

Vérification de la sécurité d'automates à files par apprentissage actif

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1 Introduction

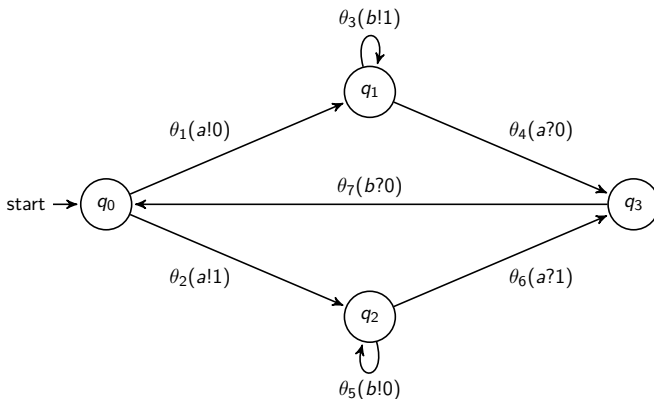
- Automates à files
- Sécurité
- Complexité
- Apprentissage actif

2 Méthode utilisée

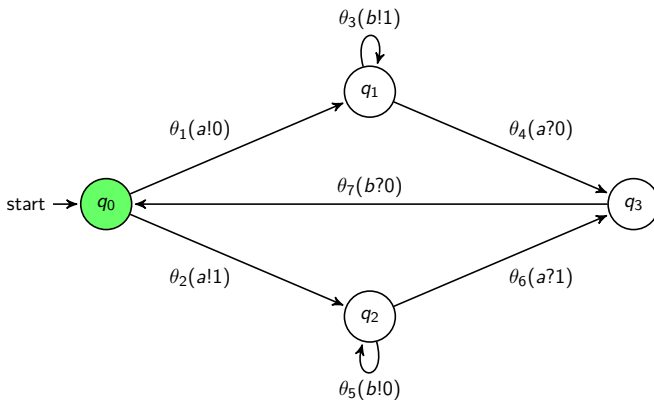
- Apprentissage de $AL(F)$
- Langage de traces annotées
- Oracle d'appartenance
- Point fixe
- Intersection avec la zone à risque
- Validité du chemin

3 Conclusion

Automates à files



Automates à files

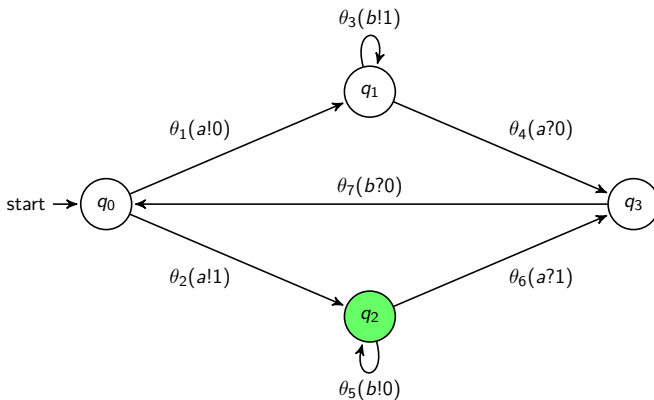
 ϵ a :

ϵ

b :

ϵ

Automates à files



θ_2

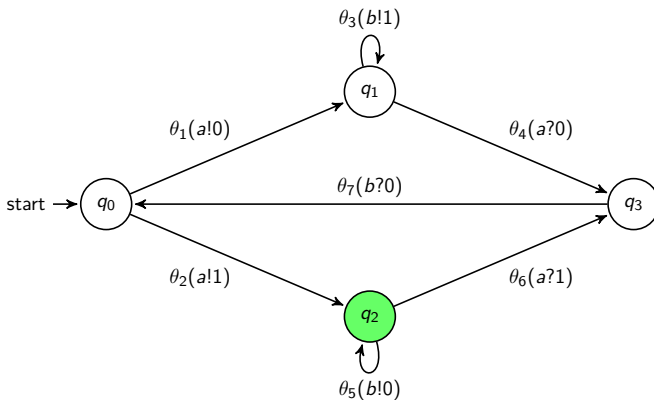
a :

1

b :

