IT2026 ASSIGNMENT 04
(Due Date: November 20, 2026)

Instructions: Your answers can be in either Chinese or English. The following points should be noted.

- If you use a word processing software to edit your answer, please make sure that the file to be submitted is either in WORD or PDF format.
- You need to submit the answer file before the due date to the Gmail account `johnsum.nchu@gmail.com`.
- Email heading must be conformed to `IT2026_Assignment04_studentID`.
- File name must be conformed to `IT2026_Assignment04_studentID`.
- It is a bonus assignment. If you are too busy to complete the assignment, you can just skip it. There is no penalty.

The assessment of this course is solely depended on your work in the course project including your written report and your oral presentation. The scores obtained from the assignments are *bonus* marked up on your project score.

SECTION A: On Ethical Issues

Question 1

Large language models, like Deep Seek, Google Gemini, Open AI GhatGPT and Xai Grok, are now widely applied.

(a) If you applies Gemini to generate some contents in your report or the answer for an assignment question, is it ethical? Besides, should Professor John Sum accept them? Please comment!

(b) If Professor John Sum applies Gemini to give comments on your report or the answer for an assignment question, is it ethical? Besides, will you accept the comments? Please comment!

(c) If Professor John Sum applies Gemini to justify the quality of and to give score for your or the answer for an assignment question, is it fair and ethical? Will you accept the score? Please comment!

Note that AAAI has since 2025 launched an AI-powered assessment system to assist the review process of a conference paper submitted to AAAI annual conferences.

Question 2

Self-Driving technology, agentic AI are other technologies which are developed alongside the LLMs.

(a) In a car accidence, a self-driving car has crashed another car. Who should take the legal responsibility?

(b) In a car accidence, a self-driving car has hit a person. That person is eventually dead. Who should take the legal responsibility?

(c) In a car accidence, two self-driving cars crash. Who should take the legal responsibility?

(d) An officer in a financial institute applied an agentic AI to analyze the trend of a stock and then invested on behalf of the client on the stock. After a week, the client found that the investment decision was wrong. The client had to settle millions of USD for the lost. Who should take the responsibility for this instance?

SECTION B: Single MP Neuron

Question 3

Given the definition of a McCulloch-Pitts neuron as follows :

$$f(x_1, x_2) = h(x_1 + x_2),$$

where x_1, x_2 are the inputs, $f(\cdot, \cdot)$ the output and $h(s) = 1$ if $s > 0$ and otherwise 0.

(a) What is the value of $f(0, 0)$?

(b) What is the value of $f(0, 1)$?

(c) What is the value of $f(1, 0)$?

(d) What is the value of $f(1, 1)$?

Question 4

Given the definition of a McCulloch-Pitts neuron as follows :

$$f(x_1, x_2) = h(x_1 + x_2 - 2),$$

where x_1, x_2 are the inputs, $f(\cdot, \cdot)$ the output and $h(s) = 1$ if $s > 0$ and otherwise 0.

(a) What is the value of $f(0, 0)$?

(b) What is the value of $f(0, 1)$?

(c) What is the value of $f(1, 0)$?

(d) What is the value of $f(1, 1)$?

Question 5

Given the definition of a McCulloch-Pitts neuron as follows :

$$f(x_1, x_2) = h(x_1 + x_2 + 1),$$

where x_1, x_2 are the inputs, $f(\cdot, \cdot)$ the output and $h(s) = 1$ if $s > 0$ and otherwise 0.

(a) What is the value of $f(0, 0)$?

(b) What is the value of $f(0, 1)$?

(c) What is the value of $f(1, 0)$?

(d) What is the value of $f(1, 1)$?

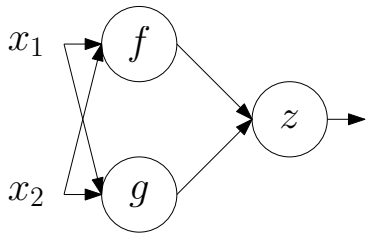

Figure 1: A network (resp. computational model) consisting of three neurons (resp. computational units). All of them are 2-input-1-output neurons.

