**INTERNATIONAL
UNIVERSITY OF
APPLIED SCIENCES**

ADVANCED WORKBOOK

Task for: DLMAIIAC01 – Inference and Causality

Task 1:

In the context of Bayesian statistics, scrutinize and compare the practical applications of a conjugate prior distribution with those of a Jeffrey prior distribution. Examine how the selection of a prior influences posterior computation and delve into the ramifications this choice may impose in a real-world scenario.

Task2:

Explain the concept of Granger causality in the context of time series data. Use an example of stock market analysis to demonstrate the concept in an application and the implications of finding a Granger-causal relationship.

Task 3:

Describe the concept of "confounders" in the context of artificial intelligence (AI) and elaborate on how addressing confounders can aid in machine learning model interpretation and reliability. Include a discussion of a technique used in AI for adjusting for confounders.

Task 4:

Consider an educational platform that detects student disengagement and sends motivational messages to improve their engagement. Explain how you would use the front-door criterion to determine the causal effect of these motivational messages on student engagement. Describe the two main variables, the mediator, and any necessary controls as well as the three conditions that must be met for the front-door criterion to hold.

Task 5:

Your task is to analyze the effect of diet on weight loss using observational data. Describe how missing values might affect your analysis and how imputation techniques that consider the causal structure could lead to different conclusions. Propose a causal approach to handle missing data and justify its importance in yielding consistent estimates.

Task 6:

Discuss the concept of collider bias in the context of a hypothetical study examining the relationship between stress, smoking, and heart disease. Explain why controlling for smoking in this scenario might lead to incorrect causal inferences and outline how collider bias can be identified and mitigated.