

memoPromela \subset PROMELA

①

Var = $\{ x_1, \dots, x_m \}$ $x_i \in \text{ide}$

Dom(x) $\subseteq \mathbb{Z}$ 13/04/17

$\subseteq \text{Bool}$

$\subseteq [z_1, z_2]$

ide ::= ~~lett~~ ide cif | ide lett | lett

cif ::= 0 | 1 | ... | 3

lett ::= _ | a | b | ... | z | A | B | ... | Z

Const = $\{ c_1, c_2, \dots, c_k \}$ $c_i \in \text{ide}$

Var \neq Const

expr ::= aexpr | bexpr

aexpr ::= num | -num' | ide

aexpr₂ AOp aexpr₁

num ::= 0 | num'

num' ::= num' cif | cif

AOp ::= + | - | * | / | %

~~num'~~
cif ::= 1 | 2 | ... | 3

bexpr ::= true | false | ide | ! bexpr |

LOp ::= && | ||

bexpr₁ != bexpr₂

bexpr₁ LOp bexpr₂ | aexpr₂ ROp aexpr₁

ROp ::= < | <= | > | >=

aexpr₁ != aexpr₂

bexpr₁ = bexpr₂ | aexpr₁ = aexpr₂

STATEMENTS

$x \in \text{ide}$

$e \in \text{expr}$

$c \in \text{ide}$

$x \in \text{Var}$

$c \in \text{Chan}$

$\text{stmt} ::= \text{skip} \mid x := e \mid c?x \mid c!e \mid$ ②

$\text{stmt}_1 ; \text{stmt}_2 \mid \underline{\text{atomic}} \{ (x := e)^+ \}$

$\text{if} :: b_1 \Rightarrow \text{stmt}_1 \mid b_2 \Rightarrow \text{stmt}_2 \mid \dots \mid b_m \Rightarrow \text{stmt}_m \mid \text{fi}$

$\underline{\text{do}} :: b_1 \Rightarrow \text{stmt}_1 \mid \dots \mid b_m \Rightarrow \text{stmt}_m \mid \underline{\text{od}}$

Var, Chan

$\mathcal{S} : \text{stmt}$

$\longrightarrow \text{PG} [\longrightarrow \text{TS}]$

** VARIANT OF PG

WITH GUARDED COMMUNICATION

eg $\xrightarrow{g:c?x}$

$s \in \text{Stmt} \longmapsto \textcircled{\text{PG}}^{**} = (\text{Loc}, \text{Act}, \text{Effect}, \text{c} \longrightarrow, \text{Loc}_0, g_0)$

con. to skip

SOS

$\text{Act} = \{ \text{id} \} \cup \{ \text{assign}(x, e) \mid x \in \text{Var}, e \in \text{expr} \} \cup$

$\text{Loc} = \underline{\text{sub}(s)}$

$\{ c?x, c!e \mid c \in \text{Chan}, x \in \text{Var}, e \in \text{expr} \}$

*

$\text{sub} : \text{stmt} \longrightarrow \textcircled{\text{S}}_2 \text{ stmts} \cup \{ \text{exit} \}$
 $\{ d'_0, d'_1, \dots, d'_{m_2}, d''_0, d''_1, \dots, d''_{m_2}, \dots \}$

