



**UNIVERSITI KUALA LUMPUR**  
**Malaysia France Institute**

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**FINAL EXAMINATION**  
**JANUARY 2011 SESSION**

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**SUBJECT CODE** : FAD 20402  
**SUBJECT TITLE** : PROGRAMMABLE LOGIC CONTROLLER 1  
**LEVEL** : DIPLOMA  
**TIME / DURATION** : 12.30pm – 2.30pm  
( 2 HOURS )  
**DATE** : 05 MAY 2011

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**INSTRUCTIONS TO CANDIDATES**

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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.

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THERE ARE 10 PAGES OF QUESTIONS, EXCLUDING THIS PAGE.

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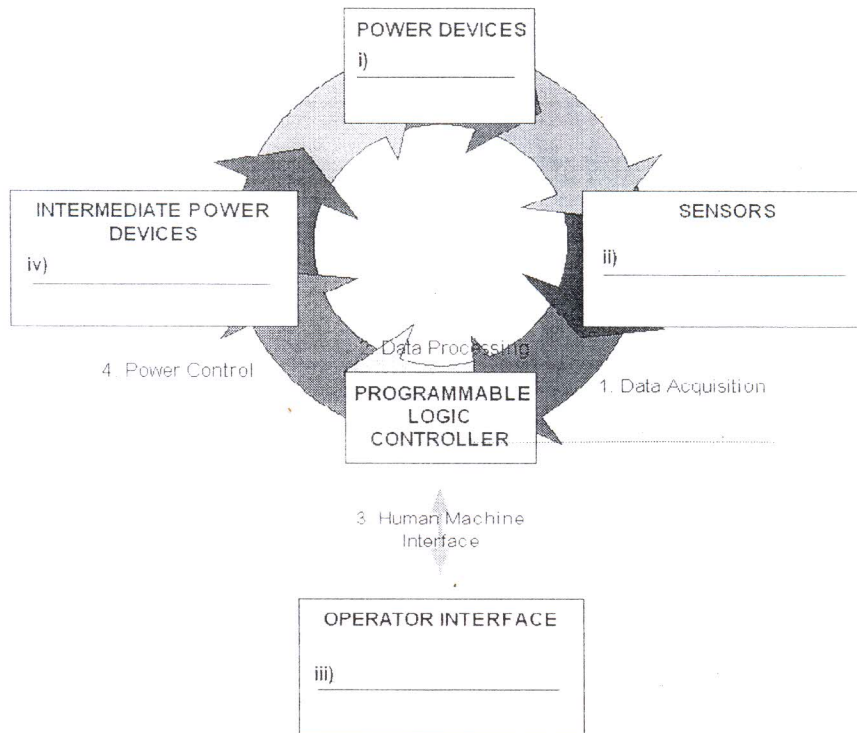
**SECTION A (Total: 60 marks)**

**INSTRUCTION: Answer ALL questions.**

**Please answers all in answer booklet provided.**

**Question 1**

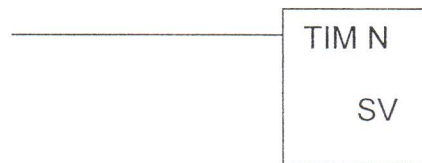
- (a) Define and give an example of Human Machine Interface (HMI). (4 marks)
- (b) List four (4) programming languages for PLC that internationally recognized. (4 marks)
- (c) Give two (2) advantages of programmable controller. (2marks)
- (d) **Figure 1** illustrates the block diagram of a basic control system. Give an example of power devices, sensors, operator interface and intermediate power devices. (4 marks)



**Figure 1:** Block diagram of basic control system

**Question 2**

- (a) Central processing unit consist of processor and memory. Define and give three (3) examples of memory. (3 marks)
- (b) The memory size of PLC is 884 words. How many bits information can be stored if PLC have 16 bits and 32 bits? (4 marks)
- (c) There are two types of DC input module which are current sourcing and current sinking. Draw and explain the sourcing input and sinking input. (6 marks)
- (d) List and explain two (2) modes of the programming console. (4 marks)

**Question 3**

**Figure 2:** Timer symbol

- (a) From **Figure 2** give the definition of the followings. (2 marks)
- i. TIM N
  - ii. SV
- (b) Timer divided into two which are On-Delay Timer and Off-Delay Timer. Describe both of the Timers. (2 marks)

