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CONFIDENTIAL

SET A

UNIVERSITI KUALA LUMPUR
Malaysia France Institute

FINAL EXAMINATION

JANUARY 2014 SESSION

SUBJECT CODE	:	**FAB 20103**
SUBJECT TITLE	:	**PROGRAMMABLE LOGIC CONTROLLER**
LEVEL	:	**BACHELOR**
TIME / DURATION	:	**3 HOURS**
DATE	:	

INSTRUCTIONS TO CANDIDATES

1. **Please read the instructions given in the question paper CAREFULLY.**
2. **This question paper is printed on both sides of the paper.**
3. **Please write your answers on the answer booklet provided.**
4. **Answer should be written in blue or black ink except for sketching, graphic and illustration.**
5. **This question paper consists of TWO (2) sections. Section A and B. Answer all questions in Section A. For Section B, answer two (2) questions only.**
6. **Answer all questions in English.**

THERE ARE *10* PAGES OF QUESTIONS EXCLUDING THIS PAGE.

SECTION A (Total: 60 marks)

INSTRUCTION: Answer ALL questions.
Please use the answer booklet provided.

Question 1

(a) Determine **five (5)** standard PLC programming languages.

(5 marks)

(b) State **two (2**) advantages of using PLC in industrial sector.

(2 marks)

(c) Illustrate the *Sourcing Input* and *Sinking Input* diagram.

(5 marks)

(d) By using CX-Programmer, explain the procedure to download the program into PLC

(4 marks)

Question 2

(a) Convert the ladder diagram in **Figure 1** below to Instruction list

(9 marks)

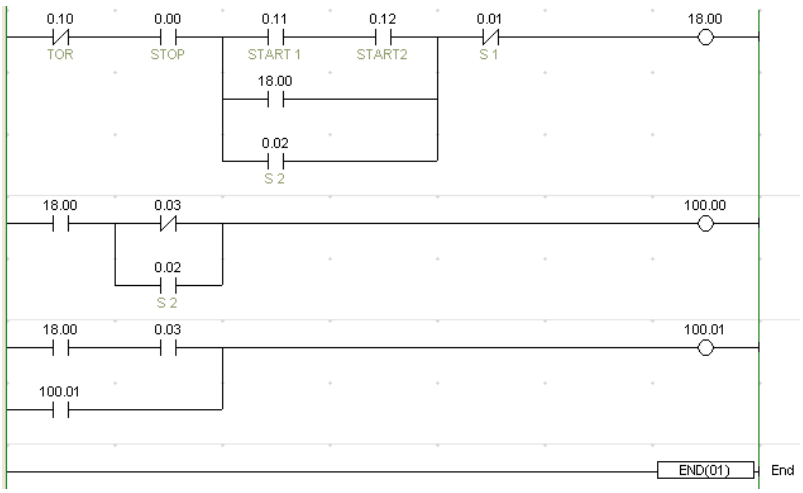


Figure 1: Ladder diagram

(b) Based on **Table 1** as shown, answer all the following questions.

Table 1: Instruction list

STEP	INSTRUCTIONS	OPERANDS/ADDRESS
00000	LD	00000
00001	LD	00001
00002	LD	1701
00003	AND	1700
00004	OR LD	
00005	AND LD	
00006	AND	00002
00007	OUT	10000
00008	LD	00003
00009	LD	00004
00010	KEEP(11)	10001
00011	LD	00005
00012	OUT	TR 0
00013	AND NOT	00006
00014	OUT	10002
00015	LD	TR 0
00016	AND	00007
00017	OUT	10003
00018	LD	00008
00019	OR	00010
00020	LD	00009
00021	OR	00011
00022	AND LD	
00023	OUT	10004
00024	END	

i. Draw the ladder diagram based on the instruction list in **Table 1**.

(10 marks)

ii. Describe the basic Function of **KEEP(11)**

(2 marks)

Question 3

Figure 2 shows a ladder diagram with Shift Register Function.

