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

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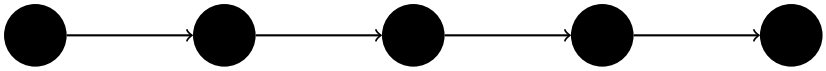
Contents

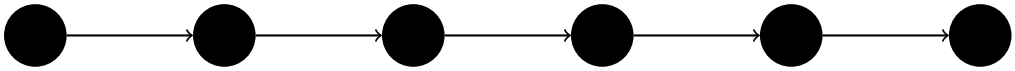
1 Question 1

(1)



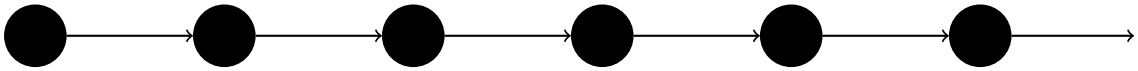
a c e	e	e	e	g

(2)

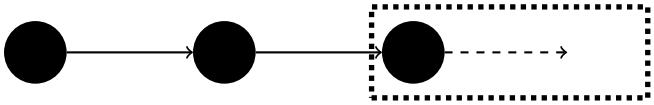


a d	y	y	y	x y	w

(3)

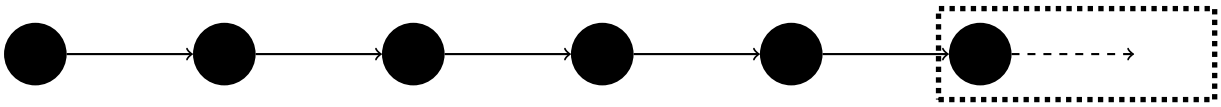


a d	y	y	y	x y	z n



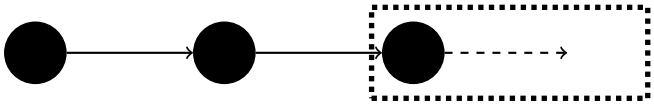
b d	y	y ...

(4)



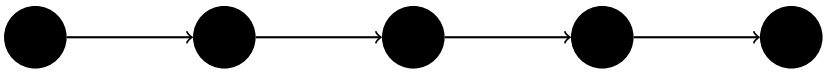
b c	y	y	y	y g	y ...

(5)

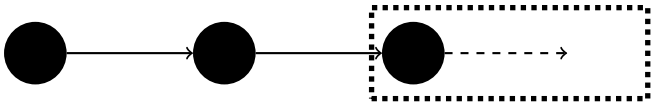


b d	y	y ...

(6)



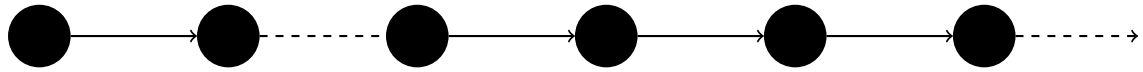
c				g

(7) 

d y y ...

There exists three model's whereby the program terminates, given by the following expressions:
$< (a \wedge c \wedge e),\ e,\ e,\ e,\ g >$
$< (a \wedge d),\ y,\ y,\ y,\ (x \wedge y),\ w >$
$< c,\ \varnothing,\ \varnothing,\ \varnothing,\ g >$

2 Question 2

(1) 

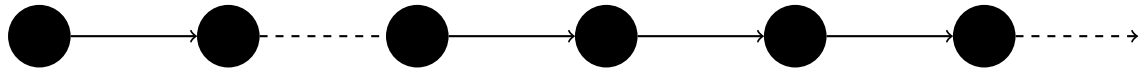
ϕ ϕ ...
ψ
or ψ
or ψ

If ϕ is an invariant, then ψ is true in some moment in time.

(2) 

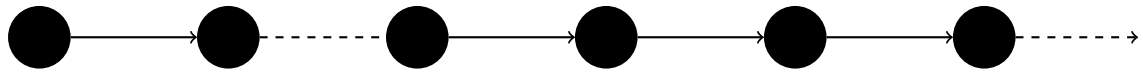
ϕ ϕ ϕ ...
ψ ψ ...
or ψ ψ ...
or ψ ψ ...

If ϕ is an invariant, then from $i+1$ onwards, ψ eventually becomes an invariant.

(3) 

ϕ ψ
τ τ ...
or τ τ ...
or τ τ ...

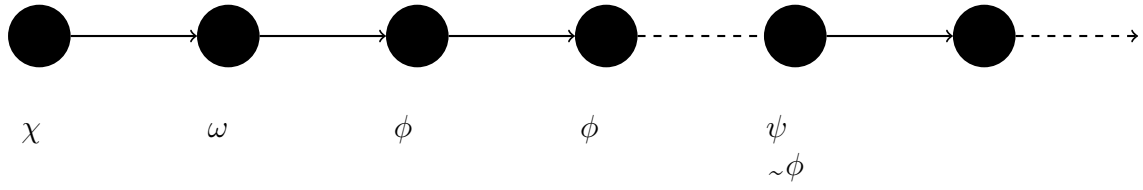
If ϕ is true at i and ψ is true at $i+1$, then τ can become an invariant anywhere on the path.

