Assessment Task No. 4			
Topic:	**Monotonic vs. Non-Monotonic Reasoning**	**Week No.**	9
Course Code:	**CSST101**	**Term:**	1st Semester
Course Title:	**Advance Knowledge Representation and Reasoning**	**Academic Year:**	2025-2026
Student Name	Capili, Judeelyn M.	**Section**	BSCS 3A
Due date		**Points**	

Learning Outcomes Assessed

After completing this assessment, students should be able to:

1. Explain the key features of **non-monotonic reasoning**.
2. Apply logical reasoning that adapts when new information is added.
3. Construct examples of **argumentation frameworks** showing conflicting knowledge.
4. Demonstrate understanding of belief revision through code or written explanation.

Assessment Title:

"When Logic Changes: Exploring Non-Monotonic Reasoning and Argumentation"

Part I. Conceptual Understanding (20 points)

Instruction:

Answer the following questions briefly but clearly. Each question is worth 4 points.

1. ***Define non-monotonic reasoning in your own words.***
   Non-monotonic reasoning is a logical process where conclusions are not fixed and may change when new information is introduced. Unlike classical logic, where once something is proven true it remains true forever, non-monotonic reasoning allows previously accepted conclusions to be revised or withdrawn. This reflects how humans actually think and make decisions in real-world situations, where knowledge is often incomplete or uncertain. For example, an AI system might initially conclude that "birds can fly," but later, after learning that penguins are birds that cannot fly, it revises this conclusion. In essence, non-monotonic

reasoning models adaptive intelligence—the ability to change beliefs when confronted with new evidence.

2. ***How does non-monotonic reasoning differ from monotonic reasoning?***

   The main difference between monotonic and non-monotonic reasoning lies in how they handle new information.
   In monotonic reasoning, adding new knowledge does not affect previously drawn conclusions; the set of conclusions can only stay the same or grow larger. For instance, in pure mathematics or classical logic, once a statement is proven true, it stays true no matter what else we discover.

   In contrast, non-monotonic reasoning allows conclusions to be retracted or modified if new evidence contradicts them. This flexibility makes it more suitable for real-world reasoning and artificial intelligence, where information may be incomplete or uncertain. It mirrors how humans revise their beliefs when learning new facts, making AI systems behave more intelligently and realistically.

3. ***Give a real-life situation where a conclusion must change after new information is added.***

   Imagine you see dark clouds forming in the sky and conclude that it is about to rain. This conclusion seems reasonable given your observation. However, after checking the weather report, you learn that the dark sky is caused by smoke from a nearby factory, not rain clouds. You now revise your previous conclusion and decide it might not rain after all.
   This example shows how reasoning can change as new data becomes available. It represents non-monotonic reasoning because your initial belief ("it will rain") was updated after obtaining more accurate information ("it's just smoke"). This process of belief revision reflects how humans and AI systems adapt their knowledge in dynamic environments.

4. ***What is a default rule? Provide one example.***

   A default rule is a logical assumption made in the absence of complete information. It allows reasoning systems (and humans) to fill in gaps with what is typically true, unless specific evidence suggests otherwise. Default rules help simplify decision-making when knowledge is incomplete.

For example:
"If an animal is a bird, then by default assume it can fly."
This assumption generally holds true for most birds. However, when new information is added (like the animal being a penguin or ostrich), the system must revise the conclusion. Default rules are a key part of non-monotonic reasoning because they allow systems to make reasonable but revisable assumptions.

5. How do argumentation frameworks help AI systems decide between conflicting rules?

Argumentation frameworks are structures that allow AI systems to handle conflicting knowledge logically and transparently. They represent arguments as nodes and conflicts as attacks between them. The system then evaluates which arguments are stronger, more specific, or better supported by evidence.

For example, consider two rules:

Rule 1: "Birds can fly."
Rule 2: "Penguins are birds that cannot fly."
When both apply, the system must decide which to accept. Argumentation frameworks help by determining that Rule 2 is more specific and therefore defeats Rule 1. This enables AI systems to make rational decisions even in the presence of conflicting information. In essence, argumentation frameworks provide a logical structure for debate and resolution, similar to how humans weigh evidence and counterarguments in reasoning.

