

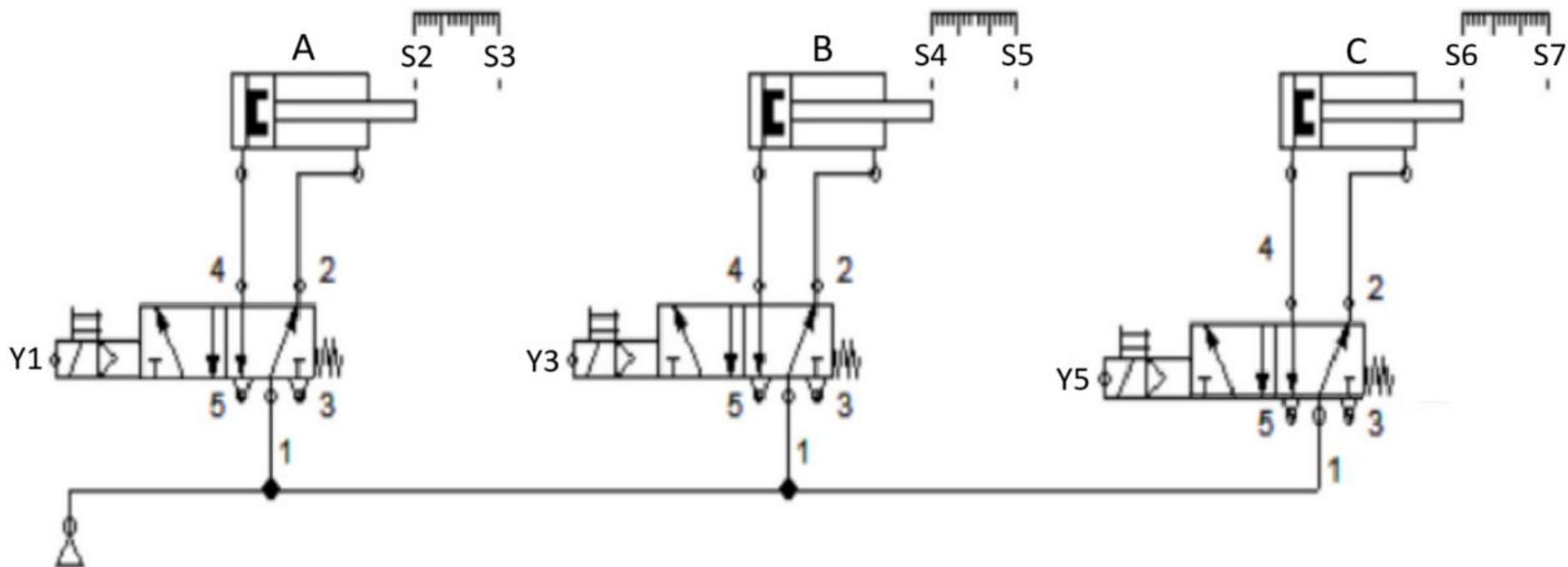
Controladores Lógicos Programáveis

Técnico em Automação Industrial

Método de programação por Maximização de contatos

Cadeia estacionária ou passo a passo

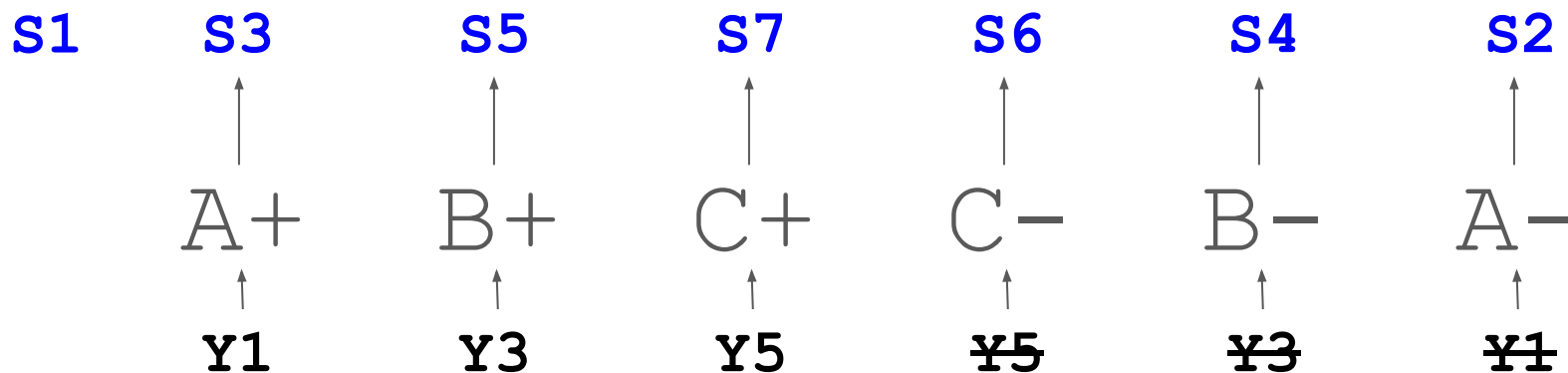
Circuito



