FACULTY *of* SCIENCE *and* ENGINEERING

Department of Computer Science
and Information Systems

SAMPLE QUESTIONS MIDTERM PAPER

Academic Year:	2022-2023	Semester:	Autumn
Module Title:	Neural Computing	Module Code:	CS4287
Duration of Exam:	1 Hours	Percent of Total Marks:	X
Lecturer(s):	J.J. Collins	Paper marked out of :	Y

Instructions to Candidates:

- **Answer all questions.**
- Each question is worth 2 marks

Q1 a) Discuss the challenges that arise in a traditional Sense-Plan-Act (SPA) cycle as shown in Figure-Q-1-a. What is the solution suggested in subsumption architectures?

1 mark.

b) What is machine learning?
What are the challenges faced by an ML implementation?

1 mark.

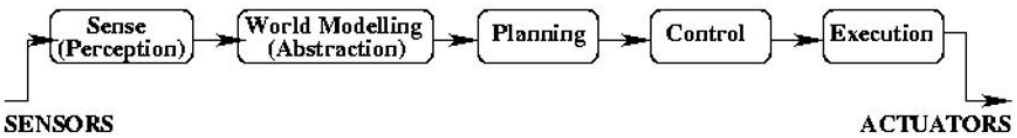

Figure Q-1-a.

Q2 a) What is the update rule for a linear perceptron

1 mark.

b) Write the code for a perceptron with fixed weights w1 = w2 =1, and bias -0.5.
Name the logical gate modelled by this perceptron.

1 mark.

Q3 a) Why are differentiable activation units used in Multi-Layered Perceptrons (MLPs)

1 mark.

b) What is δ, η, and α in the following weight update rule used in backpropagation.

$$\Delta w_{i,j}(n) = \eta \delta_j x_{i,j} + \alpha \Delta w_{i,j}(n-1)$$

1 mark.

Q4 a) What is underfitting? Draw a plot to illustrate.

1 mark.

b) What is overfitting? Draw a plot to illustrate.

1 mark.

Q5 a) Which is the better loss function: Mean Squared Error (MSE) or Cross Entropy?

1 mark.

b) Describe three regularisation techniques that can help reduce overfitting

1 mark.

Q6 a) Describe the concept of convolution in a Convolutional Neural Network (CNN).
Illustrate the discussion with a diagram of a kernel being applied to an input layer.

1 mark.

b) Write the code for a convolutional layer in a CNN.
Briefly describe the loss function and optimiser used.

1 mark.

Q7 a) How does one ensure that compositions in train and test sets
are representative of the dataset

1 mark.

b) Write the code for the output layer of a CNN used to classify MNIST10 dataset.

1 mark.

Q8 a) What is a vanishing gradient and identify common causes.

1 mark.

b) Briefly describe the approaches used to reduce the impact of vanishing gradients

1 mark.

And more