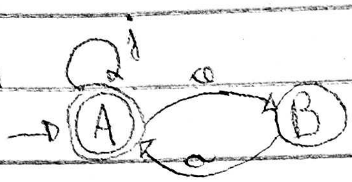
João Vitor de Carvalho Mota 160127823

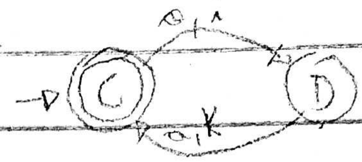
Prova 1 - Controle para automação

$E = \{j, o, a, v, i, K, t, r\}$

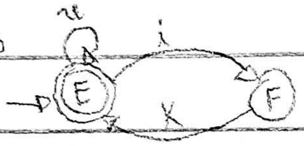
1) G_1



G_2



G_3



$\Gamma_1(A) = \{j, o\}$ $\Gamma_2(C) = \{o, i\}$ $\Gamma_3(E) = \{i, v\}$

$\Gamma_1(B) = \{a\}$ $\Gamma_2(D) = \{a, K\}$ $\Gamma_3(E) = \{K\}$

$E_1(j, o, a)$ $E_2(o, i, a, K)$

a) $G_1 \times G_3$

1. $x_0(A, E)$

2. $\Gamma_1(A) \cap \Gamma_3(E) = \{\} =$ n.d. Como $\Gamma_1(A) \cap \Gamma_3(E) =$ n.d., a multiplicação $G_1 \times G_3$ é um autômato vazio.

b) $G_1 \| G_2 \| G_3$

$G_1 \| G_2$

1. $x_0 = (A, C)$ ✓

$f_{1\|2}((A, C), o) = (B, D)$ ✓

$f_{1\|2}((A, C), j) = (A, C)$ ✓

$f_{1\|2}((A, C), i) = (A, D)$ ✓

2. $f_{1\|2}((B, D), a) = (A, C)$ ✓

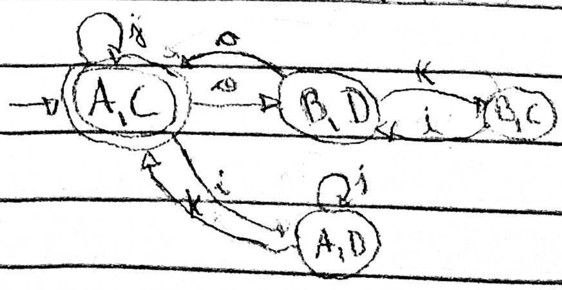
$f_{1\|2}((B, D), K) = (B, C)$

3. $f_{1\|2}((A, D), j) = (A, D)$ ✓

$f_{1\|2}((A, D), K) = (A, C)$ ✓

4. $f_{1\|2}((B, C), i) = (B, D)$ ✓

$G_1 \| G_2$: $E_{1\|2} = \{j, o, a, i, k\}$

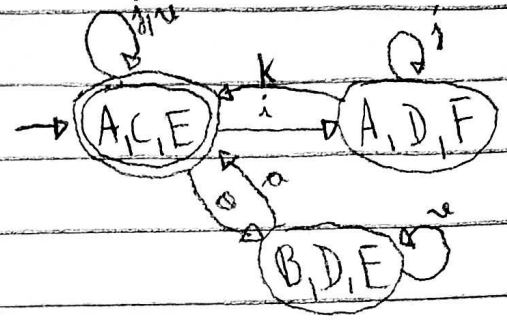


$G_1 \| G_2$: $\Gamma_{1\|2}(A,C) = \{a, i, i\}$ $\Gamma_{1\|2}(A,D) = \{i, K\}$ $\Gamma_3(E) = \{v, i\}$