Rubric:

- 4 pts – clear, accurate, example-supported answer
- 3 pts – mostly correct, minor errors
- 2 pts – incomplete or unclear
- 1 pt – incorrect or irrelevant

Part II. Laboratory Application (40 points)

Task 1: Belief Revision Simulation (20 points)

Objective: Implement a simple reasoning program in Python or R that revises conclusions when new information is added.

Instructions:

1. Create a program that starts with the rule:
   “If an animal is a bird, assume it can fly.”
2. Ask the user to input the animal name.
3. If the animal is a known exception (like penguin or ostrich), revise the conclusion.
4. Display the system’s reasoning process step-by-step.

Sample Output:

```
Input: penguin
Reasoning: Penguins are birds.
However, penguins do not fly.
Conclusion: penguins cannot fly.
```

Rubric:

Criteria	Excellent (5)	Good (4)	Fair (3)	Needs Improvement (2–1)
Correct logical flow	Complete & accurate	Mostly accurate	Minor issues	Incomplete
Program output clarity	Clear reasoning steps	Somewhat clear	Basic	Unclear
Code quality	Efficient & well-structured	Functional	Some redundancy	Many errors
Comments/documentation	Fully commented	Some comments	Few comments	None

Activity 4 > Task_4.py > ...

```python

# Default rule: "If an animal is a bird, assume it can fly."

def can_fly(animal):
    birds = ["sparrow", "eagle", "parrot", "penguin", "ostrich"]
    exceptions = ["penguin", "ostrich"]

    print("Reasoning process:")
    if animal.lower() in birds:
        print(f"1. {animal.capitalize()} is a bird.")
        print("2. By default, birds can fly.")
        if animal.lower() in exceptions:
            print(f"3. However, {animal.capitalize()} is an exception.")
            print(f"4. Therefore, {animal.capitalize()} cannot fly.")
            return False
```

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL PORTS

```
PS C:\Users\Princess Shaira\Documents\BSCS 3A CAPILI, JUDEELYN\github\CSST 101> & "C:\Users\Princess Shaira\AppData\Local\Microsoft\WindowsApps\python3.13.exe" "c:/Users/Princess Shaira/Documents/BSCS 3A CAPILI, JUDEELYN/github/CSST 101/Activity 4/Task_4.py"
Enter the name of an animal: penguin
Reasoning process:
1. Penguin is a bird.
2. By default, birds can fly.
3. However, Penguin is an exception.
4. Therefore, Penguin cannot fly.

Conclusion: Penguin cannot fly.
PS C:\Users\Princess Shaira\Documents\BSCS 3A CAPILI, JUDEELYN\github\CSST 101> & "C:\Users\Princess Shaira\AppData\Local\Microsoft\WindowsApps\python3.13.exe" "c:/Users/Princess Shaira/Documents/BSCS 3A CAPILI, JUDEELYN/github/CSST 101/Activity 4/Task_4.py"
Enter the name of an animal: eagle
Reasoning process:
1. Eagle is a bird.
2. By default, birds can fly.
3. No exception found for Eagle.
4. Therefore, Eagle can fly.
```

Task 2: Argumentation Framework (20 points)

Objective: Create a simple argument diagram showing conflicting knowledge and how the stronger argument prevails.

Example Scenario:
Rule 1: Birds can fly.
Rule 2: Penguins are birds that cannot fly.
Fact: Tweety is a penguin.