(4) 

ψ χ
τ

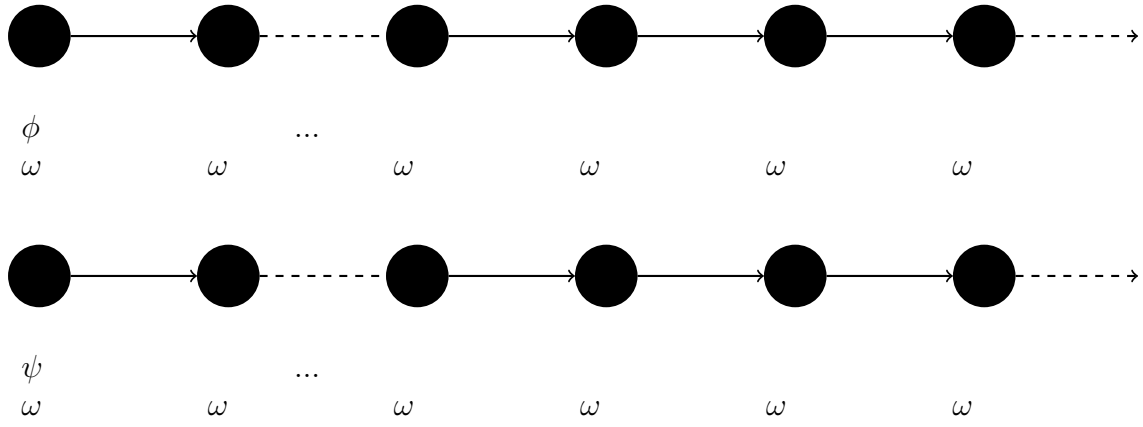
If ψ is true at i and χ is true at $i+1$, then τ is also true at $i+1$.

(5)



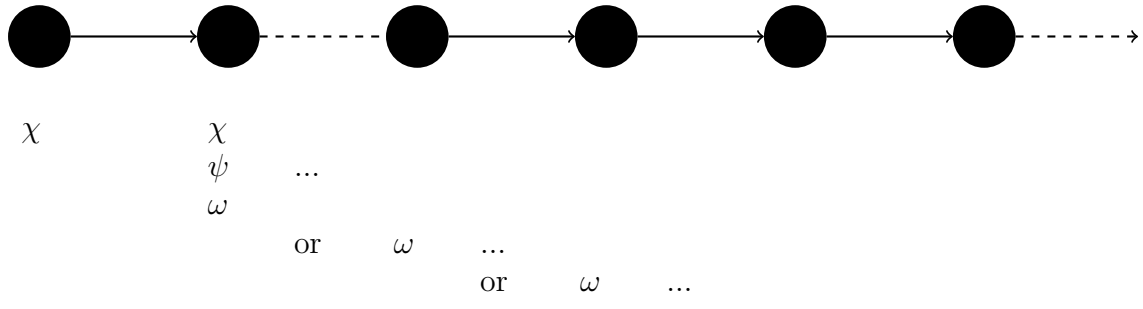
If χ is true at i and ω is true at $i+1$, then from $i+2$ onwards, ϕ is true until ψ becomes true.

(6)



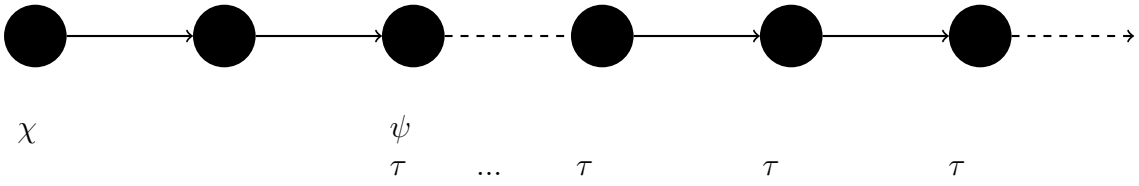
If either ϕ or ψ is true, then ω will always be true.

(7)

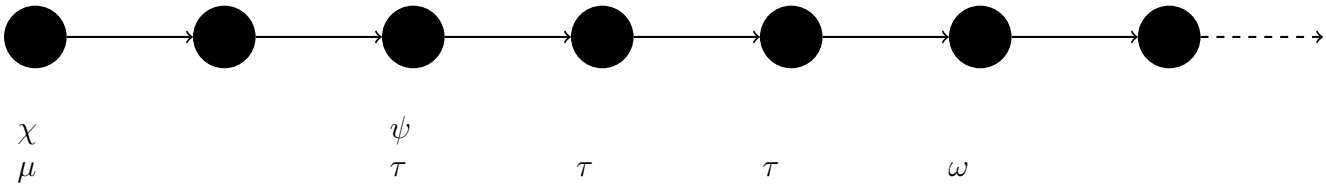


If χ is true at i and χ & ψ is true at $i+1$, then ω can become an invariant anywhere on the path.

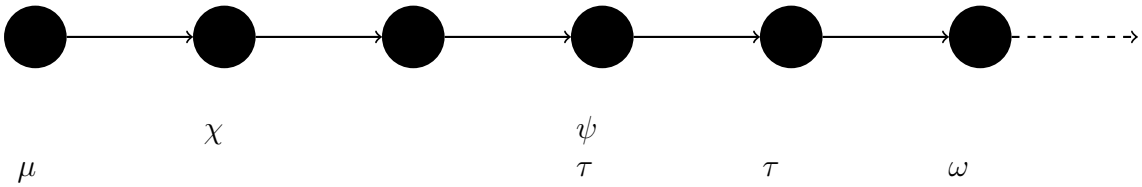
(8)



Or...



Or...



And so on...

If χ is true at i and ψ is true at $i+2$, then from $i+2$ onwards, τ is true unless ω becomes true. If μ is true at i, then ω will be true at $i+5$.