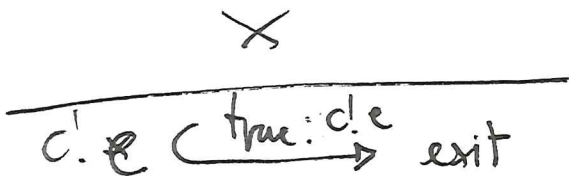
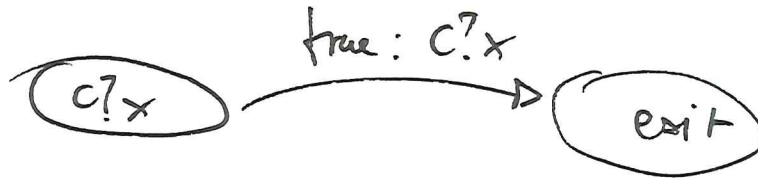
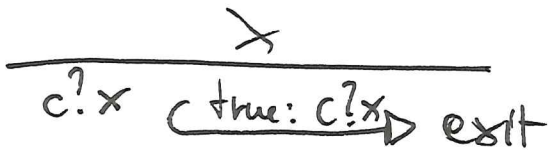
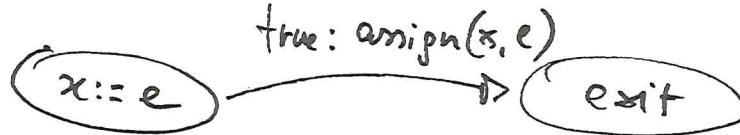
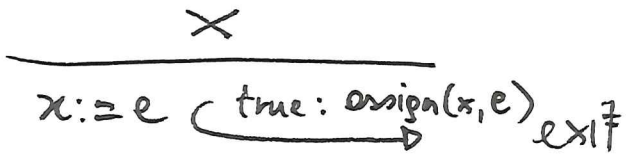
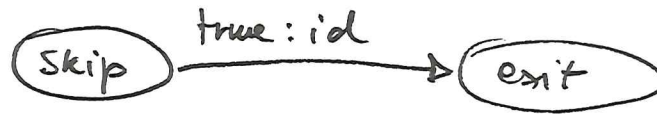
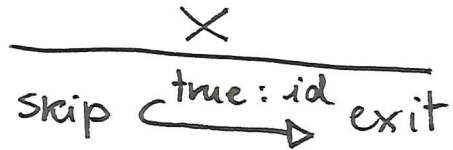
$$Loc_p = \{ stmt \}$$

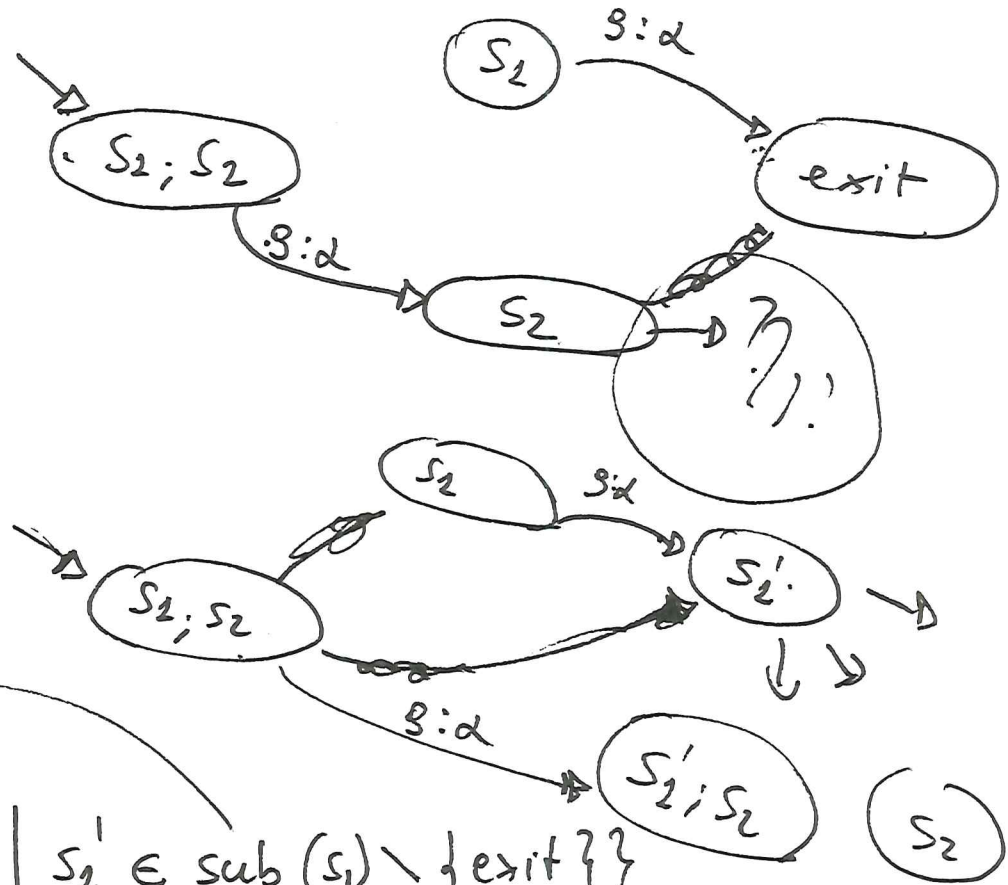
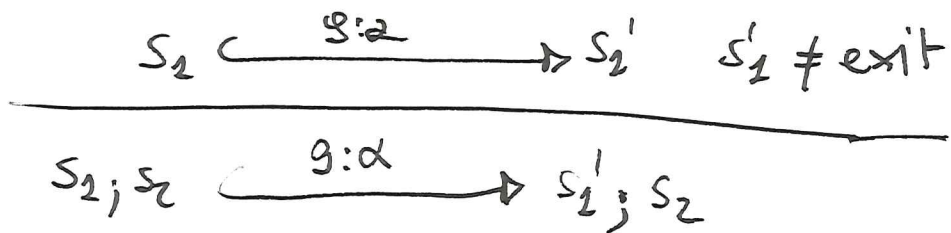
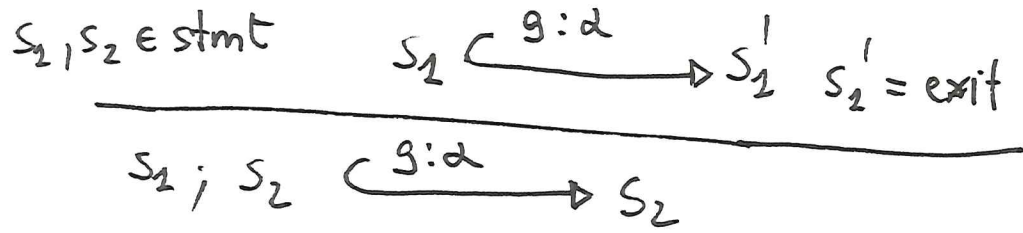
$$g_0 \equiv \bigwedge_{x \in Var} x = 0 \quad \wedge \quad \bigwedge_{x \in Var} x = false$$