$\Gamma_{1\|2}(B,D) = \{a, K\}$ $\Gamma_{1\|2}(B,C) = \{i\}$ $\Gamma_3(F) = (K)$

$E_{1\|2} = \{i, a, a, i, K\}$ $E_3 = \{v, i, K\}$

$(G_1 \| G_2) \| G_3$



1. $x_0((A,C,E)$ ✓

2. $f_{1\|2\|3}((A,C,E),i) = (A,D,F)$ ✓

$f_{1\|2\|3}((A,C,E),a) = (B,D,E)$ ✓

$f_{1\|2\|3}((A,C,E),i) = (A,C,E)$ ✓

$f_{1\|2\|3}((A,C,E),v) = (A,C,E)$ ✓

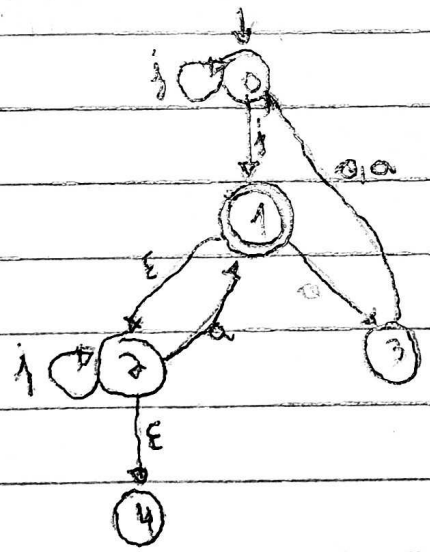
3. $f_{1\|2\|3}((A,D,F),K) = (A,C,E)$ ✓

$f_{1\|2\|3}((A,D,F),i) = (A,D,F)$ ✓

4. $f_{1\|2\|3}((B,D,E),a) = (A,C,E)$ ✓

$f_{1\|2\|3}((B,D,E),v) = (B,D,E)$ ✓

2) G_{nd}



a) $Obs(G_{nd})$

1. $x_{0obs} = \varepsilon R(\{0\}) = \{0\}$

2. $f_{obs}(\{0\}, i) = \varepsilon R(\{0,1\}) = \{0,1,2,4\}$ ✓

$f_{nd}((0), i) = \{0,1\}$

3. $f_{obs}(\{0,1,2,4\}, i) = \varepsilon R(\{0,1,2\}) = \{0,1,2,4\}$ $f_{obs}(\{0,1,2,4\}, a) = \varepsilon R\{3\} = \{3\}$ ✓

$f_{nd}((0,1), i) = \{0,1\}$ $f_{nd}(1, a) = \{3\}$

$f_{nd}(2, i) = \{2\}$

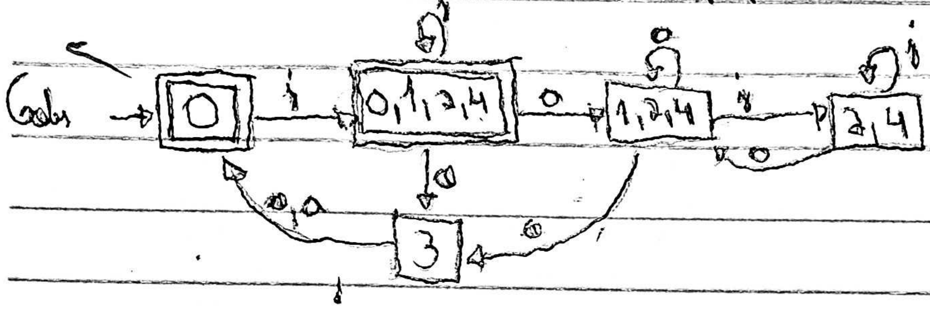
$f_{obs}(\{0,1,2,4\}, a) = \varepsilon R(\{1\}) = \{1,2,4\}$ ✓

$f_{nd}(2, a) = \{1\}$

4. $f_{obs}(\{3\}, o) = \{0\}$ ✓ $f_{obs}(\{3\}, a) = \{0\}$

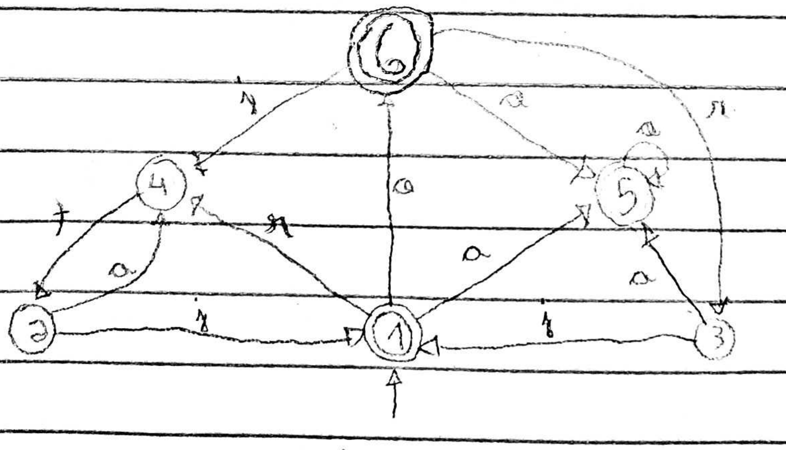
5. $f_{obs}(\{1,2,4\}, j) = \{2,4\}$ ✓ $f_{obs}(\{1,2,4\}, o) = \{3\}$ ✓
$f_{nd}(2, j) = \{2\}$ $f_{nd}(1, o) = \{3\}$
$f_{obs}(\{1,2,4\}, a) = \{1,2,4\}$ ✓
$f_{nd}(2, a) = \{1\}$

6. $f_{obs}(\{2,4\}, j) = \{2,4\}$ ✓ $f_{obs}(\{2,4\}, a) = \{1,2,4\}$ ✓
$f_{nd}(2, j) = \{2\}$ $f_{nd}(2, a) = \{1\}$



b) Dez palavras erros = {j, jj, ja, jjj, jja, ja j, jaa, jjjj, jja, jajj, jaaa...}
Servem como alerta pois pode ter ocorrido falha no sistema e ocorrer bloqueio no estado 4.