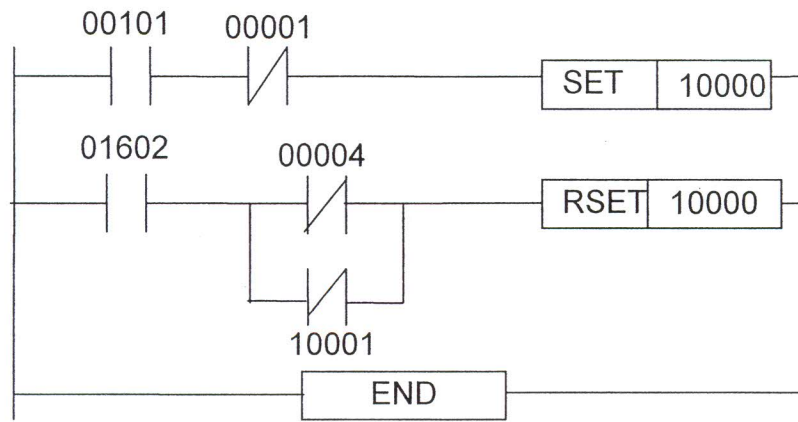


Figure 3: Ladder diagram with SET/RESET

- (c) Explain the function of SET/RESET. (2 marks)
- (d) Redraw the ladder diagram in Figure 3 by replaces the SET/RSET to KEEP. (3 marks)
- (e) Draw a symbol and explain the function of KEEP. (3 marks)

Question 4

- (a) Based on the Figure 4 convert the ladder diagram into Instruction List. (7 marks)

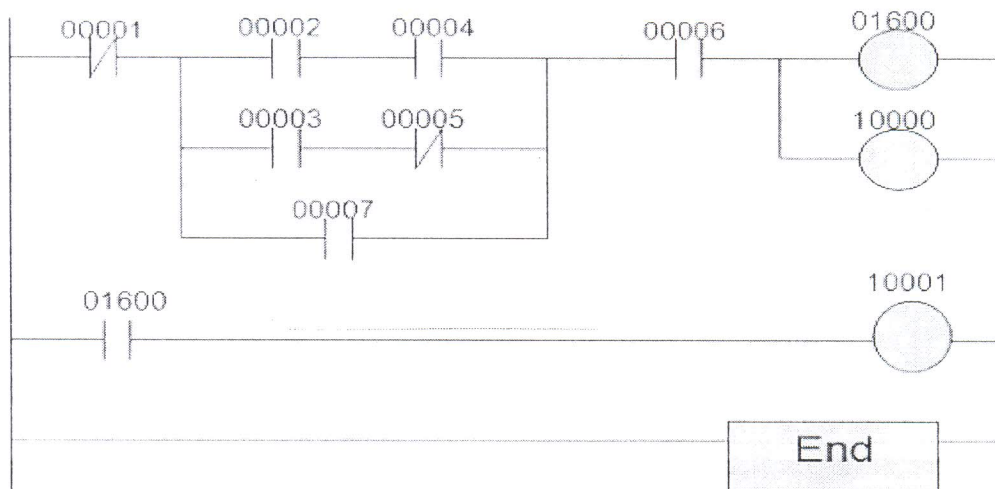


Figure 4: Ladder Diagram

(b) Draw the ladder diagram based on **Table 1**.

(10 marks)

**Table 1: Instruction List**

STEP	INSTRUCTIONS	OPERANDS/ADDRESS
00000	LD	00000
00001	SET	01600
00002	LD NOT	00001
00004	OR NOT	00002
00005	RST	01600
00006	LD	01600
00007	OUT	TR0
00008	AND NOT	TIM 00
00009	OUT	10000
00010	LD	TR 0
00012	AND	00003
00013	OUT	10001
00014	LD	00004
00015	DIFU(13)	01601
00016	LD	01601
00017	AND	01600
00018	OUT	10003
00019	LD	00005
00020	AND	01600
00021	TIM	00
		#100
00022	END	-

## SECTION B (Total: 40 marks)

INSTRUCTION: Answer TWO (2) questions only.

Please answers all in answer booklet provided.

