your submission. Do not mix R scripts with HTML code within the same file.
    - Missing any of the previous points will result in **5% penalty deduction** for each of the missing points not included.
- <mark>**Plagiarism is a serious offence and will not be tolerated.**</mark>
- **Extension**: no extensions. To ensure the equity and fairness to the majority of students who perform on time, a new exam with the same duration (12hrs) will be given for those who have genuine and exceptional circumstances. Here you can find the required documentation needed https://www.canberra.edu.au/current-students/forms

Topic 1 – General AR/VR Knowledge. (15 marks)

There are 3 questions in this topic, each with different mark.

1. In under 100 words, as covered in our lectures, which two prominent industries played pivotal roles in driving the early development of AR/VR technologies? Explain your answer. **(4 Marks)**

2. In under 100 words, briefly explain in your own words the following diagram. **(4 marks)**
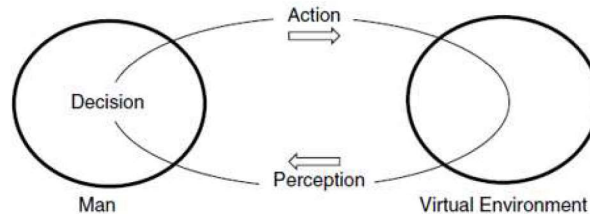
3. Imagine that you work for a software development company, you have given the task to develop a VR or AR solution for a client. In this project you need to propose the use of one (not both) of these technologies (AR or VR) to solve the client's problem. The client's problem is the need to improve the learning experience in literacy classes, the teachers need to be able to control the learning situation, so the students (year 4) can get a better understanding of certain aspects of the experience. Currently, the teachers show some examples using media such as documentaries or presenting images with projectors. After initial meetings with the client, you have collected the client's requirements, that will help you guide the design towards the most appropriate execution. Requirements:
   - There are 20 students (in average) per group, there are three groups. The groups can take turns to use the system.
   - The school has 20 laptops, 20 iPads, 20 Oculus Quest, and 20 HoloLens 2 that can be used for any of these applications.
   - Ideally, the students need to concentrate in the content. So, learning experience is a priority.
   - Interaction with content is needed, so students can change parameters and visualise the content from different angles.
   - Students could share same device, but a device per students should be prioritised.
   - Feel free to liberally make other assumptions as needed for the purpose of this example.

   Using the above information, evaluate your project by answering the following questions:

   a) What technology would you choose (VR/AR) and why? **(2 marks)**

   b) What are the benefits (describe at least 3) of your proposed system against traditional teaching methods? **(3 marks)**

   c) What should the end-user experience be? **(2 marks)**

Topic 2 – Data Analysis and Visualisation. (41 marks)

There are 2 questions in this topic, each with different marks. All R/HTML code needs to be submitted separately. The use of hard-coded paths is penalised.

4. Create an interactive user interface (a ShinyApp) that displays content in a sidebar layout of the attached dataset, where the sidebar panel is on the left and the output (plots) is on the right. The app needs to do display the following:
   a) It needs to read the file "dataset_shinyapp.csv". **(2 marks)**

b) It needs to include a single boxplot presenting the distribution within each category (HIGH_HAND, HIGH_LEG, LOW_HAND, LOW_LEG), on the output panel. Remove background colour and gridlines. **(7 marks)**

c) In the input side, add a check box to allow the user to select the categories. The user will have the option to select the number of categories (1-4) to be displayed in the boxplot. For instance, if the user checks two boxes, only two categories will be displayed in the boxplot. **(3 marks)**

d) In the input side, add a slider that controls the number of samples (Experiment_ID) that should be displayed in the box plot. For instance, if the user choses the range 70-89, only 20 samples will be displayed. **(3 marks)**

e) Also in the input side, add a slider that controls the data range for each category (4 sliders in total) and where the user can adjust the minimum and maximum value to be plotted for each variable. For instance, the slider for "HIGH_HAND" could be adjusted from 6 to 10 and if the user changes the slider to 8, then the boxplot will only show those data points from 6 to 8 for this category. Note that each category has different data range. **(4 marks)**