$Dom(x) \subseteq \mathbb{Z} \qquad Dom(x) = Bool$

(3)

INFERENCE RULES





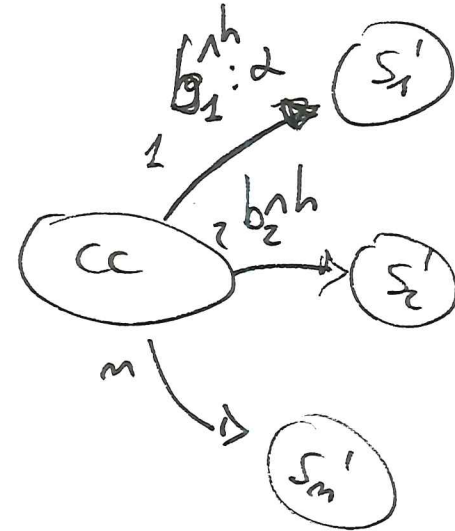
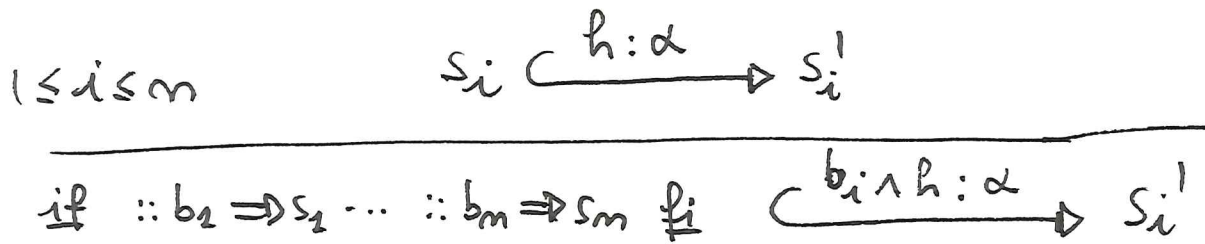
$$\text{Sub}(s_1; s_2) = \{ \cancel{s_1; s_2} \} \cup \{ s_1'; s_2 \mid s_1' \in \text{sub}(s_1) \setminus \{ \text{exit} \} \}$$

$$\cup \text{Sub}(s_2)$$

(4)

CONDITIONAL COMMAND $cc = \text{if} :: b_1 \Rightarrow s_1 \quad :: b_2 \Rightarrow s_2 \quad \dots \quad :: b_m \Rightarrow s_m \quad fi$

(5)