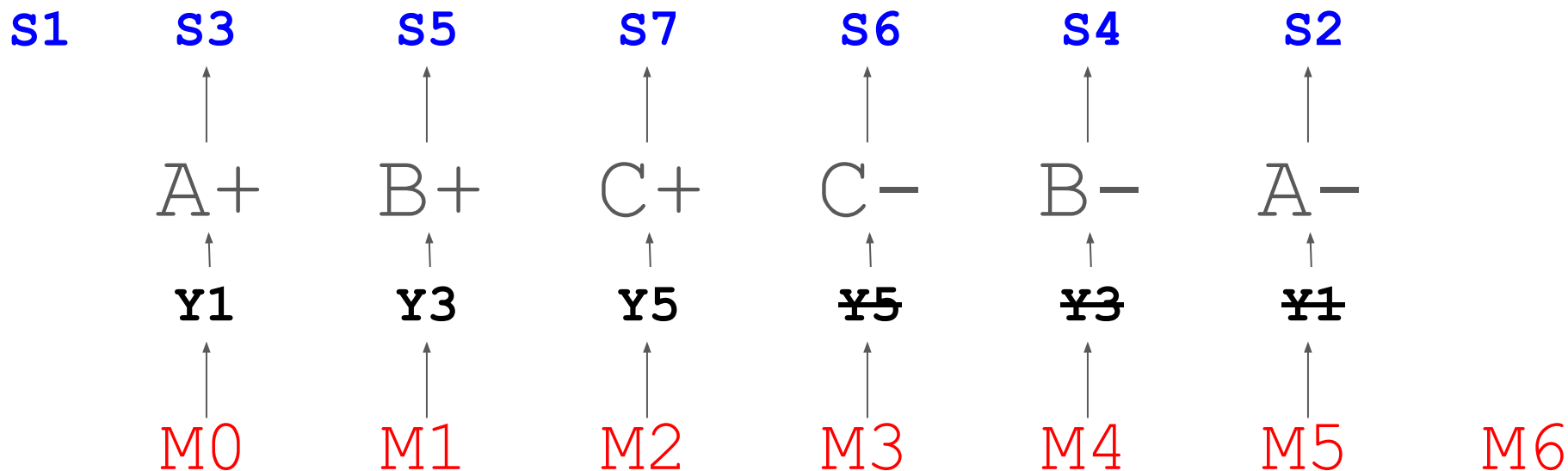
Passo 0: Sequência de acionamento

A+ B+ C+ C- B- A-

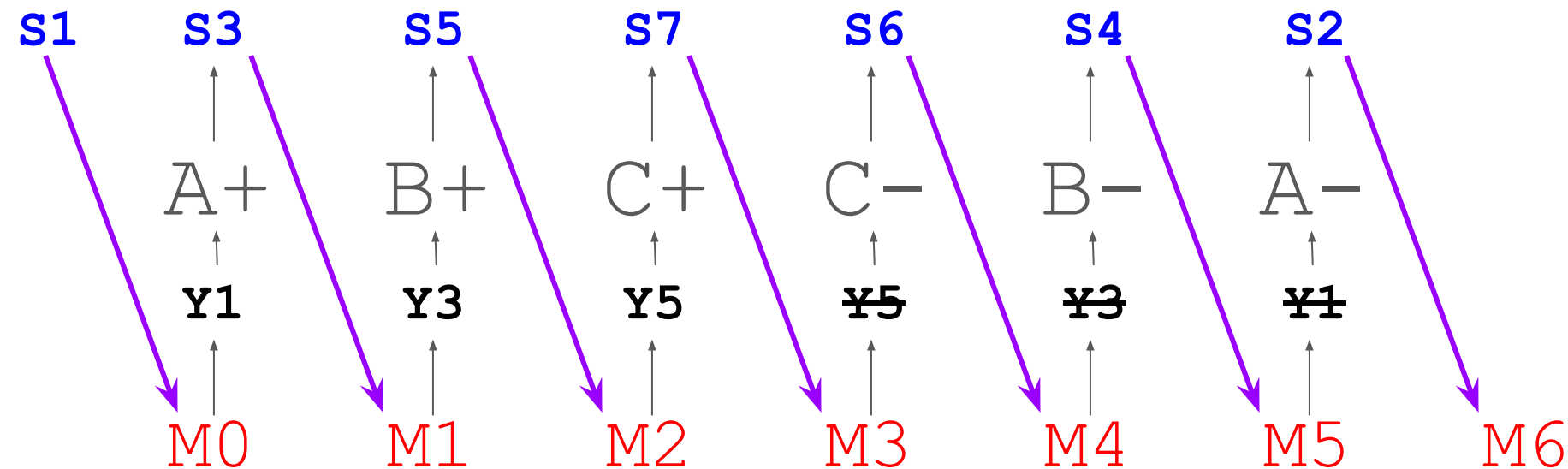
Passo 1: Atuadores e Fins de Curso



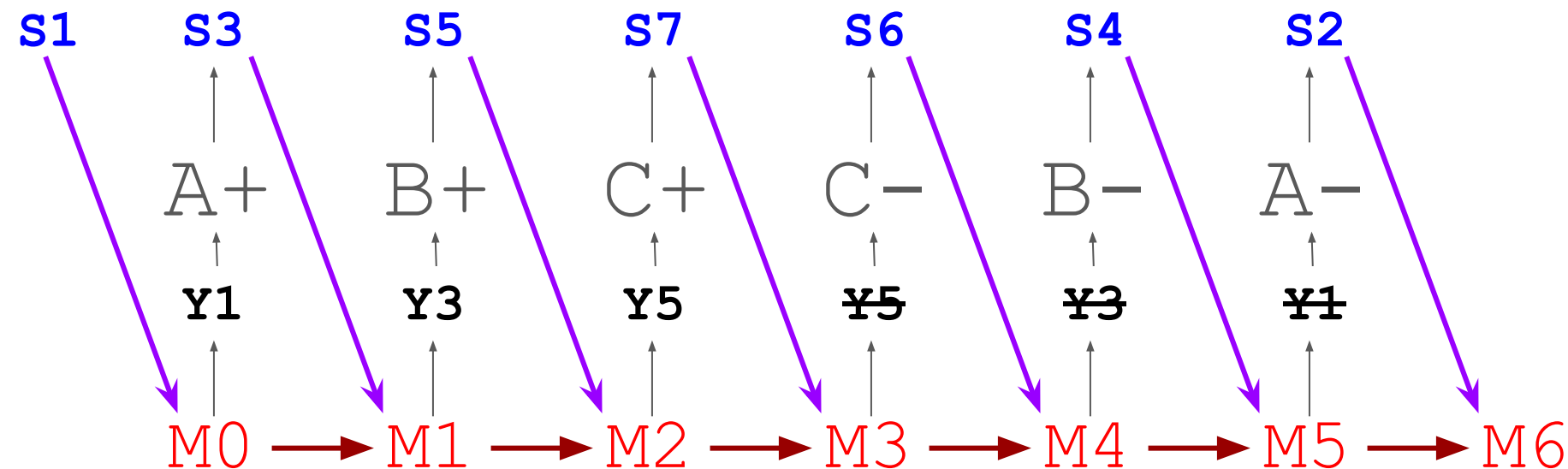
Passo 2: Para cada movimento, uma **memória**, +1