f) The mean value and standard deviation for each category should appear under the boxplot, on the output panel. **(4 marks)**
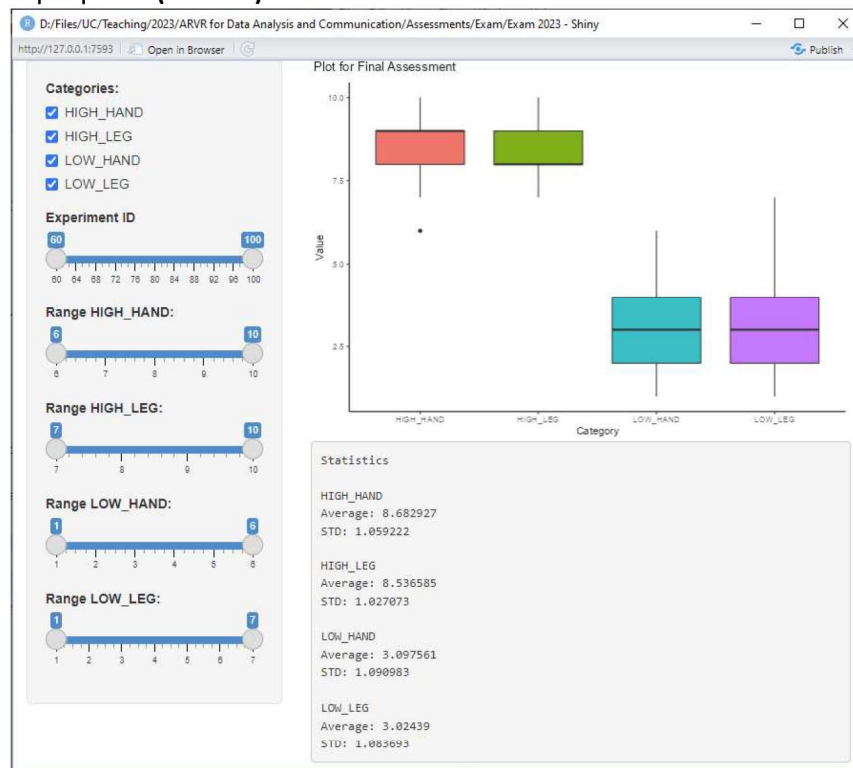
5. As data engineer, you have been tasked to visualise a dataset in a virtual environment (VR). After analysing the data (dataset_aframe.csv), you decided to plot a three-dimensional scatterplot with A-Frame. Your tasks are **(18 marks)**:

a) Prepare your data to be plotted in the right format in R file. Consider only three variables and with a bubble size of 3. Assign a distinct colour (e.g., red, green, blue, yellow) to each type of observation (target variable). For instance, rows 2 to 11 can be represented in red, and rows 12 to 21 in green.

b) Using A-Frame, include the data you have organised in the previous step in your HTML file. Use a forest environment with 100 mushrooms in the background. Example below.

c) You should submit both files.
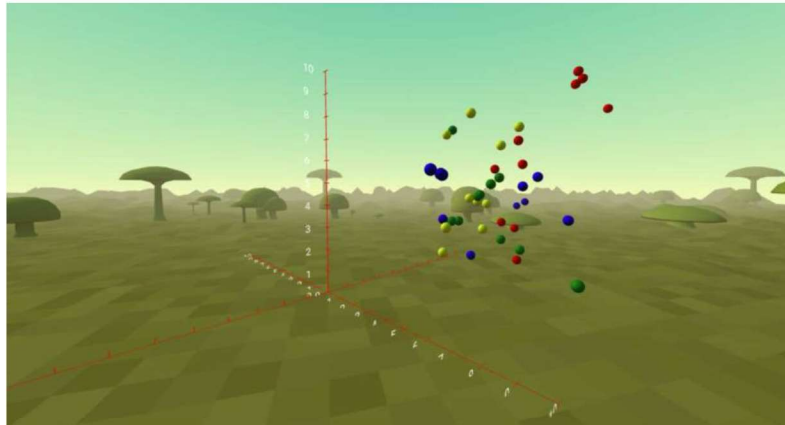
Topic 3 – Data Visualisation and Communication. (44 marks)

There are 2 questions in this topic, each with differing marks. All code needs to be submitted separately. The use of hard-coded paths is penalised.