ϵ

Automates à files

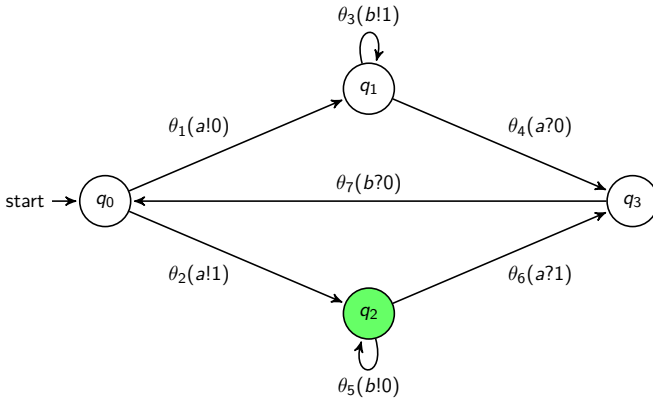
 $\theta_2\theta_5$ a :

1

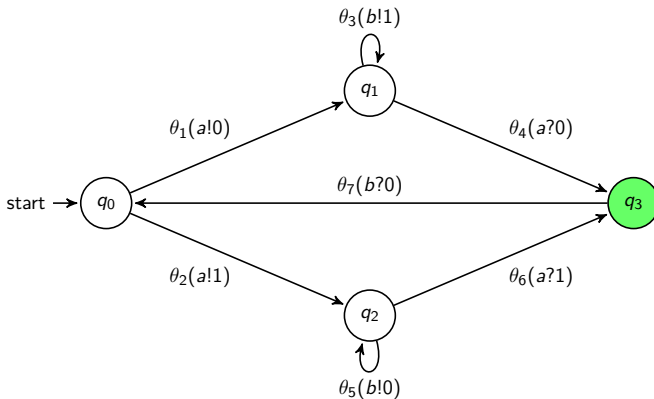
b :

0

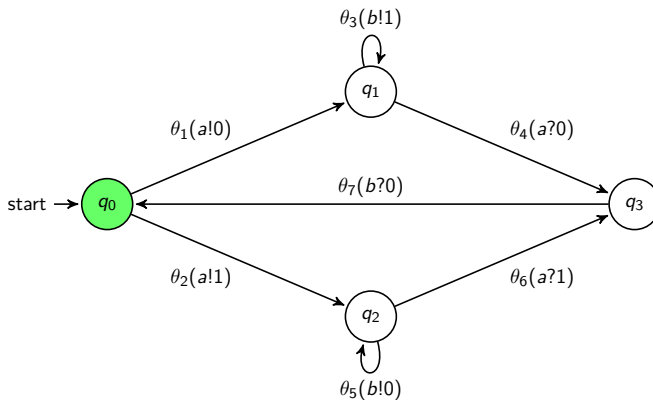
Automates à files


$$\begin{array}{l} \theta_2 \theta_5 \theta_5 \\ \mathbf{a} : \boxed{0} \\ \mathbf{b} : \boxed{0} \boxed{0} \end{array}$$

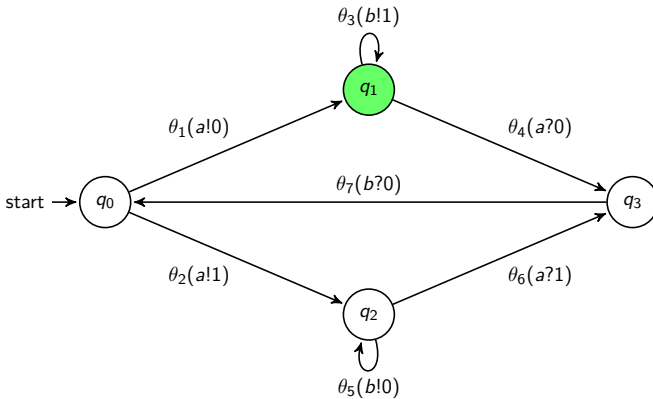
Automates à files


 $\theta_2 \theta_5 \theta_5 \theta_6$
 $a : \boxed{\epsilon}$
 $b : \boxed{0} \boxed{0}$

Automates à files

 $\theta_2 \theta_5 \theta_5 \theta_6 \theta_7$ a : b :