## Question 5

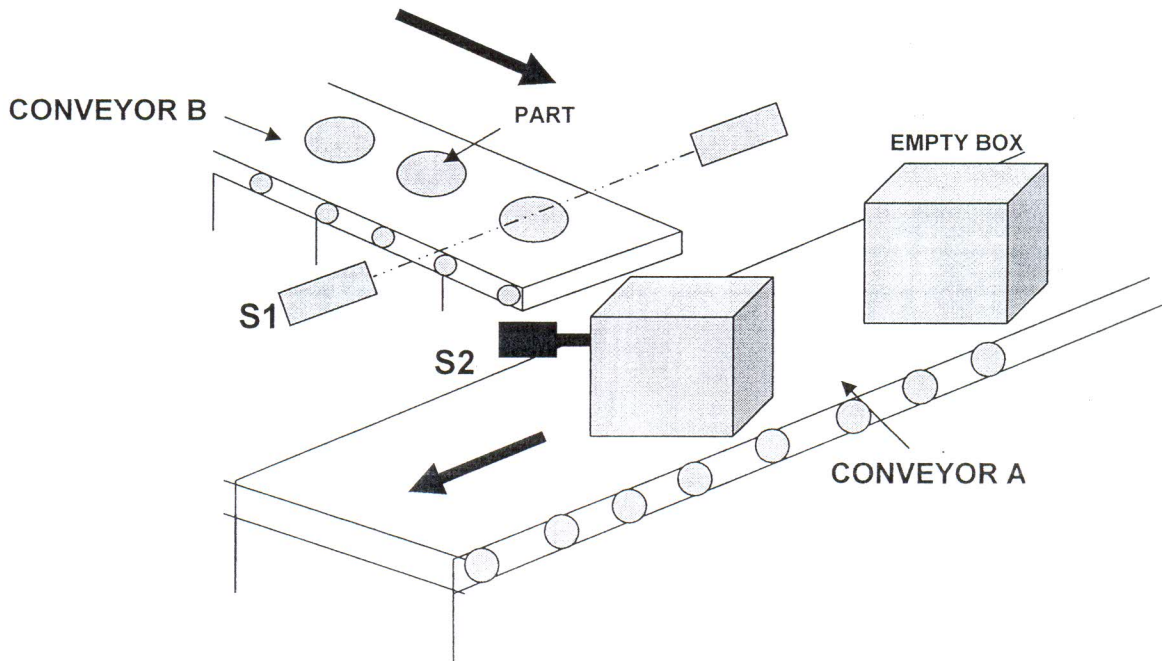


Figure 5: Apples Conveyor System

Description of the system:

When PB1 (START Push Button) is pressed and released, the following will execute:

- Conveyor A moves.
- When S2 detect empty box, the conveyor A stops and conveyor B will start.
- Part sensor (S1) will count for 10 apples.
- When the box is filled with 10 parts, Conveyor B stops and conveyor A starts again. Counter will be reset and operation repeats until PB2 (STOP Push Button) is pressed.

Answer the following questions:

- (a) List all the inputs and outputs of the system. (3 marks)
- (b) Draw the PLC input and output wiring. (3 marks)
- (c) Design the Ladder Diagram for the system in **Figure 5**. (6 marks)
- (d) Convert the Ladder Diagram to Instruction List. (3 marks)
- (e) If the system is modified by adding a TIMER, the following will happen:
- When PB1 (START Push Button) is pressed, the conveyor A moves.
  - When S2 detect the box present, the conveyor A stops.
  - **10 Seconds after the conveyor A stop**, the conveyor B will move.
  - Part sensor (S1) will count for 10 apples.
- When the box is filled with 10 Apples, Conveyor B stops and conveyor A starts again. Counter will be reset and operation repeats until PB2 (STOP Push Button) is pressed.
- Redesign the ladder diagram as according to the modification. (5 marks)

