Mohamed Cherif Messaadia University, Souk Ahras
Faculty of Science and Technology

Department of Electrical Engineering
Subject: PLC
Level: 3rd year

May 11, 2025
Duration: 01 :30H
Speciality: Control

Correction of the Final Exam

Correction of the exercise 1: (05.5 pts)

1. Sensors: LDR sensor, Gyroscope sensor. **(0.75 pts)**
   Pre-actuators: Relay, Speed controller.
   Actuators: Cylinder, DC motor.
2. The most widely used PLC in the industry are: **(0.75 pts)**
   Siemens, Allen Bradley and Modicon.
3. **The advantages of the PLCs are**: **(1.5 pts)**
   - Robust design: Operates reliably in harsh environments.
   - Optimized electronics: Ensures fast, real-time response.
   - Easy maintenance: Modules are quickly replaceable.

   The disadvantages of PLC are:
   - More expensive than microcontroller-based solutions.
   - Cost varies with I/O count, memory, and modules.
   - Requires training in specific, often visual, languages.
   - Language and mapping vary by brand, despite IEC 1131 standard.
4. The factors that can affect the cycle time of a PLC are: **(1.0 pts)**
   - Longer programs increase execution time.
   - Complex calculations slow the cycle.
   - More I/Os require more processing time.
   - Faster CPU reduces cycle time.
   - Some processes need faster response times.
5. The operating principles of a PLC are: **(1.5 pts)**
   1. Inputs read and stored in Input Image Memory (IIM).
   2. User program executed to process inputs.
   3. Outputs updated from Output Image Memory (OIM).
   4. Communication with external devices managed.
   5. Self-diagnosis performed and anomalies reported.

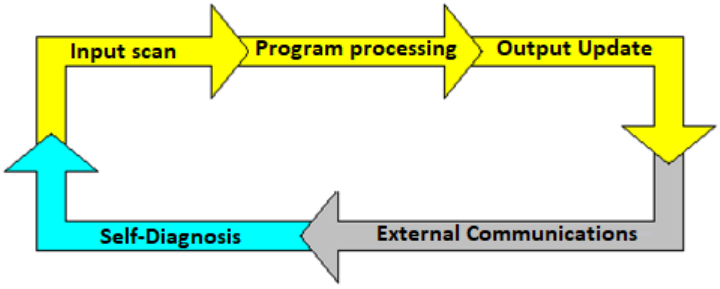


Figure 1. Operating Principle of a PLC

Correction of the exercise 2: (02.0 pts)

a) **True.** **(0.5 pts)**
b) **False.** **(0.5 pts)**
c) **False.** **(0.5 pts)**
d) **False.** **(0.5 pts)**

Correction of the exercise 3: (03.0 pts)

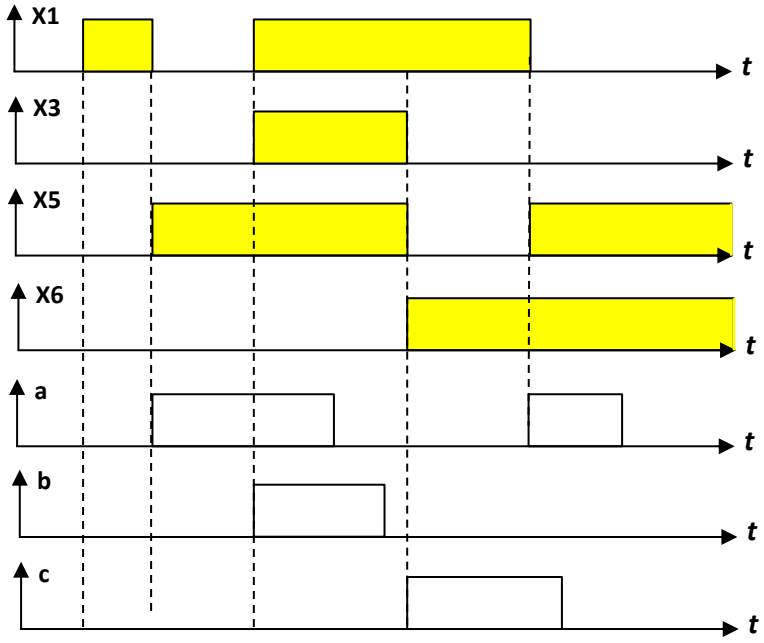
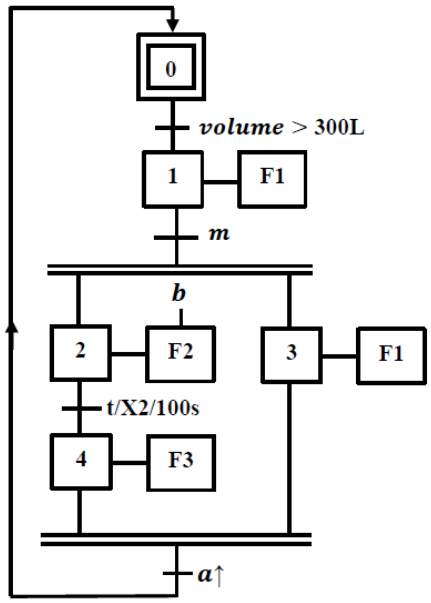


Figure 2. The timing diagram.