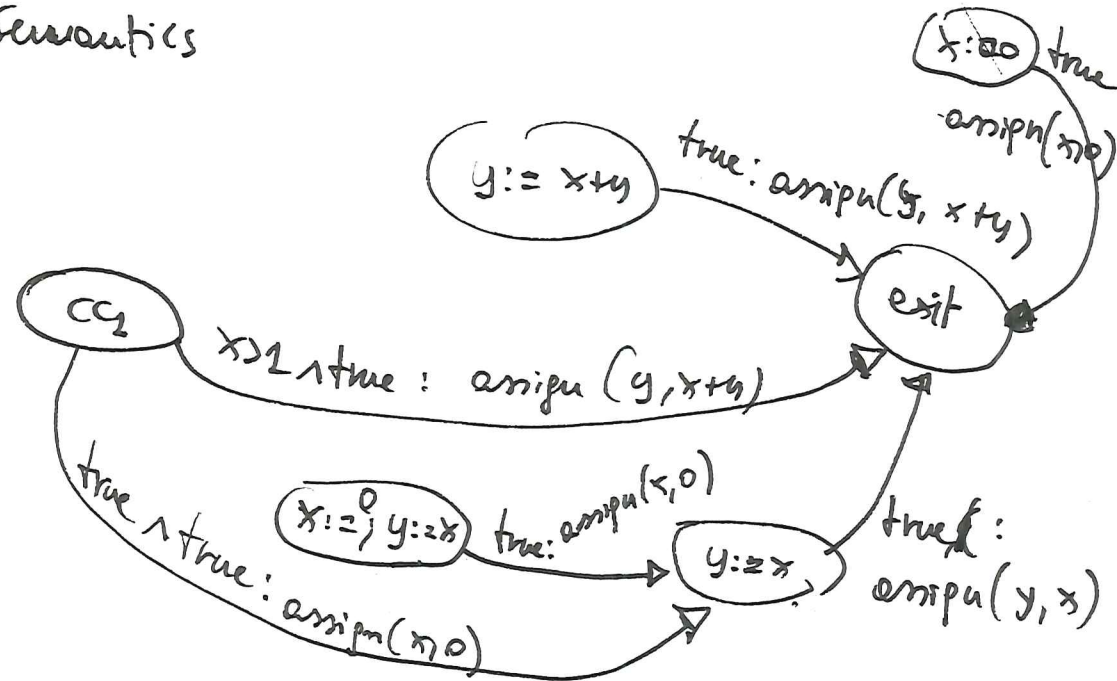
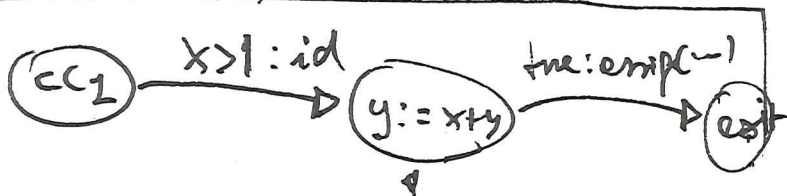
Test and Set Semantics \neq Two-steps Semantics

$$\underline{cc}_1 \quad \underline{\text{if}} :: x > 1 \Rightarrow y := x + y$$

$$\quad \quad \quad :: \text{true} \Rightarrow x := 0; y := 2x$$

$$\neq ?$$

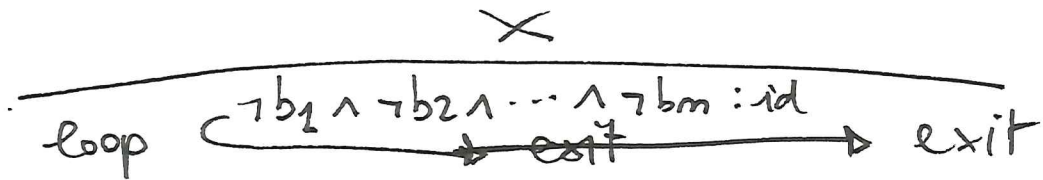
Two-step sem



Loop Command

loop do :: $b_1 \Rightarrow s_1$:: $b_2 \Rightarrow s_2$... :: $b_m \Rightarrow s_m$ ~~od~~ od