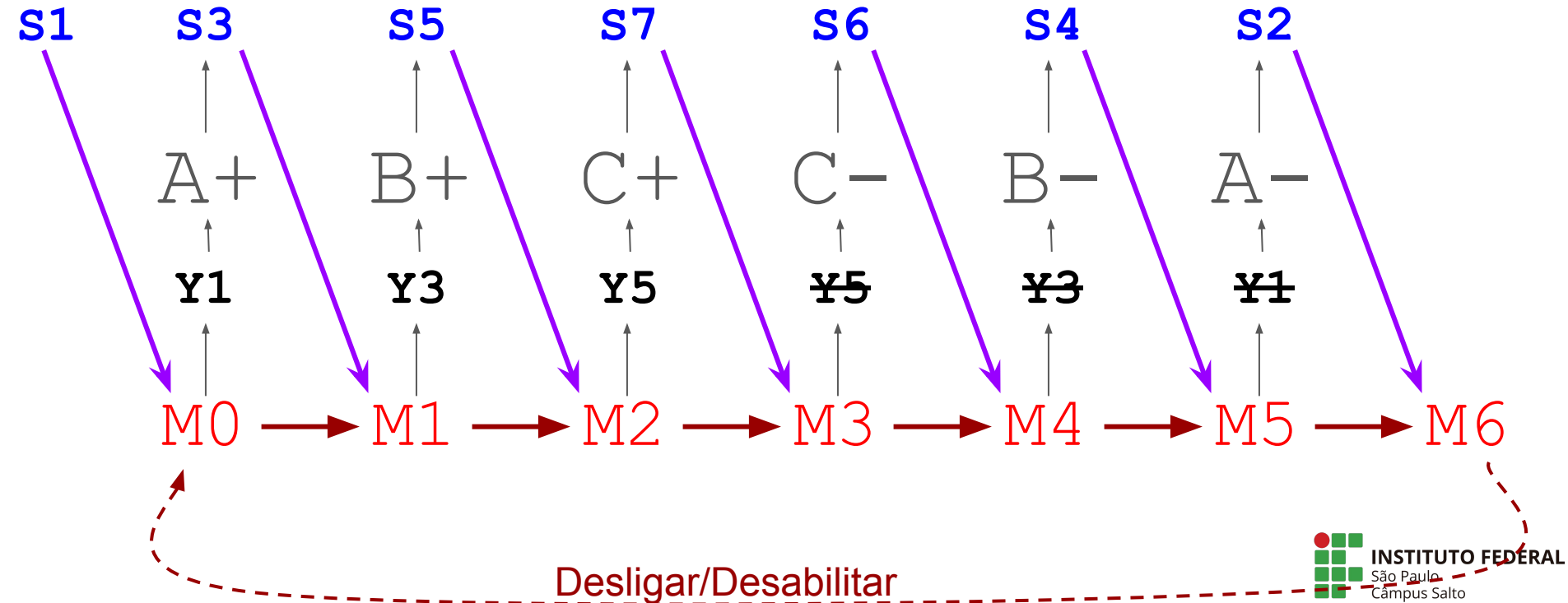
Passo 3: Acionamento das memórias



Passo 4: Habilitação das Memórias



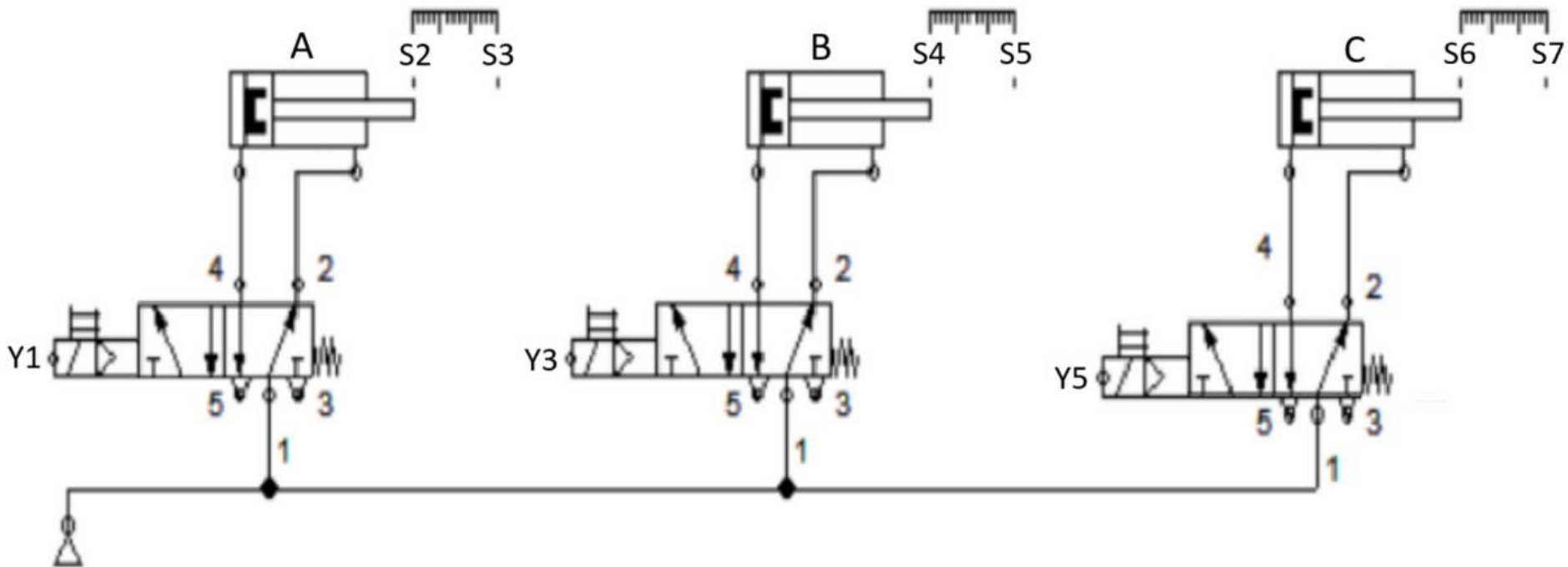
Passo 5: Desabilitação das Memórias



Programação no PLC

Linguagem Ladder

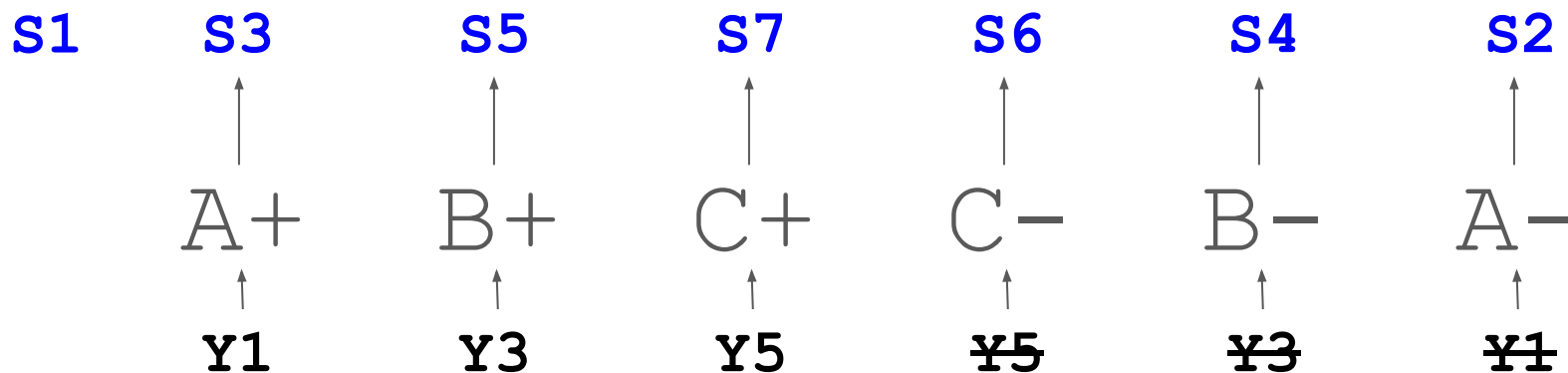
Circuito



Passo 0: Sequência de acionamento

A+ B+ C+ C- B- A-

Passo 1: Atuadores e Fins de Curso



Declaração de Entradas (Fins de curso) e Saídas (Atuadores) de acordo com o diagrama

