

PAPUR ARHOLIAD / EXAMINATION PAPER

LLEOLIAD / LOCATION:	ABERTAWE / SWANSEA
CYFNOD ARHOLIADAU / EXAMINATION PERIOD:	IONAWR 2026 / JANUARY 2026
LEFEL / LEVEL:	7

MODIWL / MODULE: ACCA7026 ARTIFICIAL INTELLIGENCE

AMSER / TIME:	2 HOURS (Use 1 ½ Not 1.5 for time)
CYFARWYDDIADAU / INSTRUCTIONS:	ANSWER <u>TWO</u> QUESTIONS OUT OF <u>THREE</u> IN <u>SECTION A</u> ANSWER <u>ALL</u> QUESTIONS IN SECTION B

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Office Use Only:

Author:		Semester:	
Internal Verifier:		R Y/N?	Yes / No (Please delete as applicable)
Contribution to Overall Module Assessment (%):			

Section A: [40 Marks]

This section contains **THREE** questions; **Answer** any **TWO** questions from this section.

1. Question One [20 Marks]

Agentic AI represents a new generation of artificial intelligence systems capable of autonomous reasoning, planning, and tool use. In healthcare, this evolution raises important questions about the nature of intelligence, autonomy, and responsibility.

- a. Define Agentic AI and explain how it differs from traditional AI systems used in healthcare. Illustrate your answer with examples of agentic capabilities. **[5]**
- b. Analyse the differences between Weak AI and Strong AI in the context of healthcare. In your answer, define each type of AI and explain how they differ in terms of autonomy, reasoning, and adaptability when performing clinical tasks such as diagnosis, treatment planning, or patient interaction. **[6]**
- c. Identify and explain the key features of Agentic AI that align with the characteristics of both Weak AI and Strong AI. In your answer, describe how these features reflect the functional strengths of each type of AI and how they contribute to the performance of Agentic AI systems in healthcare. **[6]**
- d. Briefly evaluate two ethical considerations that arise from deploying Strong Agentic AI in healthcare. Your answer should address issues such as autonomy, accountability, or trust. **[3]**

2. Question Two [20 Marks]

Reinforcement Learning (RL) is increasingly used in healthcare to support sequential decision-making, optimize treatment strategies, and personalize care. RL agents interact with their environment to learn optimal actions through trial and error, guided by feedback in the form of rewards.

- a. Explain the main components of reinforcement learning system. Analyse how each of these components would operate in a real-world healthcare scenario. **[9]**
- b. Compare model-based and model-free reinforcement learning approaches. In your answer, discuss how each method might influence the design and performance of clinical decision-making systems. **[5]**
- c. Define the components of the PEAS (Performance Measure, Environment, Actuators, Sensors) framework and identify two key examples for each component in the context of an AI-powered Clinical Appointment Scheduling System used in a general practice (GP) clinic to perform its functions. **[6]**

3. Question Three [20 Marks]

EduBot, developed by LearnTech Solutions, is a Natural Language Processing (NLP)-based virtual assistant designed to support students on an online learning platform. The chatbot helps users with course navigation, assignment deadlines, and technical support.

- a. Analyse the following conversation and identify the intent, entities, and dialogue management strategies used by the chatbot. Explain how these elements contribute to the overall effectiveness of the virtual assistant in an educational setting. **[6]**

Student: "Hello, Can you tell me when the assignment for Artificial Intelligence is due?"

EduBot: "Sure! Please hold on while I check the deadline for your Artificial Intelligence Module."

EduBot: "The assignment is due on Friday, 18th December at 3 PM."

Student: "Thanks! Can you also help me find the lecture slides?"

EduBot: "Of course. The latest lecture slides are available under the 'Week 5' section in your course materials."

Student: "Perfect. That's all for now."

EduBot: "Glad I could help! Let me know if you need anything else."

- b. Explain the roles of text preprocessing, feature extraction, and model selection in building NLP-based virtual assistants like EduBot. Discuss how each stage contributes to the chatbot's ability to understand and respond accurately to student queries. **[9]**
- c. Explain how the Term Frequency-Inverse Document Frequency (TF-IDF) method helps in identifying important words in a document. Using the following sentence, calculate the Term Frequency (TF) of the word "assignment." **[5]**

"Can you tell me when the assignment for Artificial Intelligence is due"

Section B [35 Marks]

Question 4: [35 Marks]

A medical Artificial Intelligence research group is developing two separate models to detect pneumonia from chest X-ray images:

- Model A: A Convolutional Neural Network (CNN) trained directly on raw image data.
- Model B: An Artificial Neural Network (ANN) trained on handcrafted features extracted from the same images (e.g., texture, intensity histograms, edge density).

The dataset includes 10,000 labelled X-ray images (Pneumonia / Normal). The team is evaluating both models to determine which is more suitable for deployment in a clinical setting.

- In the context of the pneumonia detection task described, determine whether the problem is best approached as a classification or regression task. In your answer: Define and differentiate between classification and regression problems. Identify which type of problem is being addressed in this scenario and justify your reasoning. **[5]**
- Explain how the training process in a Convolutional Neural Network (CNN) uses backpropagation to update model parameters. In your answer, describe how gradients are passed through convolutional, pooling, and fully connected layers. **[10]**
- Given the two models described Model A: a CNN trained directly on raw image data, and Model B: an ANN trained on handcrafted features extracted from the same images. **Discuss** the limitations of Model B for image classification. Why might it underperform compared to Model A? **[8]**
- During the testing, Model A produced the following results.
 - 920 pneumonia cases were correctly identified as pneumonia.
 - 80 pneumonia cases were incorrectly classified as normal.
 - 150 normal cases were incorrectly classified as pneumonia.
 - 1850 normal cases were correctly identified as normal.

Complete the following confusion matrix by identifying the values of True Positive (TP), False Positive (FP), False Negative (FN) and True Negative (TN). **[2]**

	Predicted		
Actual		Pneumonia	Normal
	Pneumonia	?	?
	Normal	?	?

- e. Based on the confusion matrix in question d, calculate the accuracy, precision, recall and F1-score (with a Beta value of 2) of model A and interpret the results. Use the attached Formula sheet (appendix A) for selecting the correct equation. **[6]**
- f. Interpret the results and discuss the clinical implications of false positives and false negatives. **[4]**

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Appendix A: Formula Sheet

$Accuracy = \frac{TP + TN}{TP + TN + FP + FN}$	$Sensitivity = \frac{TP}{TP + FN}$
$Specificity = \frac{TN}{TN + FP}$	$Precision = \frac{TP}{TP + FP}$
$F1\ score = \frac{2 * Precision * Recall}{Precision + Recall}$	$Error\ Rate = \frac{FP + FN}{TP + TN + FP + FN}$
$False\ Positive\ Rate = \frac{FP}{TN + FP}$	$True\ Positive\ Rate = \frac{TP}{FN + TP}$