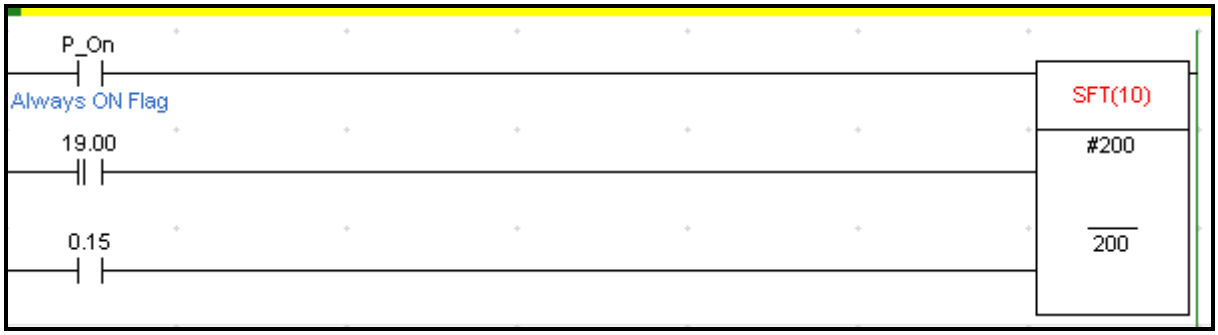


Figure 2: Ladder Diagram with Shift Register instructions

(a) Describe the function of **P_On** in this ladder diagram.

(2 marks)

(b) State the function of address **19.00** and **0.15.**

(2 marks)

(c) Indicate the error(s) in **Figure 2.**

(2 marks)

(d) State the **End** word for this Shift Register.

(2 marks)

Question 4

Design a ladder diagram according to the statement below.

- When push button 1 (00000) is pressed then released, internal bit 01700 will ON. It will stop when we press the stop button (00001)

(2 marks)

- When the internal bit 01700 is equal to `1`, it will calculate the value **99_{BCD} + 69_{BCD}** and store the result in **HR001**.

(2 marks)

- The value in **HR001** will always **MOVE** to address **HR003.**

(2 marks)

- When the internal bit 01700 is equal to 1, Move value **150_{BCD}** to **HR004**.

(2 marks)

- The program will always compare the value between **HR003** and **HR004.** The result of comparison must respect all the condition in **Table 2**.

Table 2: Comparison Results

data	**10002**	**10003**	**10004**
HR003 **>** HR004	ON	OFF	OFF
HR003 **=** HR004	OFF	ON	OFF
HR003 **<** HR004	OFF	OFF	ON

(7 marks)

SECTION B (Total: 40 marks)

INSTRUCTION: Answer TWO (2) questions only.
Please use the answer booklet provided.

Question 5

In **Figure 3,** a photoelectric sensor is installed in the middle of the conveyor. This sensor will calculate the amount of bottles passing through the conveyor. Initially an instruction called COUNTER (CNT) is used in the ladder program. For upgrading purposes, the counter needs to be replaced with an arithmetic instruction. The old ladder diagram is shown in **Figure 4**.

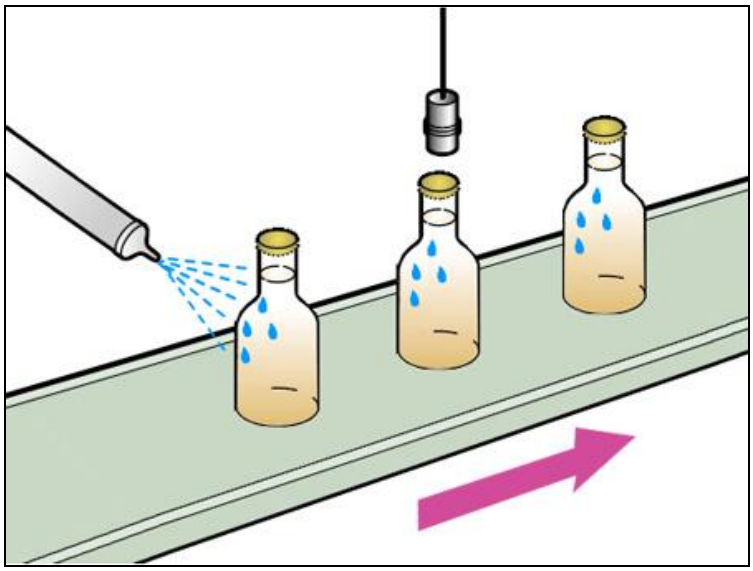


Figure 3: Bottle Counting Process

In **Figure 3,** a photoelectric sensor is installed in the middle of the conveyor. This sensor will calculate the amount of bottles passing through the conveyor. Initially an instruction called COUNTER (CNT) is used in the ladder program. For upgrading purposes, the counter needs to be replaced with an arithmetic instruction. The old ladder diagram is shown in **Figure 4**.