Correction of the exercise 04: (05.0 pts)



Nom	Type de données	Adresse
m	Bool	%I0.0
a	Bool	%I0.1
b	Bool	%I0.2
volume_acqui	Int	%IW66
F1	Bool	%Q0.0
F2	Bool	%Q0.1
F3	Bool	%Q0.2
X0	Bool	%M0.0
X1	Bool	%M0.1
X2	Bool	%M0.2
X3	Bool	%M0.3
X4	Bool	%M0.4
fm_a	Bool	%M0.5
fin_tempo	Bool	%M0.6
t/X2/100s	Bool	%M0.7
vol_normal	Real	%MD2
volume	Real	%MD6
volume>300	Bool	%M1.0

(0.25 pts)

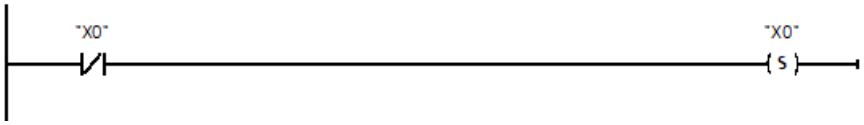
Table of Step Activation and Deactivation Conditions (1.0 pts)

Step (X_i)	Activation Condition (CA_i)	Deactivation Condition (CD_i)
X_0	$X_3 \cdot X_4 \cdot a\uparrow$	X_1
X_1	$X_0 \cdot (volume > 300L)$	$X_2 \cdot X_3$
X_2	$X_1 \cdot m$	X_4
X_3	$X_1 \cdot m$	X_0
X_4	$X_2 \cdot (t/X2/100s)$	X_0

Table of Actuator Activation Conditions (0.25 pts)

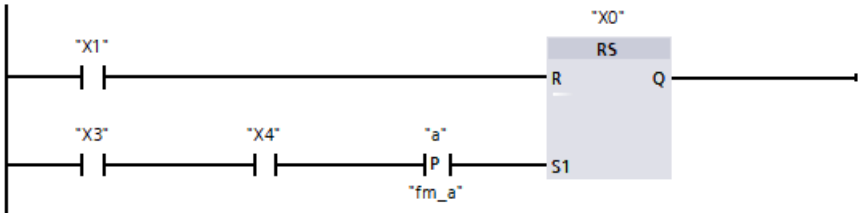
Actuator	Step
F1	$X_1 + X_3$
F2	$X_2 \cdot b$
F3	X_4

OB100 (Startup Bloc) (3.5 pts)

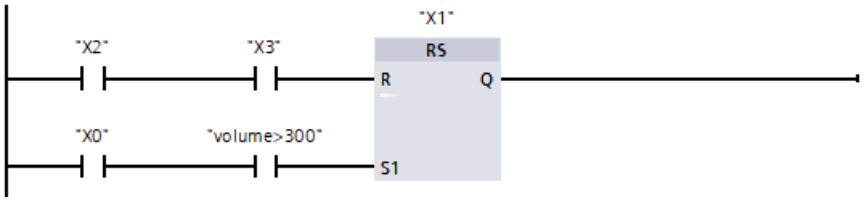


OB1 (Program Cyclic)