POUs

- NAVEGA (PRG)
- PLC_PRG (PRG)
- seq_ABCcba (FB)

PLC_PRG (PRG-LD)

```
0001 PROGRAM PLC_PRG
0002 VAR
0003     Exemplo: seq_ABCcba;
0004     (* Entradas *)
0005     S1 AT %IX0.1: BOOL;
0006     S2 AT %IX0.2: BOOL;
0007     S3 AT %IX0.3: BOOL;
0008     S4 AT %IX0.4: BOOL;
0009     S5 AT %IX0.5: BOOL;
0010     S6 AT %IX0.6: BOOL;
0011     S7 AT %IX0.7: BOOL;
0012     (* Saídas *)
0013     Y1 AT %QX1.2: BOOL;
0014     Y3 AT %QX1.4: BOOL;
0015     Y5 AT %QX1.6: BOOL;
0016 END_VAR
```

seq_ABCcba (FB-LD)

```
0001 FUNCTION_BLOCK seq_ABCcba
0002 VAR_INPUT
0003     LIGAR: BOOL;
0004     XA0: BOOL;
0005     XA1: BOOL;
0006     XB0: BOOL;
0007     XB1: BOOL;
0008     XC0: BOOL;
0009     XC1: BOOL;
0010 END_VAR
0011 VAR_OUTPUT
0012     Em_execucao: BOOL;
0013     YA1: BOOL;
0014     YB1: BOOL;
0015     YC1: BOOL;
0016 END_VAR
0017 VAR
0018     M0: BOOL;
0019     M1: BOOL;
0020     M2: BOOL;
0021     M3: BOOL;
0022     M4: BOOL;
0023     M5: BOOL;
0024     M6: BOOL;
0025 END_VAR
```

Diagrama Ladder:

0001

S1

Exemplo

seq_ABCcba

LIGAR

Em_execucao

YA1-Y1

YB1-Y3

YC1-Y5

S2-XA0

S3-XA1

S4-XB0

S5-XB1

S6-XC0

S7-XC1

Declaração de interface do Bloco Funcional da Sequência

The image displays the Siemens STEP 7 LAD editor interface, showing the declaration of a functional block interface for a sequence block. The interface is divided into three main panes:

- POUs (Program Objects Units) List:** Located on the left, it shows the project structure with the following items:
 - NAVEGA (PRG)
 - PLC_PRG (PRG)
 - seq_ABCcba (FB)
- PLC_PRG (PRG-LD) Editor:** The main editor window shows the Ladder Logic (LAD) code for the PLC_PRG program. The code is as follows:

```
0001 PROGRAM PLC_PRG
0002 VAR
0003     Exemplo: seq_ABCcba;
0004 (* Entradas *)
0005 S1 AT %IX0.1: BOOL;
0006 S2 AT %IX0.2: BOOL;
0007 S3 AT %IX0.3: BOOL;
0008 S4 AT %IX0.4: BOOL;
0009 S5 AT %IX0.5: BOOL;
0010 S6 AT %IX0.6: BOOL;
0011 S7 AT %IX0.7: BOOL;
0012 (* Saidas *)
0013 Y1 AT %QX1.2: BOOL;
0014 Y3 AT %QX1.4: BOOL;
0015 Y5 AT %QX1.6: BOOL;
0016 END_VAR
```
- seq_ABCcba (FB-LD) Editor:** The right pane shows the declaration of the functional block interface for the sequence block. The code is as follows:

```
0001 FUNCTION_BLOCK seq_ABCcba
0002 VAR_INPUT
0003     LIGAR: BOOL;
0004     XA0: BOOL;
0005     XA1: BOOL;
0006     XB0: BOOL;
0007     XB1: BOOL;
0008     XC0: BOOL;
0009     XC1: BOOL;
0010 END_VAR
0011 VAR_OUTPUT
0012     Em_execucao: BOOL;
0013     YA1: BOOL;
0014     YB1: BOOL;
0015     YC1: BOOL;
0016 END_VAR
0017 VAR
0018     M0: BOOL;
0019     M1: BOOL;
0020     M2: BOOL;
0021     M3: BOOL;
0022     M4: BOOL;
0023     M5: BOOL;
0024     M6: BOOL;
0025 END_VAR
```

A blue arrow points from the **seq_ABCcba (FB)** entry in the POU list to the **seq_ABCcba (FB-LD)** editor window, indicating the link between the object and its declaration.

The LAD editor also displays a ladder logic network (Network 0001) for the **Exemplo** block. The network shows the following connections:

- Input **S1** is connected to the **LIGAR** input of the **seq_ABCcba** block.
- The **Em_execucao** output of the **seq_ABCcba** block is connected to the **Y1** output of the network.
- The **YA1** output of the **seq_ABCcba** block is connected to the **Y3** output of the network.
- The **YB1** output of the **seq_ABCcba** block is connected to the **Y5** output of the network.
- The **YC1** output of the **seq_ABCcba** block is connected to the **Y5** output of the network.

Inserir → Bloco Funcional... → FB def. pelo usuário

The screenshot displays the Siemens STEP 7 software interface, illustrating the process of inserting a user-defined functional block (FB) into a ladder logic program.

Left Panel (POUs): Shows the project structure with the following elements:

- NAVEGA (PRG)
- PLC_PRG (PRG)
- seq_ABCcba (FB)

Top Panel (PLC_PRG (PRG-LD)): Displays the ladder logic program. The code is as follows:

```
0001 PROGRAM PLC_PRG
0002 VAR
0003   Exemplo: seq_ABCcba;
0004   (* Entradas *)
0005   S1 AT %IX0.1: BOOL;
0006   S2 AT %IX0.2: BOOL;
0007   S3 AT %IX0.3: BOOL;
0008   S4 AT %IX0.4: BOOL;
0009   S5 AT %IX0.5: BOOL;
0010   S6 AT %IX0.6: BOOL;
0011   S7 AT %IX0.7: BOOL;
0012   (* Sidas *)
0013   Y1 AT %QX1.2: BOOL;
0014   Y3 AT %QX1.4: BOOL;
0015   Y5 AT %QX1.6: BOOL;
0016 END_VAR
```

A purple box highlights the declaration `Exemplo: seq_ABCcba;`, and a purple double-headed arrow indicates its connection to the functional block in the ladder logic diagram.