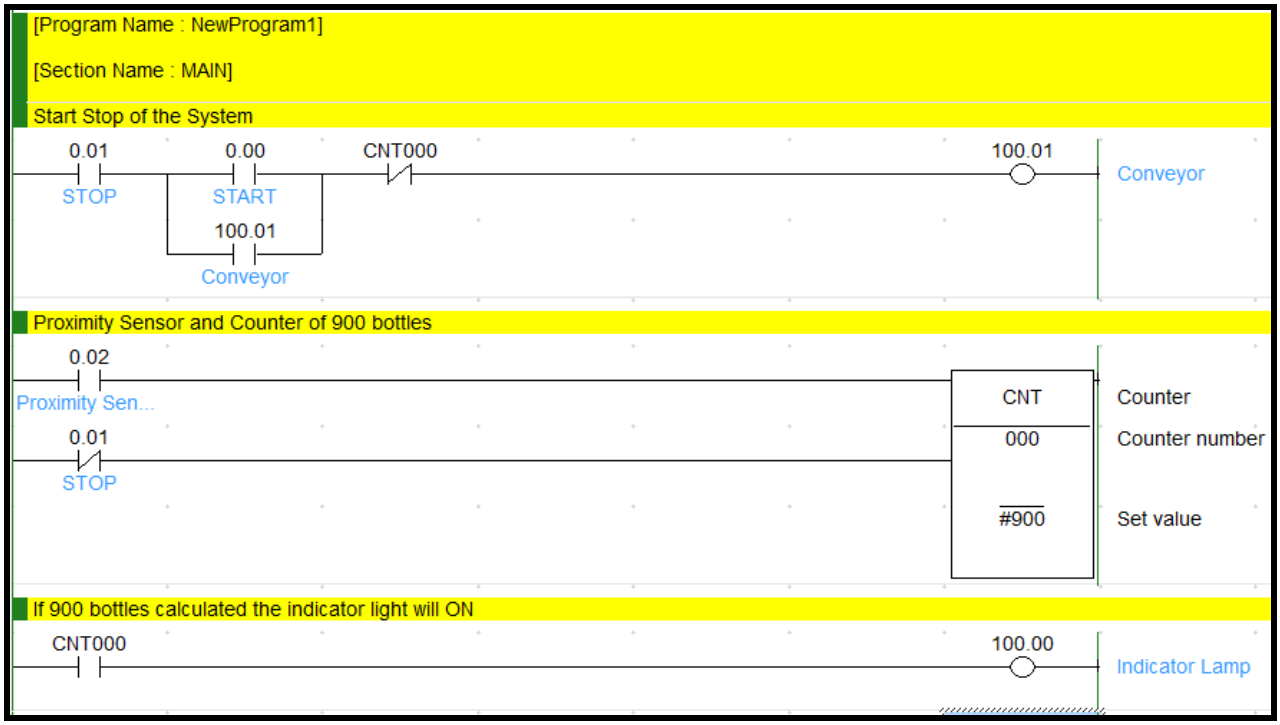


Figure 4: Ladder Diagram of the system using Counter

(a) Convert the ladder diagram in **Figure 4** to Instruction List

(4 marks)

(b) Define the Input and Output list of the system.

(2 marks)

(c) Draw the Input and Output wiring of the system

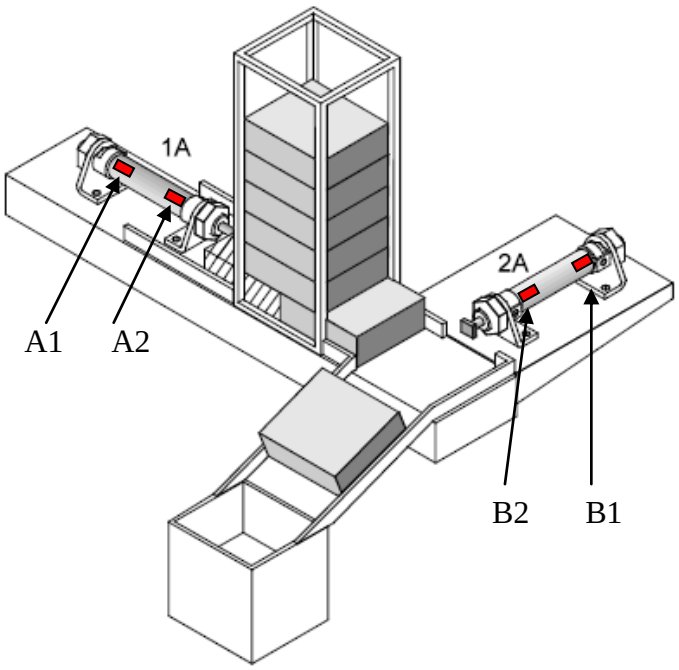
(4 marks)