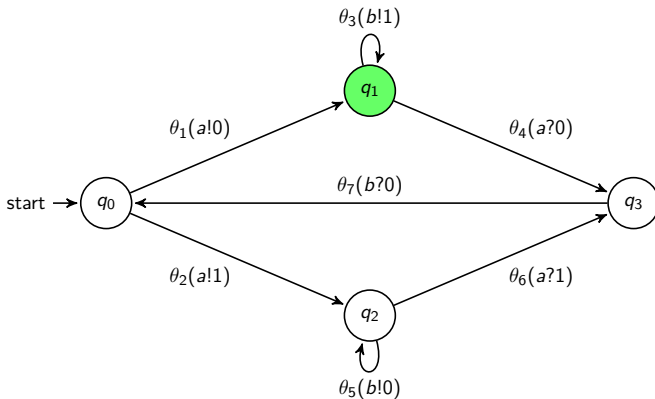
Automates à files


$$\theta_2\theta_5\theta_5\theta_6\theta_7\theta_1$$

a : 0

b :	0
-----	---

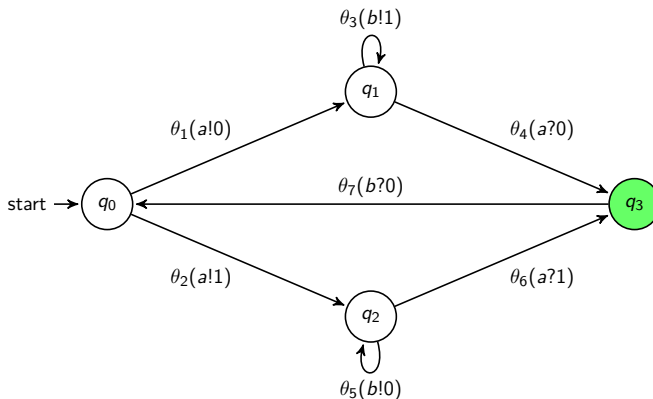
Automates à files


$$\theta_2\theta_5\theta_5\theta_6\theta_7\theta_1\theta_3$$

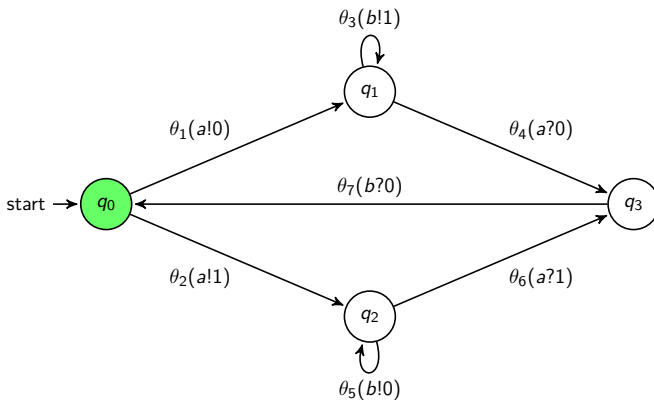
a :	0
-----	---

b :	0	1
-----	---	---

Automates à files


 $\theta_2 \theta_5 \theta_5 \theta_6 \theta_7 \theta_1 \theta_3 \theta_4$
 $a : \boxed{\epsilon}$
 $b : \boxed{0} \boxed{1}$

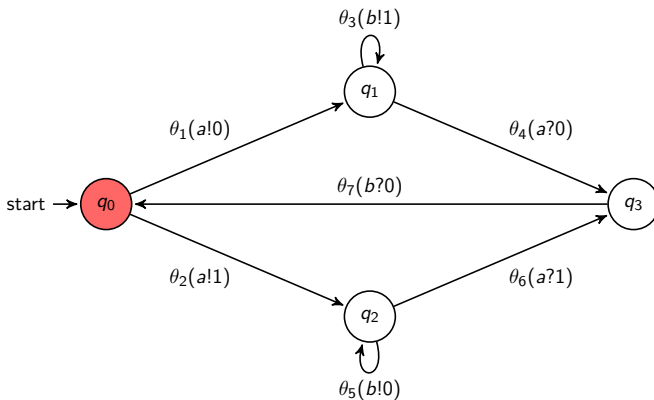
Automates à files


 $\theta_2 \theta_5 \theta_5 \theta_6 \theta_7 \theta_1 \theta_3 \theta_4 \theta_7$

a :

b :

Sécurité



?