5 brs



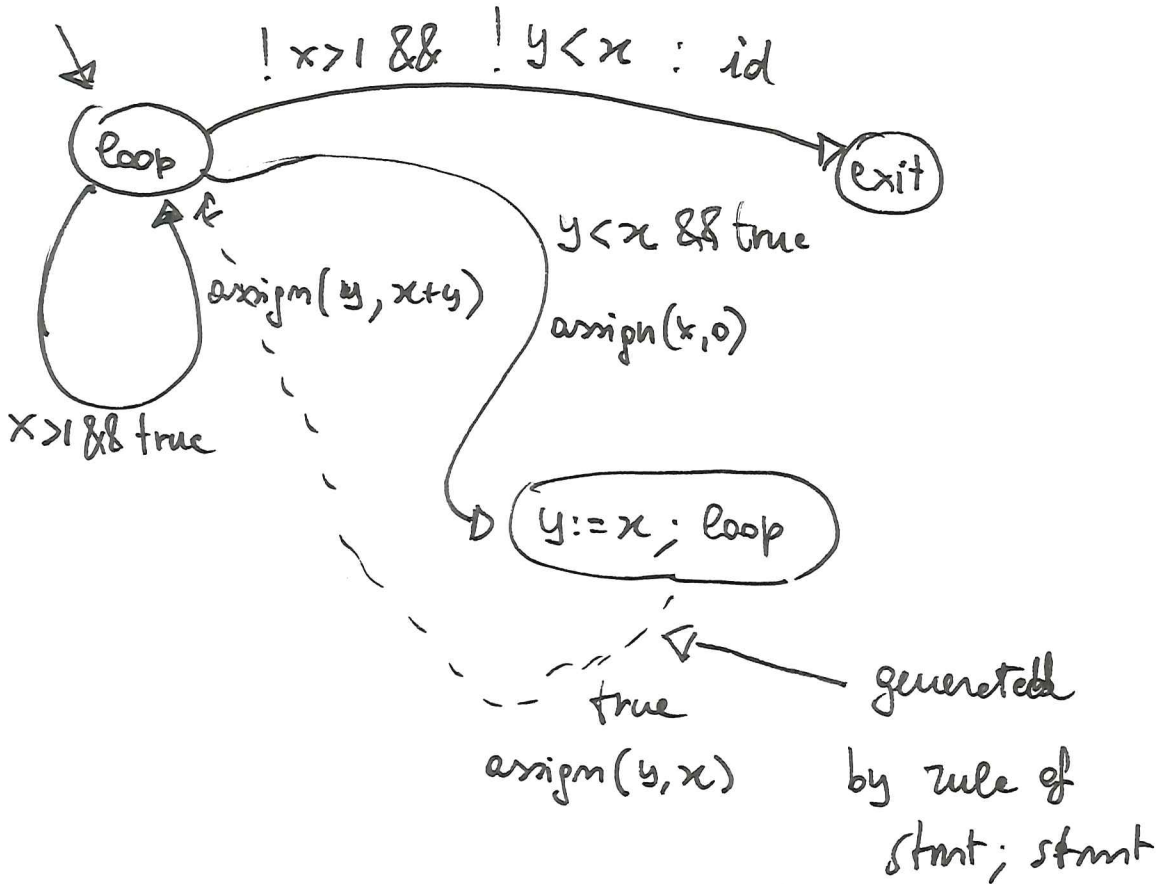
$1 \leq i \leq m$ $s_i \xrightarrow{h:d} s_i'$ $s_i' = \text{exit}$

loop $b_i \wedge h:d \rightarrow$ loop

$1 \leq i \leq m$ $s_i \xrightarrow{h:d} s_i'$ $s_i' \neq \text{exit}$

loop $b_i \wedge h:d \rightarrow$ s_i' ; loop

$\text{loop} = \underline{\text{do}} :: x > 1 \Rightarrow y := x + y$
 $:: y < x \Rightarrow x := 0; y := x$
 $\underline{\text{od}}$



$x := 0 \xrightarrow{\text{true: assign}(x, 0)} \text{exit}$

 $x := 0; y := x \xrightarrow{\text{true: assign}(x, 0)} y := x$

$S_1 \xrightarrow{h: \alpha} S_1' \quad S_2' = \text{exit}$

 $S_1; S_2 \xrightarrow{h: \alpha} S_2$

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Two-step seq

7

cc

$1 < i \leq m$

if $:: b_1 \Rightarrow s_1 \dots :: b_m \Rightarrow s_m \text{ fi } \left(b_i : id \right) \rightarrow s_i$

loop

loop $\left(\neg b_1 \wedge \dots \wedge \neg b_m : id \right) \rightarrow \text{exit}$

$1 < i \leq m$

do $:: b_1 \Rightarrow s_1 \dots :: b_m \Rightarrow s_m \left(b_i : id \right) \rightarrow s_i ; \text{ loop}$