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. Speed Dating (25% of assignment grade)
This question considers the statistical aspects of dating.

- The first sub-question concerns dating on a TV show. Three women are hidden behind three doors. The man chooses a door, it opens and he sees a woman. The gameshow host gives the man the choice of choosing this woman or choosing one of the other 2 doors. What should he do if he wants to choose the most beautiful woman? Explain the statistics of the problem.
- Give a definition of a Type-I and a Type-II error in speed dating.
- Now consider a male-female speed dating evening in Delft where there are 30 women and 30 men. Each person gets to meet 10 randomly selected persons of the opposite sex. At the end of the evening each person chooses either 1 person they met or nobody. What is the chance that someone chooses their ideal partner (from those present) and what is the chance that 2 persons choose each other? Explain your reasoning.

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.