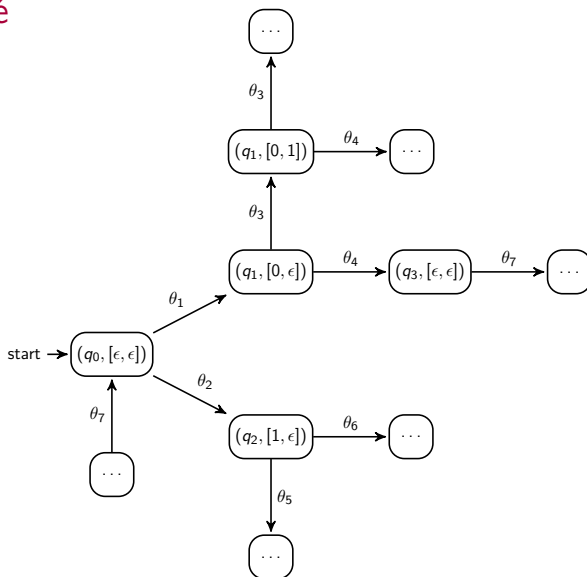
a :

€

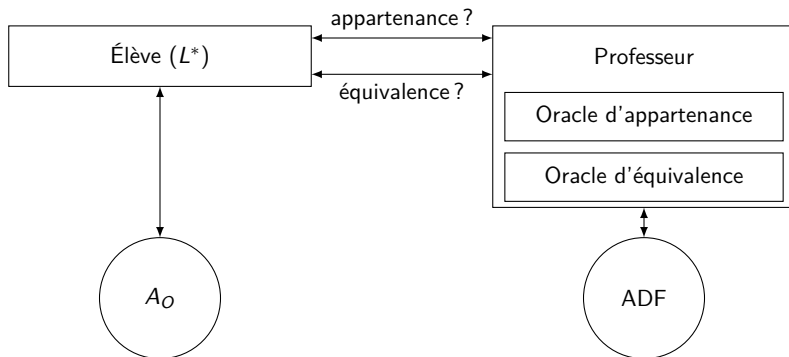
b :

1	1
---	---

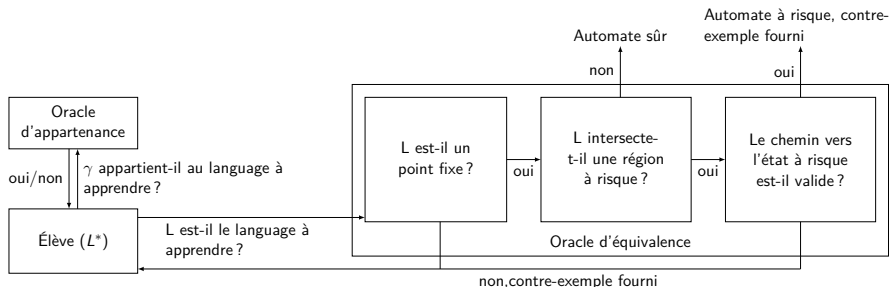
Complexité



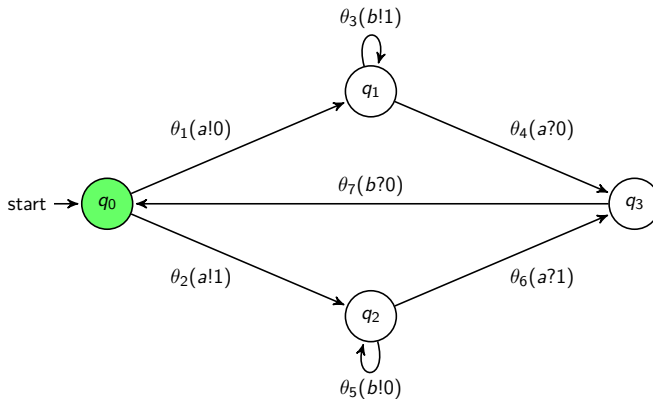
Apprentissage actif



Apprentissage de AL(F)



