University of Lincoln Assessment Framework
Assessment Briefing Template 2025-2026

1. Module code & title	CMP9794M Advanced Artificial Intelligence
2. Assessed learning outcomes	• [LO1] Critically appraise a range of AI techniques for knowledge representation, reasoning and decision-making under uncertainty, identifying their strengths and weaknesses, and selecting appropriate methods to serve particular roles. • [LO2] Design and develop a software algorithm for solving complex AI problems in an application domain of interest.
3. Assessment title	Fraud Detection and Medical Diagnosis using Probabilistic AI
4. Contribution to final module mark (%)	**50**%
5. Description of assessment task	This is Assessment Item 1 and is an individual assignment. The task is to use materials covered during the lectures and workshops of this module to implement a software solution for Fraud Detection and Medical Diagnosis problems by performing probabilistic reasoning from data. The sources of data and random variables of each of these datasets are (click the hyperlinks): • **Fraud Detection** (synthetic, 50K instances): Transaction_ID, User_ID, Transaction_Amount, Transaction_Type, Timestamp, Account_Balance, Device_Type, Location, Merchant_Category, IP_Address_Flag, Previous_Fraudulent_Activity, Daily_Transaction_Count, Avg_Transaction_Amount_7d, Failed_Transaction_Count_7d, Card_Type, Card_Age, Transaction_Distance, Authentication_Method, Risk_Score, Is_Weekend, Fraud_Label (target) • **Heart Disease** (1025 instances): age, gender, chest pain type, BP, cholesterol, FBS over 120, EKG results, max HR, exercise angina, ST depression, slope of ST, number of vessels fluro, thallium, heart disease (target) Your task is to implement a solution to answer probabilistic queries such as `P(target|evidence)` as part of carrying out probabilistic reasoning on the datasets above. The probabilistic methods you use should include at least one of the following: • Discrete Bayesian Networks • Gaussian Bayesian Networks • Gaussian Processes The methods above will be covered in the module and example implementations in Python will be provided during workshops. You are encouraged to make your own implementations of algorithms, to

	extend/reimplement the ones provided, or to find your own solution by using publicly libraries (such as bnlearn, pmgpy and gpytorch) if you wish to do so. In any case, your comparisons of methods should make use of metrics across both datasets to report and discuss your results. Your choice of solution, to be implemented in Python, should make use of the appropriate feature values—which can be discrete or continuous. Whilst your solution can have a wide coverage of methods, you can also focus on a particular aspect such as the following: (a) comparing discrete versus continuous methods, (b) analysing different algorithms for learning the structure of Bayesian networks, (c) comparing different implementations of the same algorithms, (d) comparing different algorithms suitable for continuous data only instead of discrete (or vice-versa), among others. It is important that you consider two main steps: (1) training—to infer the parameters of your models—using only training data, and (2) inference—to answer probabilistic queries and to quantify model performance—using only test data. For this purpose, it is recommended that you use cross-validation instead of a single data split, with K=5. Please justify your choice if you use a different number of splits or folds. Your solution and results need to be presented in a report. Whilst the algorithms included in your report can be those discussed and provided during the lectures and workshops, it is totally fine if you wish to provide any other algorithm not provided as part of the module—using your own code or using code from publicly available libraries. Please justify your choices of algorithms, metrics and/or libraries. You should compare the performance of these algorithms in terms of predictive power (classification accuracy), AUC (area under the curve) score, statistical metrics (e.g., Kullback-Liebler Divergence, Brier score, Expected Calibration Loss), training and test times (in seconds), among others.
6. Assessment submission instructions	This submission is: Individual work All work should be submitted by the deadline stated (see item 7 below). Any late submissions will be subject to a lateness penalty in line with the University policy. In cases of technical issues please email your assessment to: sepssubmissions@lincoln.ac.uk by the above deadline. Please include the module code and coursework title in the email subject. You must make an electronic submission of your work in **PDF format**, NOT MS Word, by using the assessment link on Blackboard for this component. You must attend the lectures and workshops for further details, guidance and clarifications regarding these instructions. Your submitted report should be a PDF file generated by one of the provided templates in MS Word or Latex via Blackboard. The report should be concise and limited to either **3 pages** total (including references) or 4 pages total (if an appendix is included). Your submission must also include a **video of up to 3-minutes** (in MP4 format or any other compressed format) explaining and/or highlighting key aspects of your solutions. Do not just read the code submitted, explain the interesting aspects of your solution instead. Use the tools of your choice to create your video—example tools among others include OBS Studio and MS Teams. Submissions that do not meet the specified page limit, omit the required source code or video, or fail to use the recommended template will not be marked and will receive a mark of zero. Support for the assignment will be available during the scheduled workshop sessions and surgery hours.

	Your code and video should be submitted as supporting documentation in a **ZIP file**. Please make sure that you submit **your own work** (writing, results) and not somebody else's, and that you acknowledge appropriately where needed. Failure to do so will incur plagiarism or collusion, which will the reported to the School for investigation of potential academic misconduct. If you are unsure about any aspect of this assessment component, please seek advice from a member of the delivery team. DO NOT include this briefing document with your submission, and please note that links will **NOT** be accepted under any circumstances. The **deadline** for submission of this work is included in the School Submission dates (Hand in Dates SPREADSHEET) on Blackboard.
7. Date for return of mark and feedback	Please see the **Hand In Dates.xls** spreadsheet. A*ll marks awarded are provisional until confirmed by the Board of Examiners.*
8. Feedback format	Written and numerical feedback will be provided via Blackboard, and additional feedback can be provided upon request in a meeting or via email.
9. Use of Artificial Intelligence (AI) in this assessment	In this assessment you are allowed to make use of publicly available resources including libraries or chatbots such as ChatGPT. However, the use of AI tools is not permitted in the generation of the final report for this assessment. Please note that your report should be written by yourself—even if parts of your solutions are derived from responses of a chatbot. In other words, **chatbots should only be used to increase your understanding instead of writing the assignment for you**.
10. Marking criteria for assessment	A Criterion Reference Grid (CRG) is used to evaluate your learning against a set of pre-defined criteria. ***Please note that all work is assessed according to the University of Lincoln Management of Assessment Policy and that marks awarded are provisional on Examination Board decisions which take place at the end of the Academic Year.***
11. Important Information on Dishonesty, Plagiarism and AI Tools	University of Lincoln Regulations define plagiarism as *'the passing off of another person's thoughts, ideas, writings or images as one's own...*'. Examples of plagiarism include the unacknowledged use of another person's material whether in original or summary form. Plagiarism also includes the copying of another student's work'. Plagiarism is a serious offence and is treated by the University as a form of academic dishonesty. For more information on examples of Academic Offences, please see the **Academic Offence Guidance**. The use of AI tools: Permitted as indicated in above in item 9. Please note, if you use AI tools in the production of assessment work **where it is not permitted**, then it will be classed as an academic offence and treated by the University as a form of academic dishonesty. Students are directed to the University Regulations for details of the procedures and penalties involved. For further information, see www.plagiarism.org