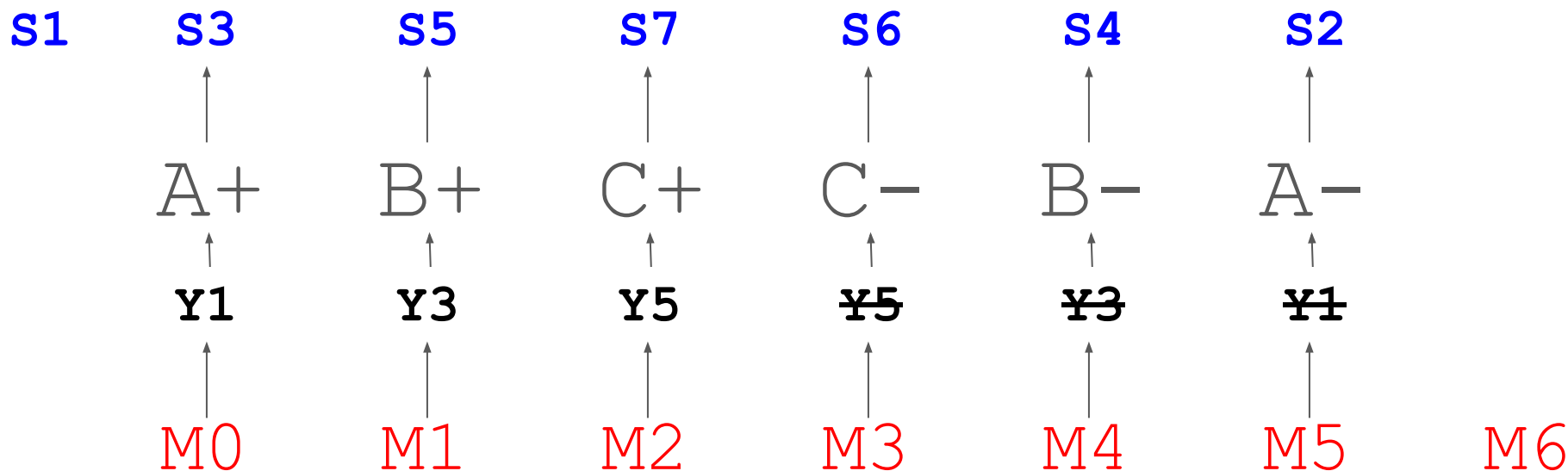
Bottom Panel (Ladder Logic Diagram): Shows a ladder logic network with the following components:

- Input S1 connected to a normally open contact.
- Input S2 connected to a normally closed contact.
- Input S3 connected to a normally open contact.
- Input S4 connected to a normally open contact.
- Input S5 connected to a normally open contact.
- Input S6 connected to a normally open contact.
- Input S7 connected to a normally open contact.
- Functional block `Exemplo seq_ABCcba` with inputs `LIGAR` and `Em_execucao`.
- Outputs `YA1`, `YB1`, and `YC1` connected to the functional block.

Right Panel (seq_ABCcba (FB-LD)): Displays the definition of the functional block. The code is as follows:

```
0001 FUNCTION_BLOCK seq_ABCcba
0002 VAR_INPUT
0003   LIGAR: BOOL;
0004   XA0: BOOL;
0005   XA1: BOOL;
0006   XB0: BOOL;
0007   XB1: BOOL;
0008   XC0: BOOL;
0009   XC1: BOOL;
0010 END_VAR
0011 VAR_OUTPUT
0012   Em_execucao: BOOL;
0013   YA1: BOOL;
0014   YB1: BOOL;
0015   YC1: BOOL;
0016 END_VAR
0017 VAR
0018   M0: BOOL;
0019   M1: BOOL;
0020   M2: BOOL;
0021   M3: BOOL;
0022   M4: BOOL;
0023   M5: BOOL;
0024   M6: BOOL;
0025 END_VAR
```


Passo 2: Para cada movimento, uma **memória**, +1



Passo 2: Para cada movimento, uma memória, +1

POUs

- NAVEGA (PRG)
- PLC_PRG (PRG)
- seq_ABCcba (FB)

PLC_PRG (PRG-LD)

```
0001 PROGRAM PLC_PRG
0002 VAR
0003     Exemplo: seq_ABCcba;
0004     (* Entradas *)
0005     S1 AT %IX0.1: BOOL;
0006     S2 AT %IX0.2: BOOL;
0007     S3 AT %IX0.3: BOOL;
0008     S4 AT %IX0.4: BOOL;
0009     S5 AT %IX0.5: BOOL;
0010     S6 AT %IX0.6: BOOL;
0011     S7 AT %IX0.7: BOOL;
0012     (* Sidas *)
0013     Y1 AT %QX1.2: BOOL;
0014     Y3 AT %QX1.4: BOOL;
0015     Y5 AT %QX1.6: BOOL;
0016 END_VAR
```

seq_ABCcba (FB-LD)

```
0001 FUNCTION_BLOCK seq_ABCcba
0002 VAR_INPUT
0003     LIGAR: BOOL;
0004     XA0: BOOL;
0005     XA1: BOOL;
0006     XB0: BOOL;
0007     XB1: BOOL;
0008     XC0: BOOL;
0009     XC1: BOOL;
0010 END_VAR
0011 VAR_OUTPUT
0012     Em_execucao: BOOL;
0013     YA1: BOOL;
0014     YB1: BOOL;
0015     YC1: BOOL;
0016 END_VAR
0017 VAR
0018     M0: BOOL;
0019     M1: BOOL;
0020     M2: BOOL;
0021     M3: BOOL;
0022     M4: BOOL;
0023     M5: BOOL;
0024     M6: BOOL;
0025 END_VAR
```

Diagrama de Ladder:

0001

S1

LIGAR

Exemplo

seq_ABCcba

Em_execucao

YA1-Y1

YB1-Y3

YC1-Y5

S2-XA0

S3-XA1

S4-XB0

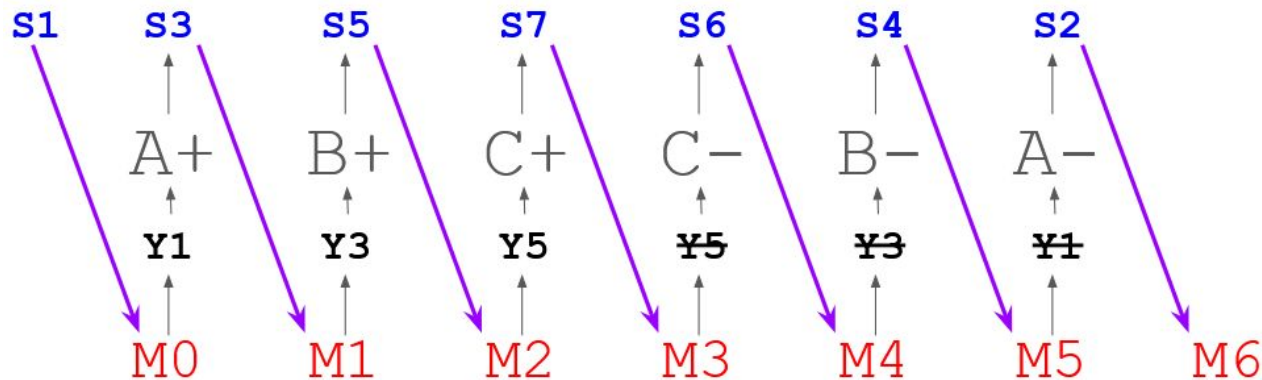
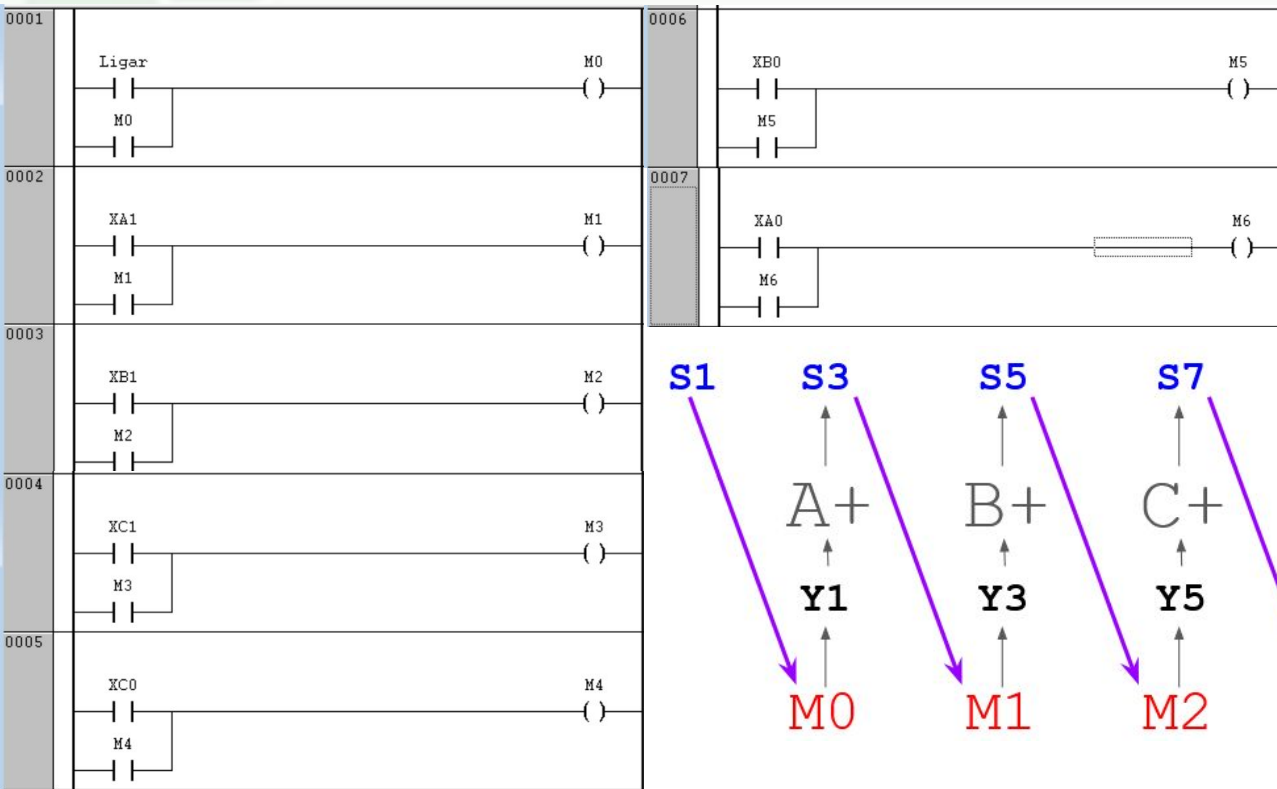
S5-XB1