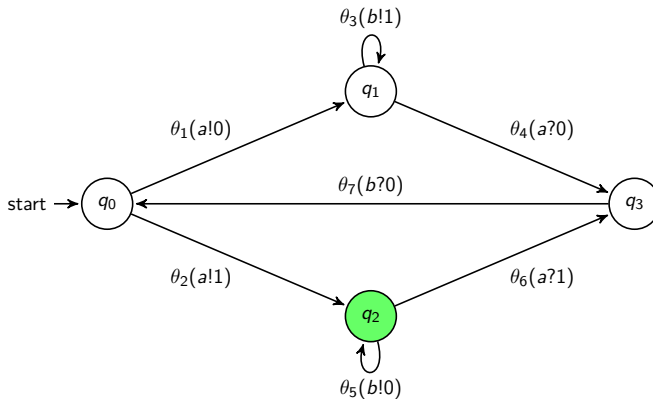
Langage de traces annotées



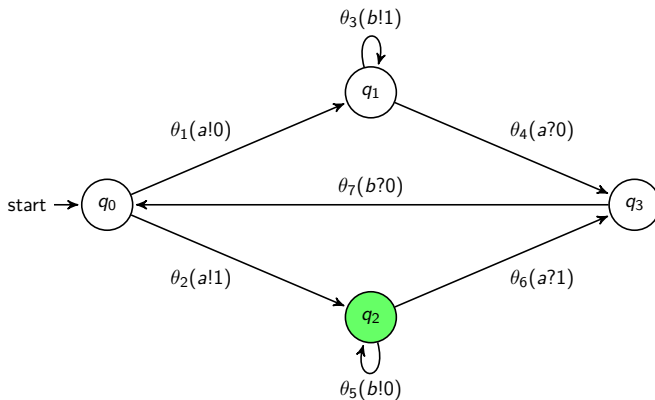
€

€

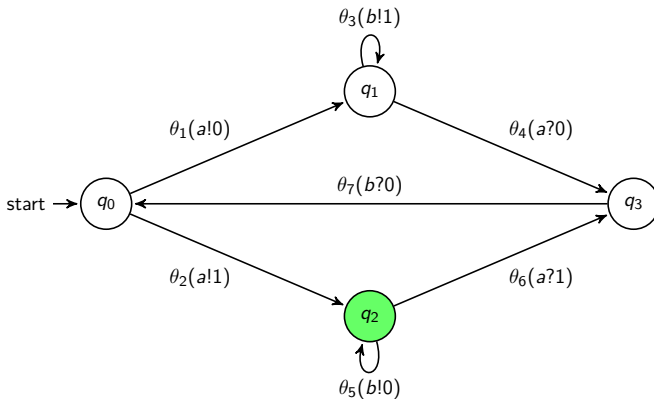
Langage de traces annotées

 θ_2 θ_2

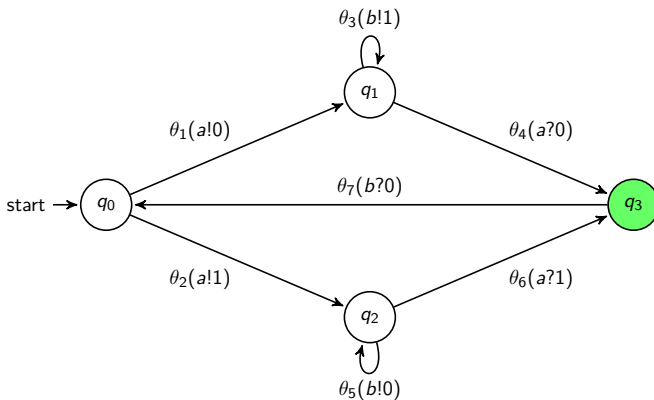
Langage de traces annotées


 $\theta_2\theta_5$
 $\theta_2\theta_5$

Langage de traces annotées


 $\theta_2\theta_5\theta_5$
 $\theta_2\theta_5\theta_5$

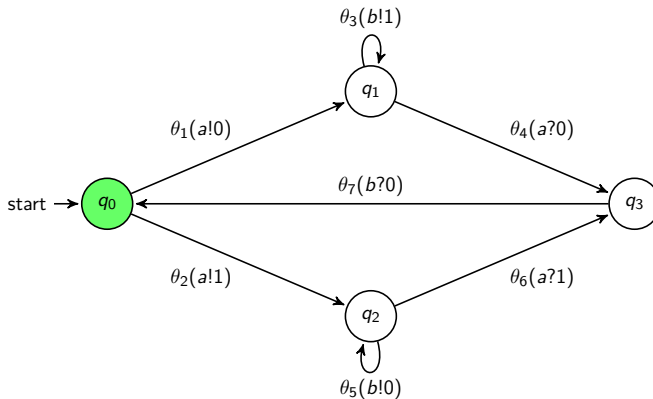
Langage de traces annotées



$$\theta_2\theta_5\theta_5\theta_6$$

$$\bar{\theta}_2\theta_5\theta_5$$

Langage de traces annotées



$$\theta_2\theta_5\theta_5\theta_6\theta_7$$

$$\bar{\theta}_2\bar{\theta}_5\theta_5$$