SECTION C: Multiple MP Neurons

Question 6

Figure 1 shows a network of three neurons. The definitions of the McCulloch-Pitts neurons $f(\cdot, \cdot)$, $g(\cdot\cdot)$ and $z(\cdot, \cdot)$ are given as follows :

$$\begin{aligned} f(x_1, x_2) &= h(x_1 + x_2 - 0.1), \\ g(x_1, x_2) &= h(x_1 + x_2 - 1.1), \\ z(x_1, x_2) &= h(f(x_1, x_2) - g(x_1, x_2) + 0.5), \end{aligned}$$

where x_1, x_2 are the inputs and $h(s) = 1$ if $s > 0$ and otherwise 0.

(a) What is the value of $z(0, 0)$?

(b) What is the value of $z(0, 1)$?

(c) What is the value of $z(1, 0)$?

(d) What is the value of $z(1, 1)$?

To answer this question, the following table might help.

x_1	x_2	$f(x_1, x_2)$	$g(x_1, x_2)$	$z(x_1, x_2)$
0	0			
0	1			
1	0			
1	1			

Question 7

Figure 1 shows a network of three neurons. The definitions of the McCulloch-Pitts neurons $f(\cdot, \cdot)$, $g(\cdot\cdot)$ and $z(\cdot, \cdot)$ are given as follows :

$$\begin{aligned} f(x_1, x_2) &= h(x_1 - x_2 + 0.1), \\ g(x_1, x_2) &= h(x_1 - x_2 + 1.1), \\ z(x_1, x_2) &= h(f(x_1, x_2) - g(x_1, x_2) + 0.5), \end{aligned}$$

where x_1, x_2 are the inputs and $h(s) = 1$ if $s > 0$ and otherwise 0.

(a) What is the value of $z(0, 0)$?

(b) What is the value of $z(0, 1)$?

(c) What is the value of $z(1, 0)$?

(d) What is the value of $z(1, 1)$?

To answer this question, the following table might help.

x_1	x_2	$f(x_1, x_2)$	$g(x_1, x_2)$	$z(x_1, x_2)$
0	0			
0	1			
1	0			
1	1			

SECTION D: On Logic Gates

Question 8

Below is the truth table for a logical OR gate.

x_1	x_2	$z(x_1, x_2)$
0	0	0
0	1	1
1	0	1
1	1	1

It is known that a logical OR gate can be implemented by one McCulloch-Piits neuron.

$$z(x_1, x_2) = h(x_1 + x_2 - 0.5).$$

Now, you need to design a network of three neurons as shown Figure 1 to implement a logical OR gate. What should be the parameters in the neurons $f(\cdot, \cdot)$, $g(\cdot, \cdot)$ and $z(\cdot, \cdot)$?

Question 9

Below is the truth table for a logical AND gate.

x_1	x_2	$z(x_1, x_2)$
0	0	0
0	1	0
1	0	0
1	1	1

It is known that a logical OR gate can be implemented by one McCulloch-Piits neuron.

$$z(x_1, x_2) = h(x_1 + x_2 - 1.5).$$

Now, you need to design a network of three neurons as shown Figure 1 to implement a logical OR gate. What should be the parameters in the neurons $f(\cdot, \cdot)$, $g(\cdot, \cdot)$ and $z(\cdot, \cdot)$?

Question 10

Below is the truth table for a logical NAND gate.

x_1	x_2	$z(x_1, x_2)$
0	0	1
0	1	1
1	0	1
1	1	0

It is known that a logical OR gate can be implemented by one McCulloch-Piits neuron.

$$z(x_1, x_2) = h(-x_1 - x_2 + 1.5).$$

Now, you need to design a network of three neurons as shown Figure 1 to implement a logical OR gate. What should be the parameters in the neurons $f(\cdot, \cdot)$, $g(\cdot, \cdot)$ and $z(\cdot, \cdot)$?