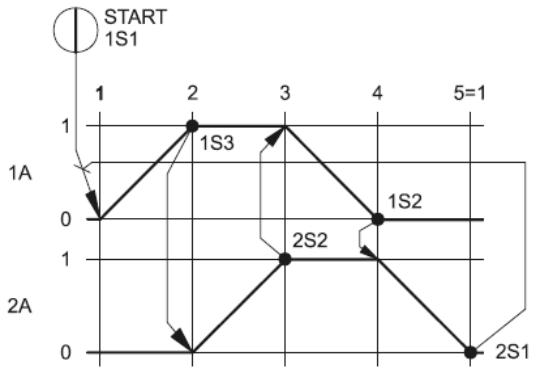
(d) Based on **Figure 3** instruction, design a new ladder diagram of the system using Data movement Instruction (**MOV**), Comparison Instruction (**CMP**) and Arithmetic Instructions (Additional, Subtraction, Multiplication).

(10 marks)

Question 6

Using a transfer station as shown in **Figure 5**, parts are to be transferred from a vertical magazine onto a chute. Both of the cylinders are controlled by single solenoid valve. The parts are pushed out of the magazine by cylinder 1A and then transferred onto the chute by cylinder 2A. The piston rod of the cylinder 1A may only extend once the cylinder 2A has retracted. The cycle is to start when a start button is pressed. Limit switches are used to confirm the cylinder positions. Differentiate Up (DIFU) is required to facilitate this requirement. **Table 3** described the input and output list of the system.





Displacement Step Diagram

Figure 5: Product transfer

Table 3: PLC Input and Output List

Input Symbol	PLC Address	Description
PB 1	000.01	Start button
PB 2	000.02	Stop button
PB 3	000.03	Stepper button
A1	000.04	Reed Switch A1
A2	000.05	Reed Switch A2
B1	000.06	Reed Switch B1
B2	000.07	Reed Switch B2

Output Symbol	PLC Address	Description
Solenoid 1A	100.01	Solenoid valve 1A
Solenoid 2A	100.02	Solenoid valve 2A

Answer these questions based on **Figure 5** and **Table 3**:

a. Draw the PLC input and output wiring.

(4 marks)

b. Design the ladder diagram for the sequence given rung by rung following the requirement below.

i. 01600 turn ON for one Scan Cycle when PB 1 pressed.

(1 mark)

ii. DIFU energized once when PB 3 is pressed.

(1 mark)

iii. Cylinder 1A bit start to move forward.

(3 marks)

iv. After cylinder 1A bit extend and reached end of stroke and PB 3 press once, solenoid 2A bit energized.

(2 marks)

v. After cylinder 2A bit reached end of stroke and PB 3 press once, solenoid 1A bit retract.

(2 marks)

vi. After cylinder 1A bit back to initial position and PB 3 press once, solenoid 2A bit retract.

(2 marks)

vii. After the cycle completed, the system will reset.

(2 marks)

viii. The solenoid valve of Cylinder 1A and Cylinder 2A trigger base on sequence of the internal bit programmed.

(3 marks)

Question 7

The wagon in **Figure 6** is moved by the forward/reverse motor. The initial position of the wagon is the left position indicated by the limit switch LS1 (NC). When the start push button is pressed (then release), the wagon will move to the right until it touches the right limit switch LS2 (NC), After ***10 Second*** , the wagon will moves to the left. Once it touches LS1; the wagon will stop. The stop button stops the motor regardless of which direction it is turning. The movement forward/reverse will be limited to ***5 times*** only. The operator needs to press a reset button before the operation can resume. The ladder diagram for the system is shown in **Figure 7.**

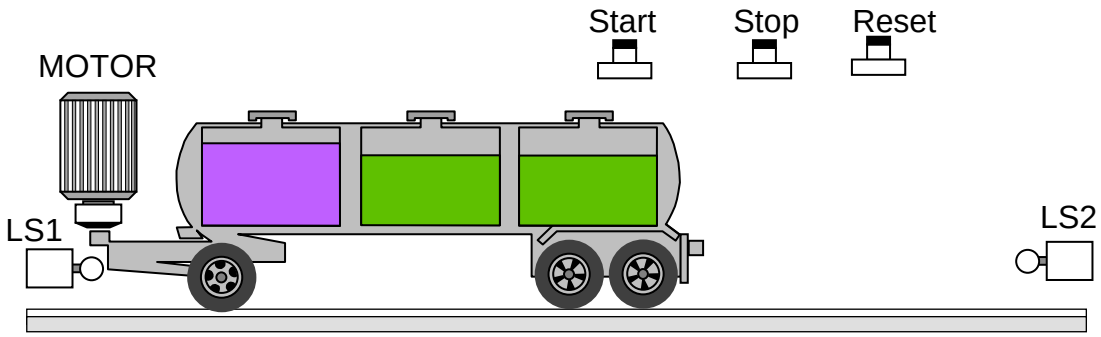


Figure 6: Automatic Carrier

Answer all the questions below

(a) Convert the ladder diagram in **Figure 6** to Instruction List.

