CPSC-354 Report

Mitchell Toney
Chapman University

September 7, 2025

Abstract

Contents

1 Introduction

2 Week by Week

2.1 Week 1: HW1

The MU puzzle is a puzzle created by Douglas Hofstadter. It consists of four rules that can be applied to a string MI.

1. $xI \to xIU$
2. $Mx \to Mxx$
3. $xIIIy \to xUy$
4. $xUUy \to xy$

When first approaching this puzzle, the first strategy that came to mind was to take advantage of rule number 2 to keep duplicating the I's until there is a multiple of three, then using rules 3 and 4 to get rid of the I's and leave a remaining U.

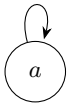
The issue with this is that $2^n \bmod 3$ will never equal 0, it infinitely cycles between equaling 1 and 2, and without being able to get rid of all the I's, which would require them being a multiple of 3, you will never be able to get MU.

Thus, the puzzle is not solvable.

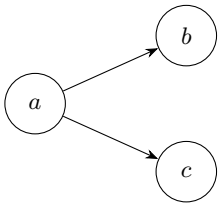
2.2 Week 2: HW2

1. $A = \varnothing,\ R = \varnothing$

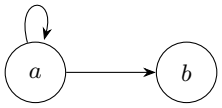
2. $A = \{a\},\ R = \varnothing$



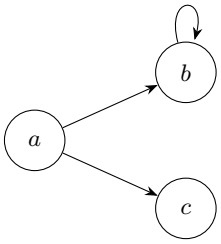
3. $A = \{a\},\ R = \{(a, a)\}$



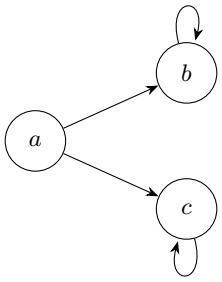
4. $A = \{a, b, c\},\ R = \{(a, b), (a, c)\}$



5. $A = \{a, b\},\ R = \{(a, a), (a, b)\}$



6. $A = \{a, b, c\},\ R = \{(a, b), (b, b), (a, c)\}$



7. $A = \{a, b, c\},\ R = \{(a, b), (b, b), (a, c), (c, c)\}$

#	Terminating	Confluent	Unique NFs
1	Yes	Yes	Yes
2	Yes	Yes	Yes
3	No	Yes	No
4	Yes	No	No
5	No	Yes	Yes
6	No	No	No
7	No	No	No

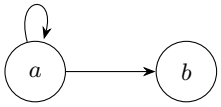
Confluent True, Terminating True, Unique NFs True

$A = \{a\},\ R = \varnothing$

Confluent True, Terminating True, Unique NFs False

(no ARS exists)

Confluent True, Terminating False, Unique NFs True



$A = \{a, b\},\ R = \{(a, a), (a, b)\}$

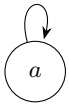
Confluent False, Terminating True, Unique NFs True

(no ARS exists)

Confluent False, Terminating False, Unique NFs True

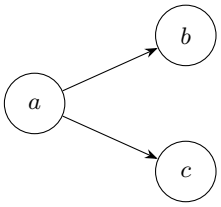
(no ARS exists)

Confluent True, Terminating False, Unique NFs False



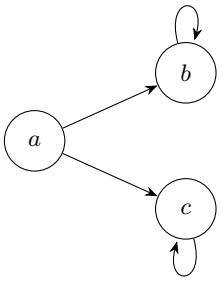
$A = \{a\},\ R = \{(a, a)\}$

Confluent False, Terminating True, Unique NFs False



$A = \{a, b, c\},\ R = \{(a, b), (a, c)\}$

Confluent False, Terminating False, Unique NFs False



$A = \{a, b, c\},\ R = \{(a, b), (a, c), (b, b), (c, c)\}$

3 Essay

4 Evidence of Participation

5 Conclusion

References

[BLA] Author, Title, Publisher, Year.