S6-XC0

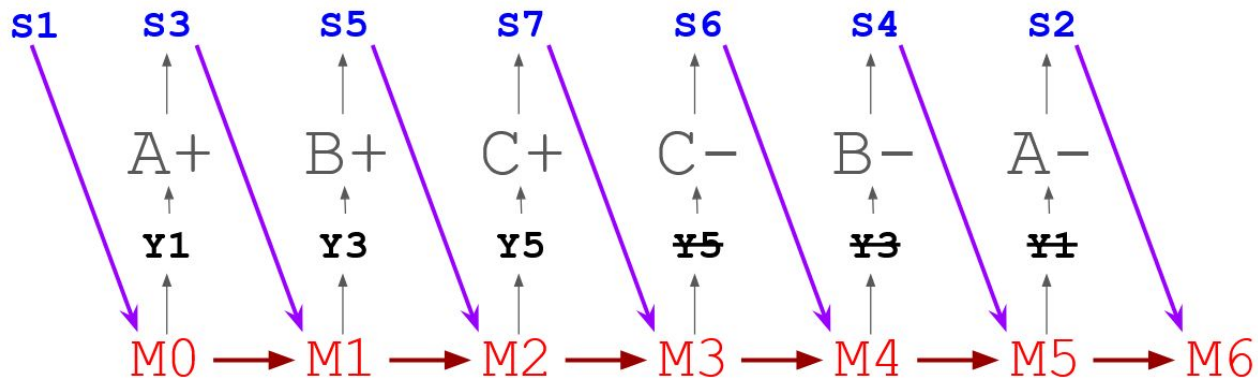
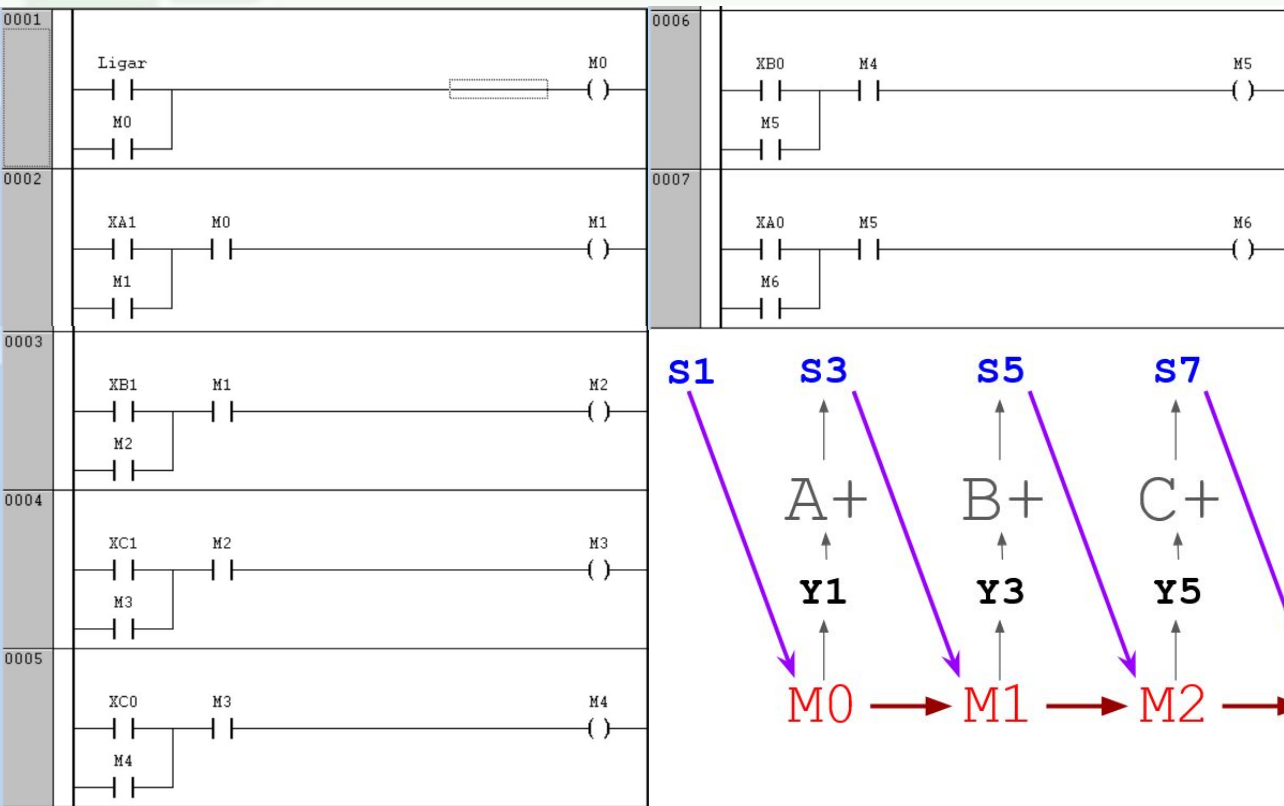
S7-XC1

Número de movimentos + 1

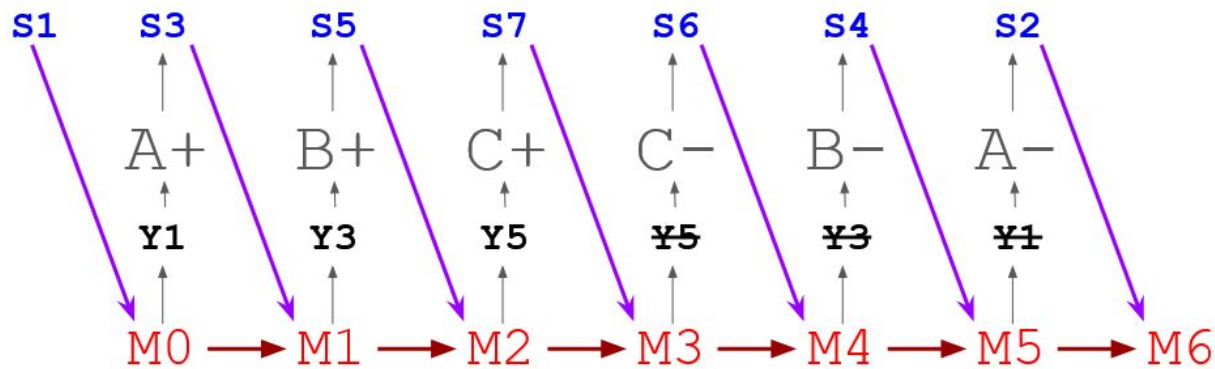
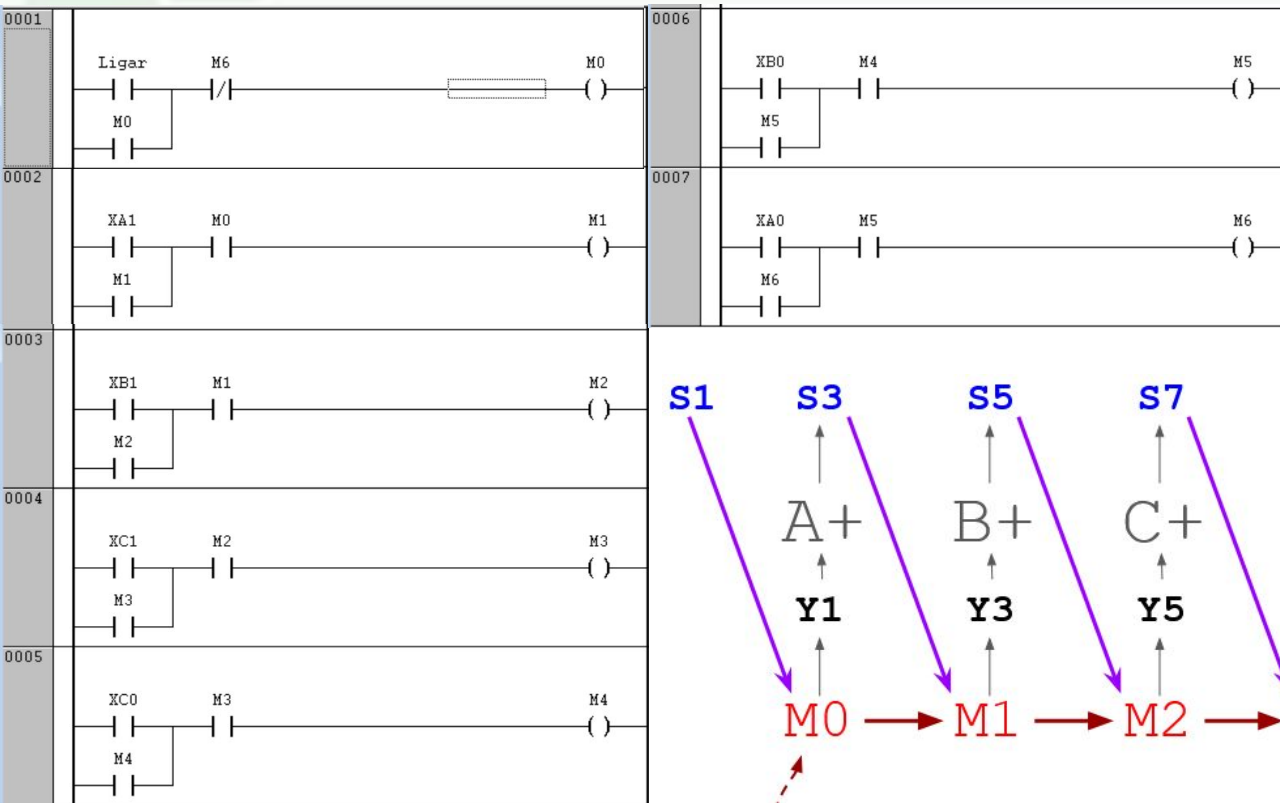
Passo 3: Acionamento das memórias



