# Concordia University Department of Computer Science and Software Engineering

# SOEN 331 - S and U Introduction to Formal Methods for Software Engineering

### Assignment 4 - Solutions

Temporal Logic

Team 19 - Section U

Samuel Boaknin 40009692 Ryan Leyland 40015165

Saleha Tariq 40006997

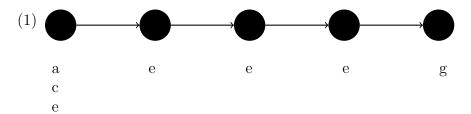
Meng Susana Ung 40099729

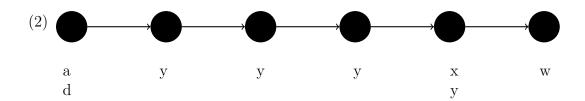
Date: April 19, 2021

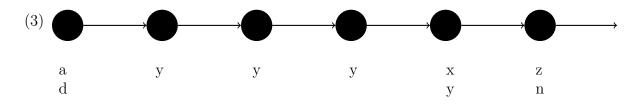
## Contents

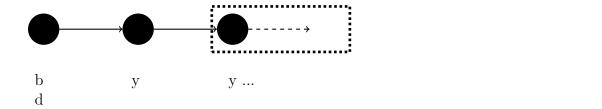
1	Question 1	3
<b>2</b>	Question 2	5

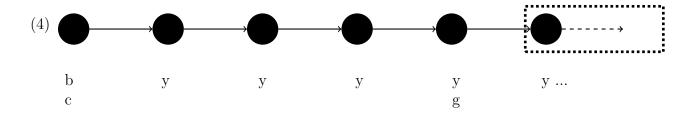
# 1 Question 1

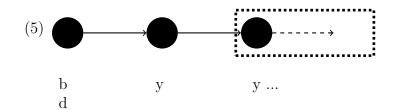


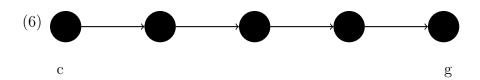


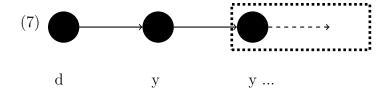








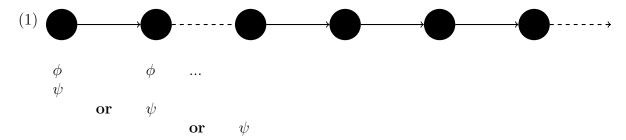




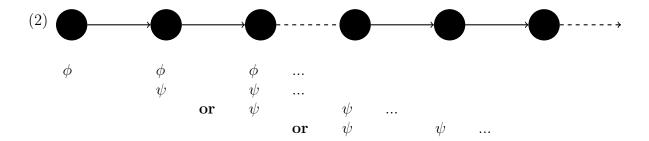
There exists three model's whereby the program terminates, given by the following expressions:

$$\begin{array}{l} <(a\wedge c\wedge e),\ e,\ e,\ e,\ g>\\ <(a\wedge d),\ y,\ y,\ y,\ (x\wedge y),\ w>\\ < c,\ \varnothing,\ \varnothing,\ \varnothing,\ g> \end{array}$$

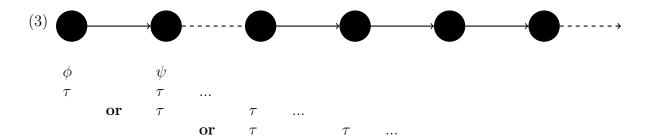
### 2 Question 2



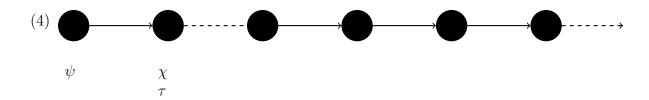
If  $\phi$  is an invariant, then  $\psi$  is true in some moment in time.



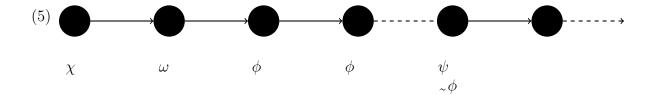
If  $\phi$  is an invariant, then from i+1 onwards,  $\psi$  eventually becomes an invariant.



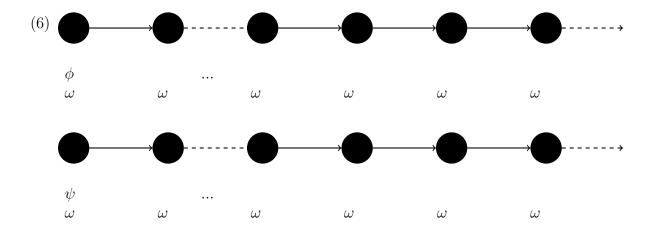
If  $\phi$  is true at i and  $\psi$  is true at i+1, then  $\tau$  can become an invariant anywhere on the path.



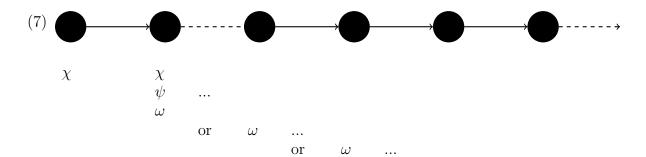
If  $\psi$  is true at i and  $\chi$  is true at i+1, then  $\tau$  is also true at i+1.



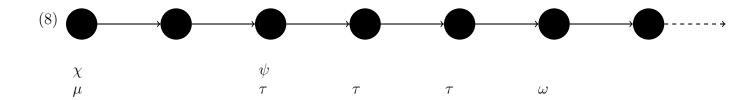
If  $\chi$  is true at i and  $\omega$  is true at i+1, then from i+2 onwards,  $\phi$  is true until  $\psi$  becomes true.



If only one of the mutually exclusive events  $\phi$  or  $\psi$  is true, then  $\omega$  will always be true.



If  $\chi$  is true at i and  $\chi$  &  $\psi$  is true at i+1, then  $\omega$  can emerge anywhere on the path.



If  $\chi$  is true at i and  $\psi$  is true at i+2, then from i+2 onwards,  $\tau$  is true unless  $\omega$  becomes true. If  $\mu$  is true at i, then  $\omega$  will be true at i+5.