# CPSC 354 Report

Drew Floyd

## Contents

# 1   The MU-Puzzle

MI → MU

    **Rule 1:** If you possess a string whose last letter is `I`, add `U`.

    **Rule 2:** Suppose you have `Mx`, you may add `Mxx`.

    **Rule 3:** If `III` occurs in one of the strings, you may make a new string with `U` in place of `III`.

    **Rule 4:** If `UU`, you can drop it.

    MI
MII $Mxx$
MIIII $Mxx$
MIIIIIIII $Mxx$
MUIIU $MIU$
∅

    MI → use $Mxx$ rule ∞ times
MIIII...

    No matter what Rule you use you will never be able to get 0 Mod3, because I will always be 1 mod 3 or 2 mod 3

    MUUU
MIII

    **Rule 1** does not affect # of I's.
**Rule 2** does not give 0 mod 3.
**Rule 3** does not solve the problem as removing 3 I's does not change the output of mod3.
**Rule 4** does not change the # of I's.

    We can never get rid of all of the I's, 0 mod 3 is not possible. Thus you cannot get MU from MI.

# 2 Rewriting Assignment

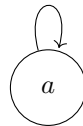1. $A = \{\}$
   $R = \{\}$



   This diagram is terminating because there are no infinite loops, confluent because all paths lead to the same result, and has a unique normal form as there is only one final state.

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



   This diagram is terminating because there are no infinite loops, confluent because all paths lead to the same result, and has a unique normal form as there is only one final state.

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



   This diagram is not terminating due to the presence of infinite loops, confluent because all paths merge, but does not have a unique normal form as multiple results are possible.

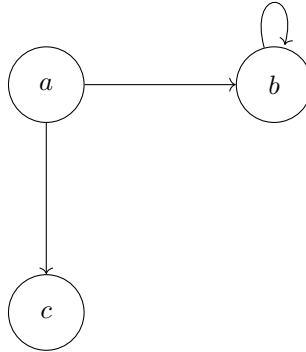4. $A = \{a, b, c\}$
   $R = \{(a, b), (a, b)\}$
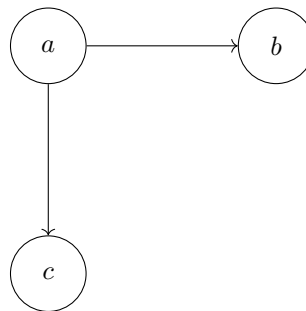
This diagram is terminating as there are no infinite loops, not confluent because paths diverge, and does not have a unique normal form due to multiple end states.

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



This diagram is not terminating due to the presence of infinite loops, not confluent because paths diverge, and has a unique normal form due to having a single end state on b.

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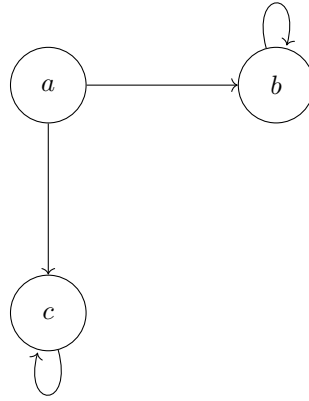   $R = \{(a, b), (b, b), (a, c)\}$



This diagram is not terminating due to the presence of infinite loops, not confluent because paths diverge, and has a unique normal form due to having a single end state on c.

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

This diagram is not terminating due to the presence of infinite loops, not confluent because paths diverge, and does not have a unique normal form due to no end states.

## Properties

|     | T | C | N |
| --- | --- | --- | --- |
| 1.  | ✓ | ✓ | ✓ |
| 2.  | ✓ | ✓ | ✓ |
| 3.  | × | ✓ | × |
| 4.  | ✓ | × | × |
| 5.  | × | × | ✓ |
| 6.  | × | × | ✓ |
| 7.  | × | × | × |

Terminating, Confluent, Unique Normal Form