(6 marks)

(b) Redraw the Ladder diagram and replace the **Self Holding Contact** to **SET** **RESET** instruction**.**

(4 Marks)

(c) Determine the address of the reset button for counter.

(1 mark)

(d) Determine the Set value of the Counter and Timer.

(2 Marks)

(e) Draw the PLC Input Wiring.

(4 marks)

(f) Draw The PLC Output Wiring

(3 marks)

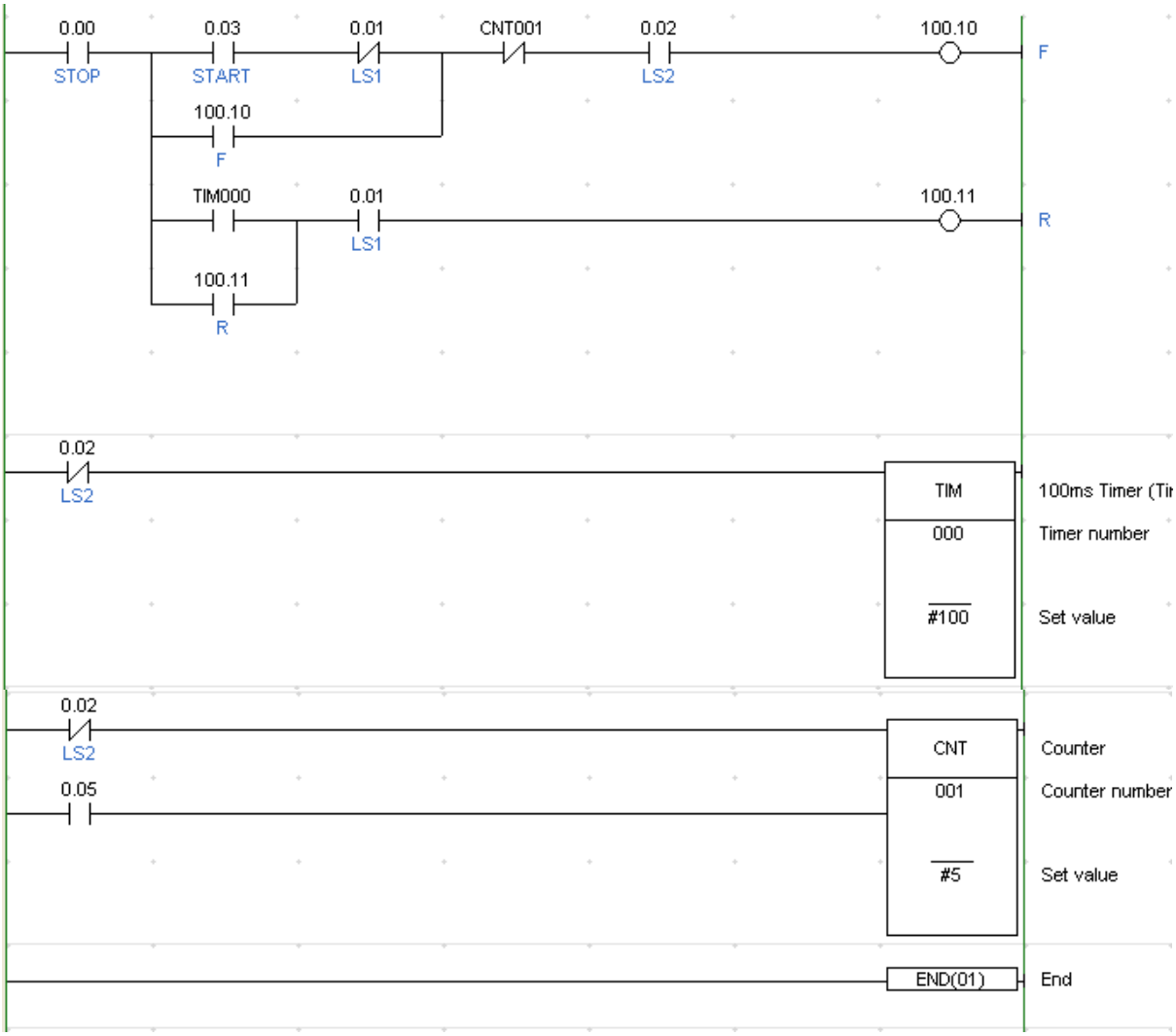


Figure 7: Ladder Diagram

END OF QUESTION