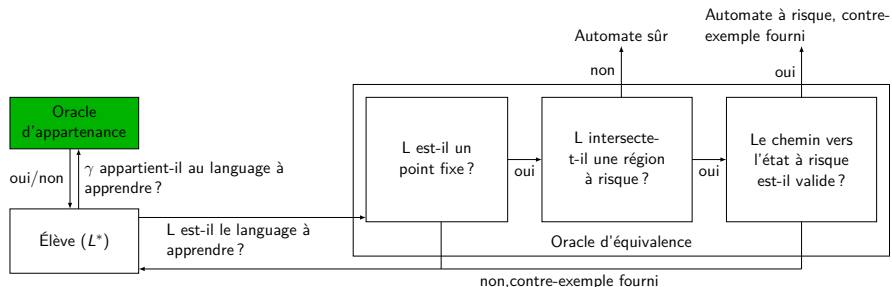
Oracle d'appartenance

$$\bar{\theta}_2 \bar{\theta}_5 \bar{\theta}_5 \bar{\theta}_1 \theta_3$$

↓ *Existe?*

$$\theta_2 \theta_5 \theta_5 \theta_6 \theta_7 \theta_1 \theta_3 \theta_4 \theta_7$$

Oracle d'appartenance



Point fixe

$$\mathcal{F}(L)$$

Point fixe

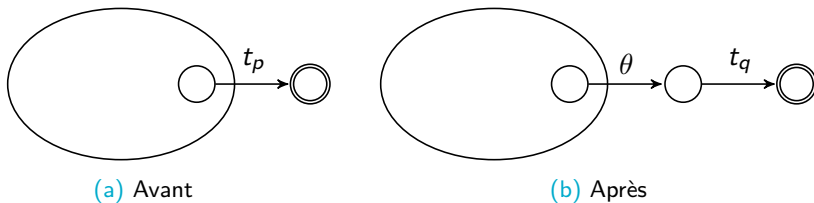
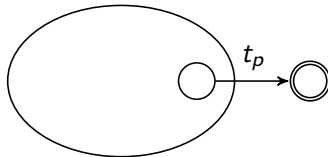
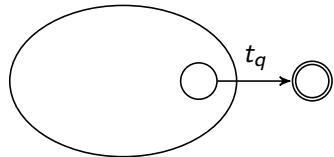


Figure – $Post(L', \theta)$ avec θ de forme $c!a$

Point fixe



(a) Avant

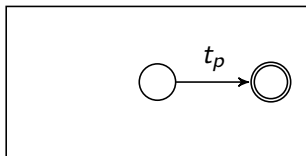


(b) Après

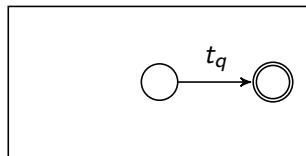
Figure – $Post(L', \theta)$ avec θ de forme τ



