



**Strathmore**  
UNIVERSITY

SCHOOL OF COMPUTING & ENGINEERING SCIENCES  
BACHELOR OF SCIENCE IN COMPUTER NETWORKS & CYBERSECURITY  
**END OF SEMESTER EXAMINATION**  
CNS 4101: INTRODUCTION TO ARTIFICIAL INTELLIGENCE

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DATE: **23<sup>rd</sup> July 2024**

TIME: **2 Hours**

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**Instructions:**

1. This examination consists of **FIVE** questions.
2. Each question has a total of **20 marks**.
3. Please answer **Question ONE (COMPULSORY)** and any other **TWO** questions.

**Question ONE**

- a) Criticize **one** definition of Artificial Intelligence (AI). (2 marks)
- b) Highlight **two** discipline that relates to AI as a foundation. (4 marks)
- c) Explain **two** ways in which AI can be applied to Networking and Cybersecurity. (4 marks)
- d) Describe each line of the python code below. (4 marks)

```
original = [1, 2, 3, 4, 5, 6, 7, 8, 9, 10]
numbers = [num for num in original if num % 2 == 0]
print(numbers)
```
- e) State **two** concerns that have been raised against the general use of AI. (2 marks)
- f) Distinguish between the following in AI; (2 marks)
  - i. Blind and heuristic search. (2 marks)
  - ii. Supervised and reinforcement learning. (2 marks)

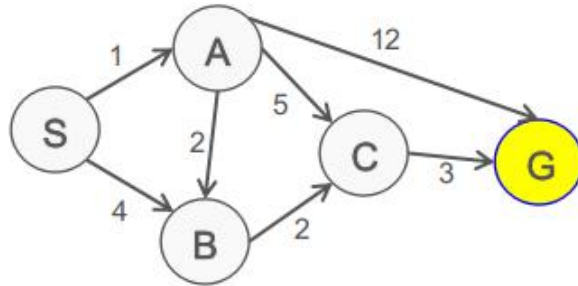
**Question TWO**

- a) You are a cybersecurity analyst working for a company that provides network security solutions. Your team has been tasked with developing a machine learning model to detect malicious network traffic and potential cyber attacks. The model should be able to analyze incoming network packets and classify them as either "benign" or "malicious".
  - i. Explain **six** key steps involved in building a supervised machine learning model for this task. (6 marks)
  - ii. Discuss the importance of feature selection and feature engineering in the context of network traffic analysis. Provide examples of **four** relevant features that could be extracted from network packets to aid in the classification task. (6 marks)
  - iii. Describe **two** machine learning algorithms that could be suitable for this classification problem, highlighting a strength and weakness of each in relation to the task. (6 marks)
  - iv. Outline **one** potential challenge of using machine learning for network intrusion detection. (2 marks)

**Question THREE**

- a) A university is offering an introductory course on AI with two sections: Section A and Section B. There are a total of 50 students enrolled in the course, with the constraints listed below. The task is to assign students to the two sections while satisfying all the given constraints. *Formulate* the problem as a constraint satisfaction problem. (10 marks)
- Each section must have at least 15 students.
  - Due to classroom capacity restrictions, Section A can have a maximum of 30 students, and Section B can have a maximum of 25 students.
  - There are 20 students who can only attend classes in the morning, and 10 students who can only attend classes in the afternoon.
  - Section A is offered in the morning, and Section B is offered in the afternoon.
  - Among the students who can attend classes in the morning, 8 of them have a strong preference for Section A.
  - Among the students who can attend classes in the afternoon, 5 of them have a strong preference for Section B.
- b) Consider the following state space graph with the initial state **S** and goal **G** and the heuristics are in the table below.

state	h
S	7
A	6
B	2
C	1
G	0



- Using the A\* algorithm, solve the above problem (9 marks)  
(*Note: show all computations*)
- State **one** way Greedy best first search is different from (i). (1 mark)

**Question FOUR**

- a) As a recent graduate, you secure an entry-level job at a Networking and Cybersecurity company. You are extensively introduced to many of the tasks that such a typical company would engage in and you notice that they have not yet made any use of AI. Given your expertise;
- Identify and clearly describe a task that can be automated using a rational agent. (2 marks)
  - Define* the rational agent for the task identified. (8 marks)
- b) Consider an agent that inhabits a finite planar maze world consisting of discrete cells. Some pairs of neighboring cells have walls that prohibit motion between the cells. The agent is located in exactly one cell at any point in time. The agent uses four actions to navigate the world N, S, E, W, each moves to the adjacent cell in the associated compass direction. The agent has two types of sensors: (i) A primitive 1-bit cheese sensor which reads 1 if and only if the agent is in a block containing a piece of cheese; (ii) A wall detector which each provide a reading of either Blocked or Open in each of the four directions. There is a piece of cheddar in one (unknown) cell, but which can be reached from the agent's initial location. Draw and describe this agent's structure. (8 marks)
- c) Analyse **one** ethical implication of using rational agents in decision-making processes. (2 marks)

## Question FIVE

- a) What are deepfakes? Describe **two** societal concerns arising from their use. (6 marks)
- b) Using **two** distinct arguments, defend the position that large language models have passed the basic-Turing test. (4 marks)
- c) Highlight **two** capabilities the models in b) above need to pass the total-Turing test. (4 marks)
- d) Review **any one** binary classification metric used in machine learning. (2 marks)
- e) Describe blocks of python code below marked with a **#**. (4 marks)

```
#
import matplotlib.pyplot as plt
import numpy as np

# create some sample data
x = np.linspace(0, 10, 100)
y = np.sin(x)

#
plt.plot(x, y)

#
plt.xlabel('X')
plt.ylabel('Y')
plt.title('Sine Wave')

#
plt.show()
```

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----- *END OF EXAMINATION* -----  
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