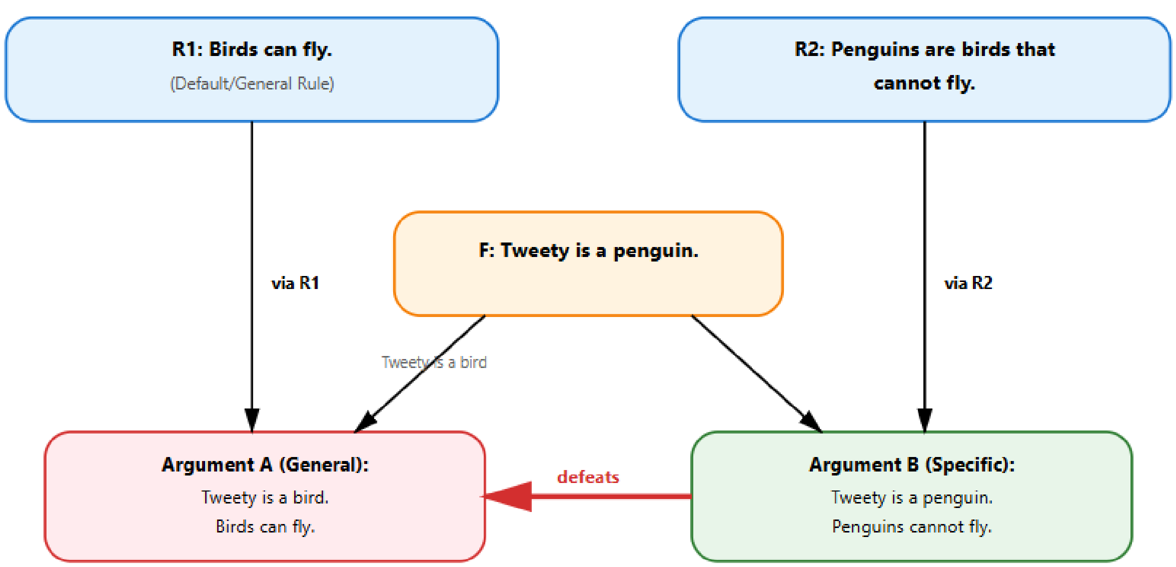
Expected Answer:
Argument A: Birds can fly.
Argument B: Penguins are birds that cannot fly.
→ **Argument B defeats A**, because it is more specific.

Rubric:

- 10 pts – complete diagram or description
- 5 pts – includes clear reasoning steps
- 5 pts – shows correct defeat or resolution

Students can draw this using **draw.io**, **Canva**, or on paper.

Task 2: Argumentation Framework



Part III. Reflection and Discussion (20 points)
Instruction: Write a short essay (150–200 words) answering the prompt below.
“Think of a time when you changed your conclusion after learning new information. How is this similar to non-monotonic reasoning in AI?”

There was a time in my life when I strongly believed that working hard was the only requirement for success. I thought that if I dedicated enough time, effort, and determination to something, I would always achieve the results I wanted. However, as I grew older and gained more experience, I began to realize that success depends on many other factors. These include strategy, collaboration, adaptability, and even timing. I learned that some people who work hard may still struggle if they lack proper direction or resources, while others who plan strategically often achieve more with less effort. This realization changed how I viewed success and taught me to adjust my beliefs whenever new information becomes available.

This personal experience is very similar to how non-monotonic reasoning works in artificial intelligence. In traditional or monotonic reasoning, once a conclusion is made, it remains true even when new data is added. However, in non-monotonic reasoning, conclusions can be modified or withdrawn when new facts appear. This ability allows AI systems to behave more like humans by adapting their conclusions based on changing circumstances. For example, an AI system might first assume that all birds can fly, but when it later learns about penguins or ostriches, it must change its conclusion.

Just like how I changed my view about hard work and success after gaining new insights, AI systems also revise their beliefs when they encounter new evidence. Both humans and AI benefit from this flexibility because it leads to a more accurate and realistic understanding of the world. Non-monotonic reasoning teaches us the importance of being open-minded, reflective, and willing to adjust our knowledge when faced with new truths. It highlights that intelligence, whether human or artificial, is not only about having information but also about being able to rethink, relearn, and adapt when the situation changes.

Rubric:

Criteria	Excellent (5)	Good (4)	Fair (3)	Poor (2–1)
Relevance to topic	Strong connection to AI reasoning	Mostly relevant	Limited relation	Off-topic
Insight & reflection	Deep and thoughtful	Some insight	Simple restatement	Superficial
Clarity & grammar	Clear and polished	Minor errors	Understandable	Hard to read

Total Points: 80

Component	**Points**
Part I – Conceptual	20
Part II – Laboratory	40
Part III – Reflection	20
Total	**80 pts**