Point fixe



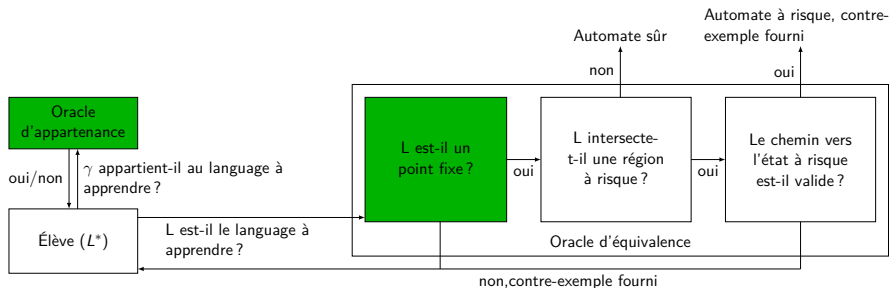
(a) Avant



(b) Après

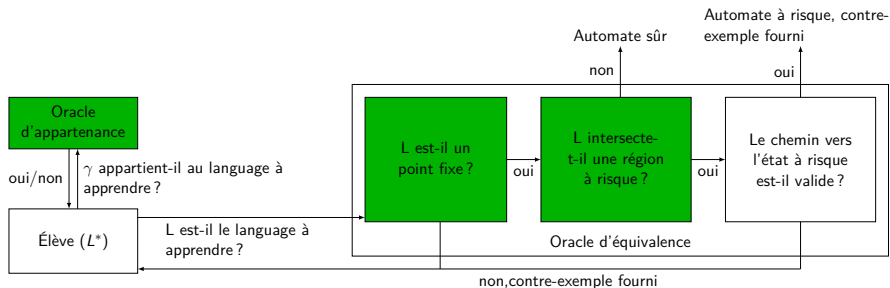
Figure – Fin du calcul de $Post(L', \theta)$ avec θ de la forme $c?a$

Point fixe



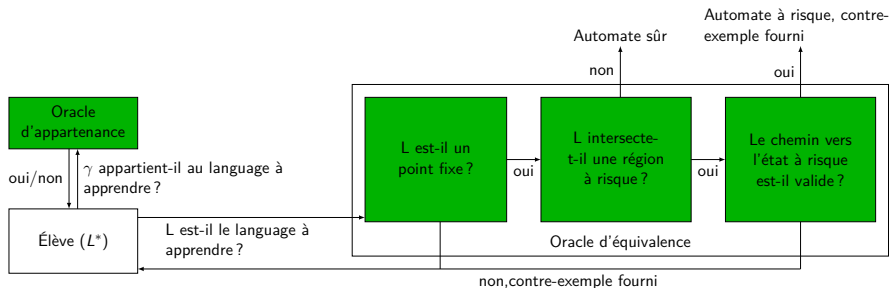
Intersection avec la zone à risque

Intersection avec la zone à risque

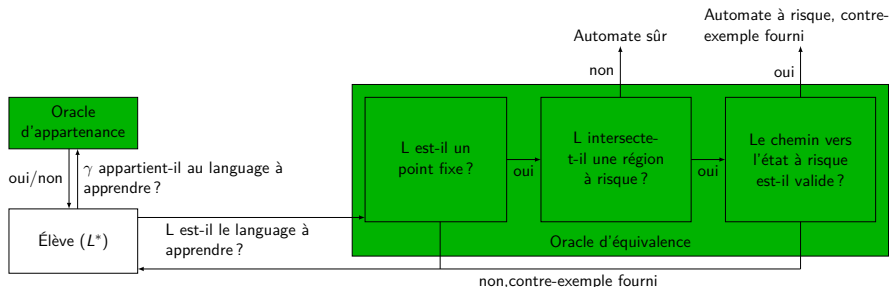


Validité du chemin

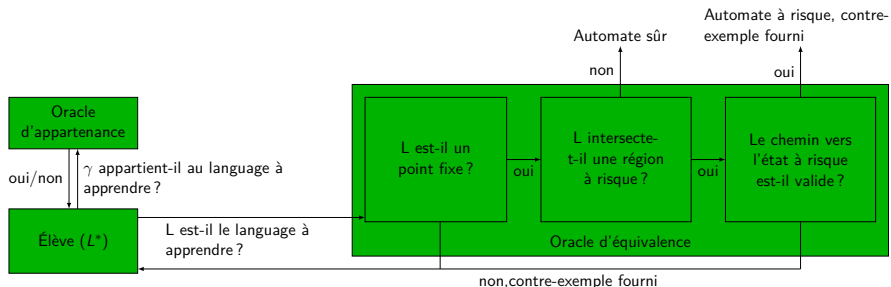
Validité du chemin



Validité du chemin



Validité du chemin



Conclusion



A. VARDHAN, K. SEN, M. VISWANATHAN, AND G. AGHA,
Actively learning to verify safety for fifo automata, in International
Conference on Foundations of Software Technology and Theoretical
Computer Science, Springer, 2004, pp. 494–505.