Passo 4: Habilitação das Memórias

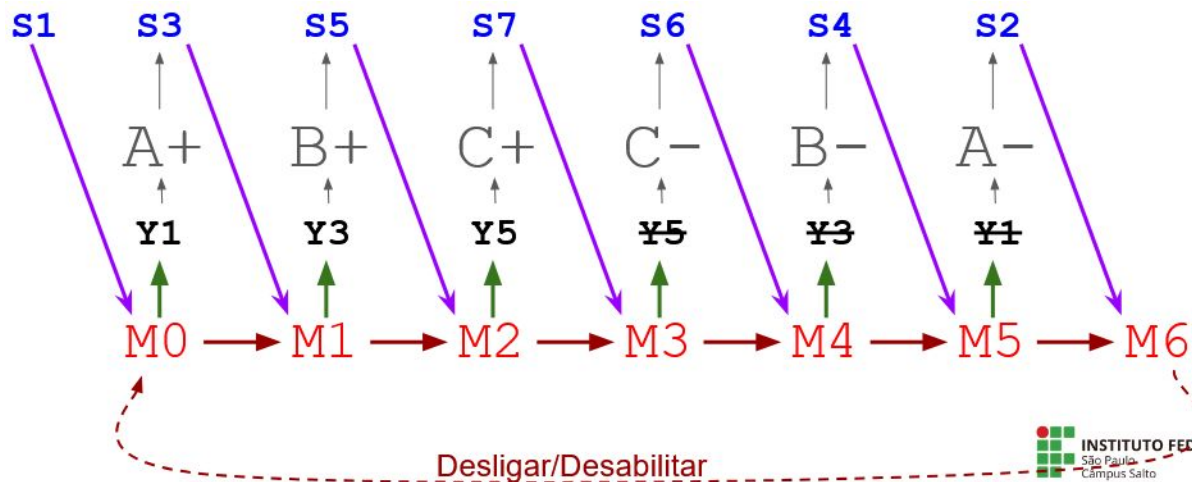
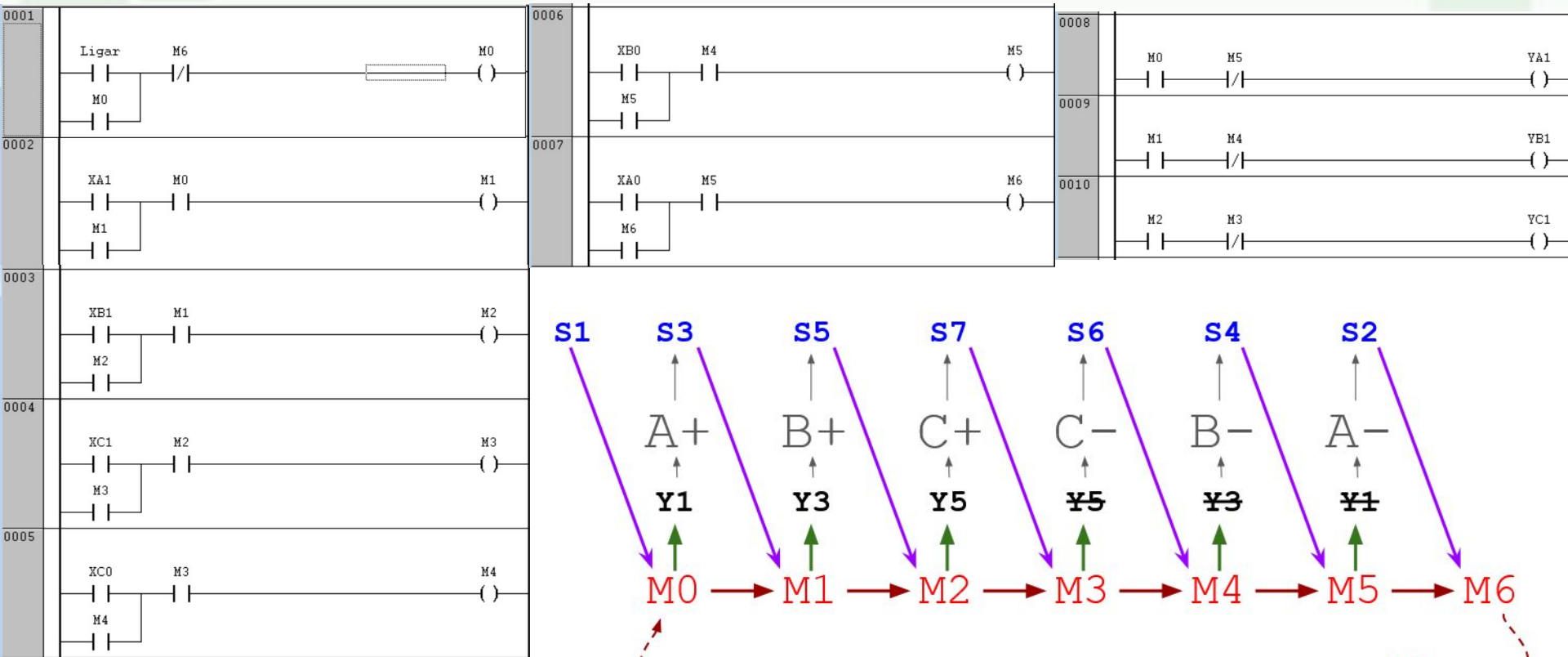


Passo 5: Desabilitação das Memórias



Desligar/Desabilitar

Passo 6: **Acionamento de Saídas**



Exercícios

Aplicar o método de Maximização de contatos, para produzir as seguintes sequências de acionamento:

1) A+ C+ C- B+ A- B-

2) A+ A- B+ B- C+ C-

3) A+ C+ [A- B+] B- C-

4) C+ B+ B- A+ C- B+ B- A-

Obs.: [A- B+]: Movimentos simultâneos