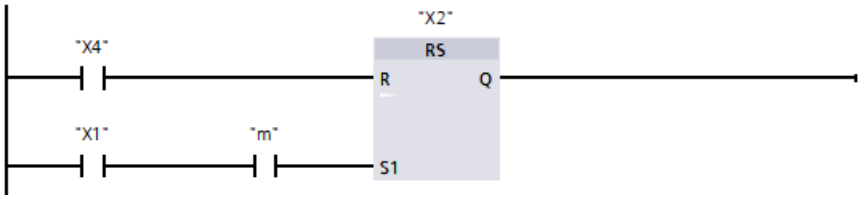
Network 1



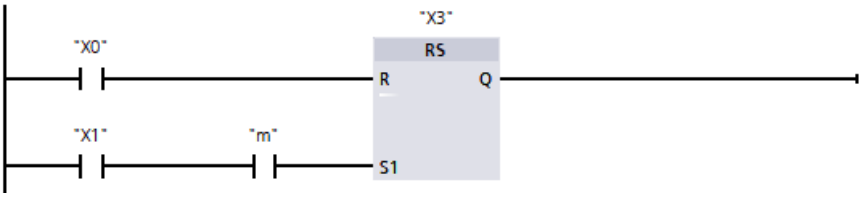
Network 2



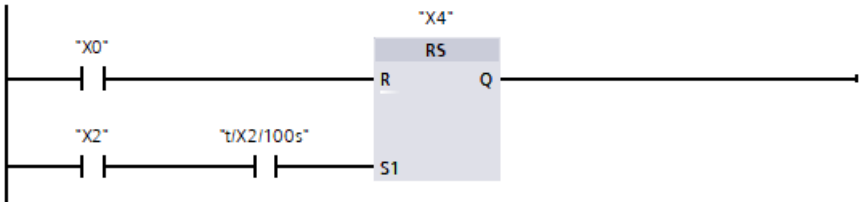
Network 3



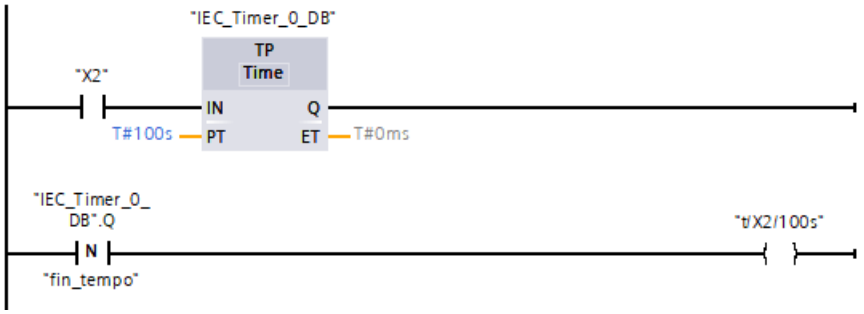
Network 4



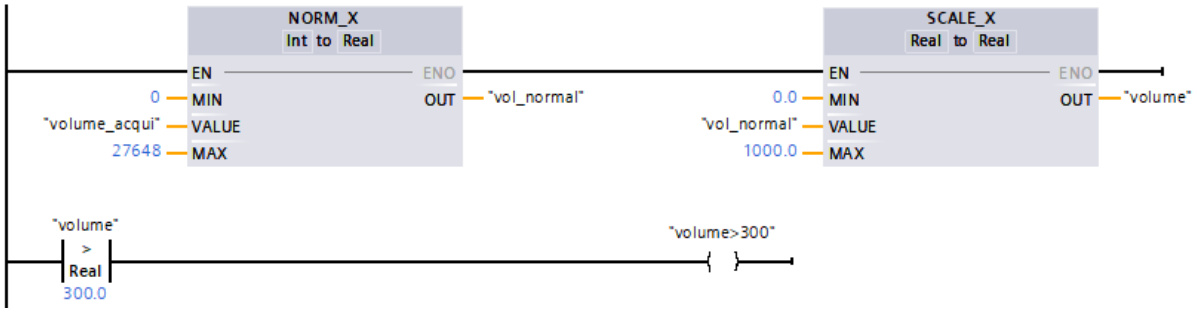
Network 5



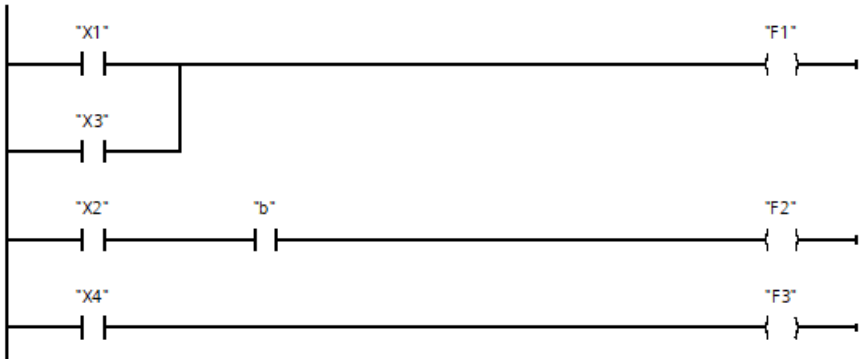
Network 6



Network 7



Network 8



Correction of the exercise 5: (5.0 pts)

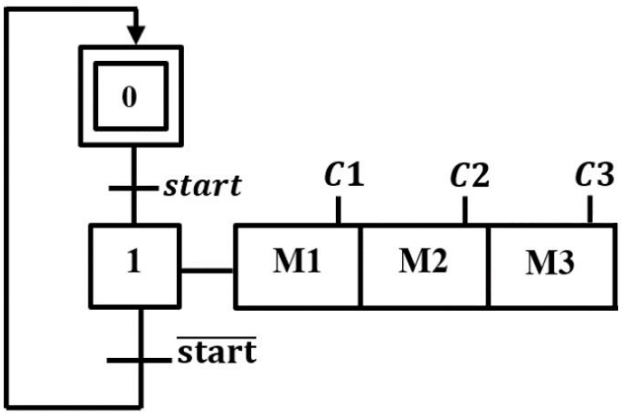


Figure 3. GRAFCET managing the cable car system