6. The following graph and table show the breakdown of new clients by tier for the recent year. Answer the following questions.
   a) List five visual elements that are not ideal about this graph, elements that make it challenging to understand for your audience. **(2.5 marks)**
   b) For each of the five things you have listed, describe how you would overcome the identified challenges. **(2.5 marks)**
   c) Using the data provided in the plot, create your own **visualisation in R** that puts into practice the solutions you have described. Embed the dataset into your code and attach the R code in your submission. Use colour to draw attention to a single feature in your visualisation that you deem significant, remaining elements should be pushed to the background. **(15 marks)**

7. Imagine you work as a data analyst for a pharmaceutical company, with research centres in several cities. This company has carried out a clinical test for a new vaccine in the last five years. The head of R&D office has contact you to help understand the patient's data and communicate your findings. Your work will help R&D make decisions on the use of the new vaccine. Your

analysis has shown that the new vaccine had increased cholesterol levels across all test groups (A-M).

You want the head of R&D to understand the trend in cholesterol rates and use that information to determine the best way forward to stop the increase of this trend. You are planning to share this analysis at an upcoming meeting. You have visualised the cholesterol rates of all patients in four different ways, as shown in the image below. Spend a moment familiarizing yourself with the data, then complete the following:

a) Create the Big Idea for your communication. Feel free to liberally make assumptions as needed for the purpose of the exercise. **(3 marks)**

b) Now, think about the narrative of your story. What pieces of information will you need to provide to your audience? What tension exists for the audience? What does your analysis suggest that resolved this tension? With these in mind, create a story (just the 5 main points) that resembles the narrative arc (plot, rising action, climax, falling action, ending). **(5 marks)**

c) Think back to the Big Idea you designed in the first step. Which of the graphs below reinforces your message best? Briefly explain your rationale. **(3 marks)**

d) Assume you want to use the plot you chose in the previous step. How could you use colour and words to make the main takeaway clear (e.g., to highlight the average value) to make the plot? Using the data below, create the **plot in R**. Embed the dataset into your code and attach the R code in your submission. **(13 marks)**

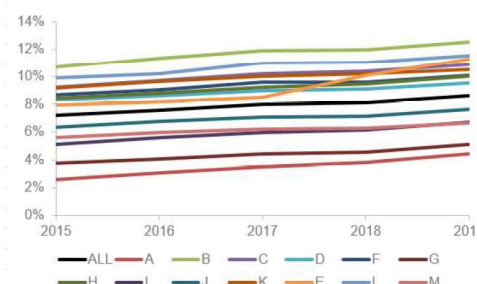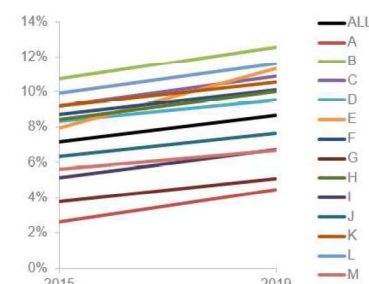**Cholesterol rates by research centre:** 4 views of the same data

OPTION A: Bars

OPTION B: Separate lines
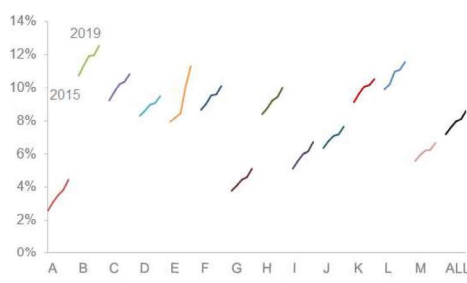
OPTION C: Standard line graph

OPTION D: Slopegraph

Dataset:

Research centre	2015	2016	2017	2018	2019
ALL	7.2%	7.6%	8.0%	8.1%	8.6%
A	2.5%	3.0%	3.4%	3.7%	4.4%

B	10.7%	11.4%	11.9%	12.0%	12.5%
C	9.2%	9.7%	10.2%	10.4%	10.9%
D	8.3%	8.6%	9.0%	9.1%	9.5%
E	7.9%	8.2%	8.5%	10.1%	11.3%
F	8.7%	9.1%	9.6%	9.6%	10.1%
G	3.7%	4.0%	4.3%	4.5%	5.0%
H	8.4%	8.8%	9.2%	9.5%	10.0%
I	5.1%	5.6%	6.0%	6.2%	6.7%
J	6.4%	6.8%	7.1%	7.2%	7.6%
K	9.2%	9.7%	10.1%	10.2%	10.5%
L	9.9%	10.2%	11.0%	11.1%	11.6%
M	5.6%	6.0%	6.2%	6.3%	6.7%

END OF ASSESSMENT.