3) G



$E_o = \{j, o, a\}$
$E_{uo} = \{f, r\}$

a) $x_{obs} = UR(1) = UR(\{1\}) = \{1, 4, 2\}$ ✓
1. $f_{obs}(\{1,2,4\}, j) = UR(\{1\}) = \{1,2,4\}$ ✓ $f_{obs}(\{1,2,4\}, o) = UR(\{6\}) = \{6,3\}$ ✓
$f(2, j) = 1$ $f(1, o) = 6$
$f_{obs}(\{1,2,4\}, a) = UR(\{4,5\}) = \{2,4,5\}$ ✓
$f(1, a) = 5$
$f(2, a) = 4$

2. $f_{obs}(\{3,6\}, j) = UR(\{1,4\}) = \{1,2,4\}$ ✓ $f_{obs}(\{3,6\}, a) = UR(\{5\}) = \{5\}$ ✓

$f(3,j)=1$ $f(6,a)=5$

$f(6,j)=4$

$f_{obs}(\{3,6\}, a) = \{5\}$ ✓

$f(3,a)=5$

3. $f_{obs}(\{2,4,5\}, j) = \{1,2,4\}$ ✓ $f_{obs}(\{2,4,5\}, a) = \{5\}$ ✓

$f(2,j)=1$ $f(5,a)=5$

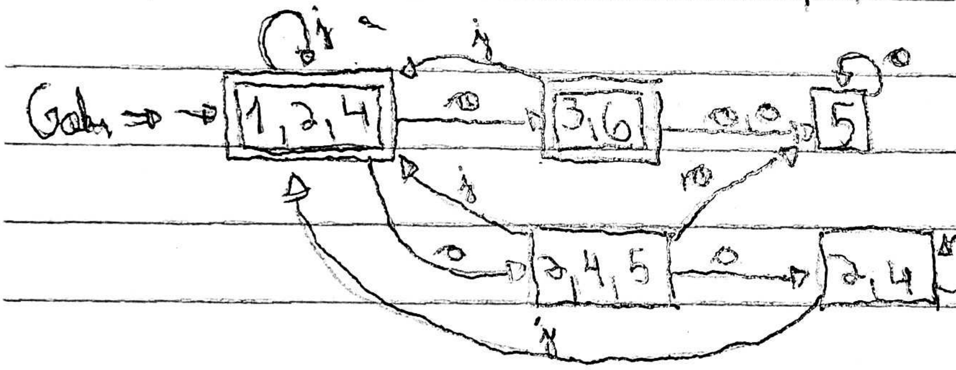
$f_{obs}(\{2,4,5\}, a) = UR(\{4\}) = \{2,4\}$

$f(2,a)=4$

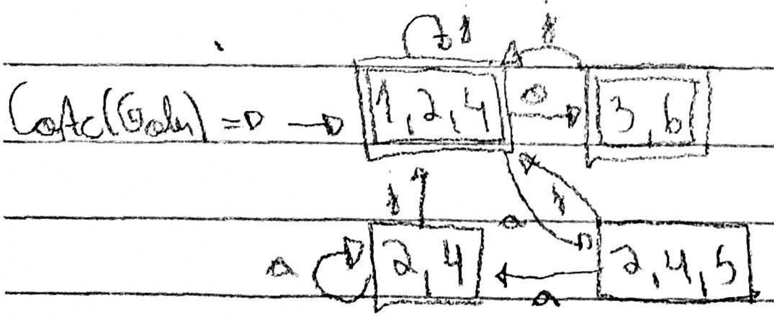
4. $f_{obs}(\{5\}, a) = \{5\}$ ✓

5. $f_{obs}(\{2,4\}, j) = \{1,2,4\}$ ✓ $f_{obs}(\{2,4\}, a) = \{2,4\}$ ✓

$f(2,j)=1$ $f(2,a)=4$



b) $\overline{L_m(Obs(G))} = L(Obs(G))$ não é verdade pois há livelock no estado $\{5\}$.



Agora $CoAc(G_{obs})$ não é bloqueante. Logo $\overline{L_m(CoAc(G_{obs}))} = L(G_{obs})$ com $G_{obs} = Obs(G)$.