AE2223-2 Experimental Research 2020 – Assignment 2

This is the second group assignment on the topic Experimental Research in the course AE2223-2. It contributes 10% towards your final grade and is a group grade.

INSTRUCTIONS

You must complete this assignment jointly with the students in your group in course AE2223-2. The assignment has been divided in 4 questions so that you can work in sub-groups of 2-3 students on the different questions.

Title page. 1 page. On the front cover of the assignment, you must include the following information:

- Course Number and Name
- Assignment Number
- Your Group Name
- Student IDs and Names of all students in your group
- Brief description of the contribution of each student the group to completing the assignment.

Answer pages.

- Start each answer on a new page
- Required length per question is between 1½ and 3 pages
- You are expected to research your own material to answer some parts of the questions
- You may include pictures, graphs if it helps in answering the question

References

- You are expected to include references to your sources
- Maximum of 1 page for references

ASSIGNMENT QUESTIONS

Q2a. Experimental Design (25% of assignment grade)

This questions explores the advantages and disadvantages of different experimental designs.

- Parallel experimental design is the most commonly used method. How would you use this method to analyse 20 single seater aircraft from different manufacturers for their aerodynamic performance at 5 different angles of attack. **Define your hypothesis!** *You may assume you have the very expensive large wind tunnel facilities to perform this full scale testing!*
- Before starting the testing, further budget and a second wind tunnel become available and you decide to combine the crossover approach with the full-factorial approach. Define the washout period. How many tests would you perform? Provide a test schedule for the 2 wind tunnels for the technicians performing the tests giving the testing order, aircraft number and angle of attack.
- The testing starts on Monday morning and proceeds at a rate of 1 test per hour (8 tests per day) in each wind tunnel. After 2 days, you are informed that you must complete the testing in 80% of the scheduled testing time. Make a revised planning using adaptive experimentation that allows you to complete the testing. Give a convincing explanation of how you are able to answer the hypothesis when using the revised testing schedule.

Q2b. Probability Distributions (25% of assignment grade)

This question is about unwanted influences in a test.

- Roll a dice once and plot the result as a probability distribution. Explain why the result does not follow a normal distribution?

- Next roll a dice 2, 4, 8, …, 256 times and plot the probability distributions. Explain why the deviation from a normal distribution varies with the number of dice rolls.
- You take a special dice used from a children's game. This has the numbers/labels 1, 2, 3, 4, OUT and 6. In the game you roll the dice and if you get a number you add it to your score, if you get *OUT* you lose a life. What is the average score you would expect to achieve before losing a life 10 times in the game? Comment on any other observations about the results.

Q2c. Likelihood (25% of assignment grade)

You are in the maintenance area of an airport and you would like to calculate the likelihood of different events occurring.

- The maintenance area of the airport is not fully secure and it is estimated that 1% of persons present (fake persons) have not passed through the security check. You are a security guard and perform random checks on id cards. What is the chance you find a fake person in a random check by taking into account other factors you find reasonable? Explain your reasoning.
- A fake person who evades your security check in the previous sub-question starts to repair the aircraft. He/she has a skill level which gives a 10% chance of performing a correct repair. What is the probability that all aircraft are correctly repaired during your 8 hours shift? You may assume that 100 maintenance staff work in the hanger, a real maintenance technician has 99% repair accuracy and that each person makes 1 repair every two hours. Explain your reasoning.
- The fake person hides in the toilets overnight and is ready to start his/her shift the next morning on Saturday morning. The fake person is a quick learner and now has a 20% chance of performing a correct repair. What is the new probability that all aircraft are correctly repaired during your 8 hours shift? Explain your reasoning.

Q2d. Decision Making (25% of assignment grade) – REVISED QUESTION

This question considers the statistics of decision making

- Three cards are drawn from a pack of 52 cards. The gambler turns over one of the three cards. Should he/she choose this card or select one of the other 2 cards. Explain the statistics of the problem.
- Give a definition of a Type-I and a Type-II error in choosing a playing card.
- There are 30 aircraft in the parking lot. Person A can see 10 aircraft from the terminal building. He/she chooses the aircraft with the largest wingspan. Person B can also see 10 aircraft from a different part of the terminal building. He/she chooses the aircraft which can carry the most number of passengers. What is the chance that Person A and Person B choose the same aircraft?

DEADLINE:

Sunday 8th March 2020 at midnight (24:00)

DELIVERY

Answer all questions in the assignment and complete a written report, using figures if necessary. The report must be uploaded as a PDF to BrightSpace by the deadline.