## Question 6

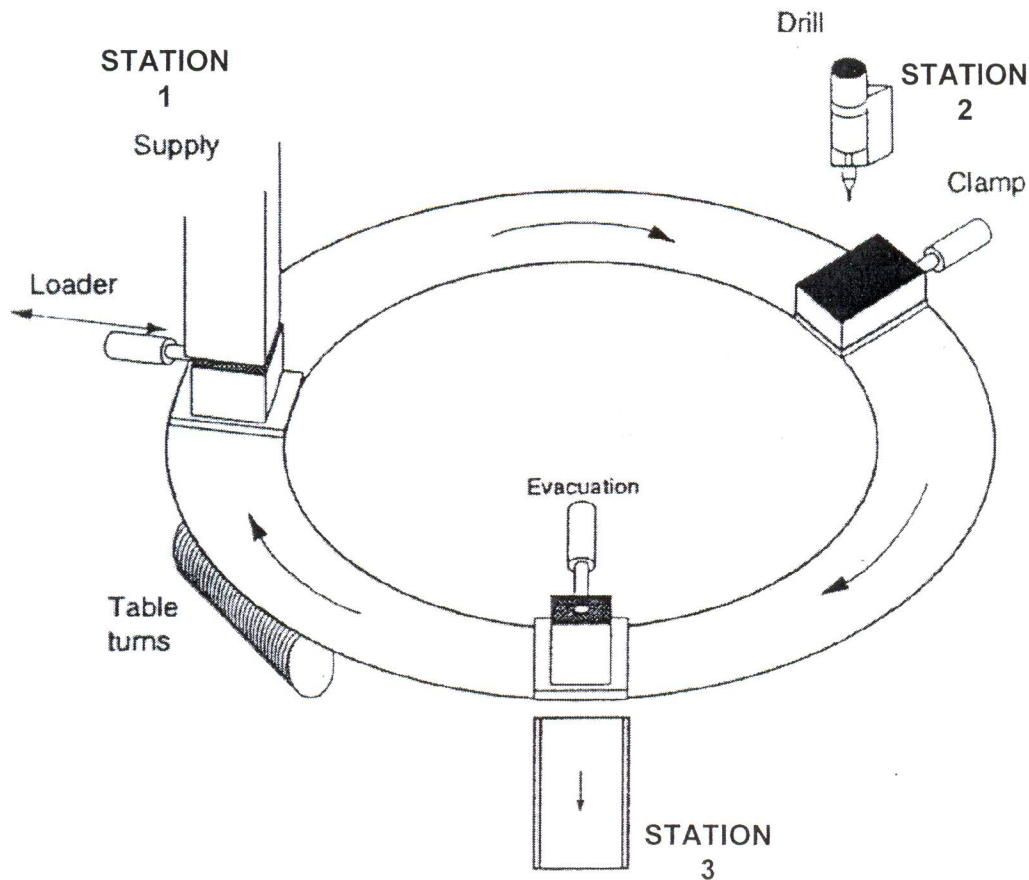


Figure 6: Turntable System

The operation of Turntable System is described as follows:

When start button is pressed, system wills on, a pneumatic cylinder will rotate the turntable 270°. A magnetic switch (MS1) is installed at the pneumatic cylinder to show that the turn table is turned. Another magnetic switch (MS2) is installed at the clamp cylinder. When stop button is pressed, all the operation will stop.

A turntable serves three work stations:

- The first is for loading –station 1
- The second is for drilling – station 2
- The third is for evacuating drilled parts – station 3



**Station 1**

The loading is supplied from a vertical chute. The part is placed on the turntable by one complete action of the loader.

**Station 2**

At the drilling station the part is clamped then the bit is lowered and the spindle is rotated.

**Station 3**

The evacuation station is activated by the forward and reverse motion of a cylinder which places the part onto the evacuation ramp.

When all the stations have completed their tasks, a pneumatic cylinder will rotate the turntable 270°.

Remark:

If there is no part at the station the operations are still performed.

- (a) List all the Input(s) and Output(s) for the application in **Figure 3**. (3 marks)
- (b) Draw the PLC input and Output wiring. (3 marks)
- (c) Design the ladder diagram for the station 1.
- i. When MS1 equal to 1, loader cylinder will retract for 3 seconds. (1.5 marks)
  - ii. After 3 seconds, the cylinder will extend to initial. (1.5 marks)
- (d) Design the ladder diagram for station 2.
- i. When MS1 equal to 1, clamp cylinder will extend for 10 seconds. At the same time the drill cylinder descend until MS2 energized. (1.5 marks)
  - ii. When MS2 equal 1 the drill cylinder will go back to initial. (1.5 marks)
  - iii. After 10 seconds, the clamp cylinder will retract and the turn table will rotate one turn. (1 marks)

- (e) Design the ladder diagram for station 3.
- i. When MS1 equal to 1, the evacuation cylinder will retract for 3 seconds. (1.5 marks)
  - ii. After 3 seconds, it will extend to initial position. (1.5 marks)
- (f) Convert the entire ladder diagram to Instruction list for each station. (4 marks)

### Question 7

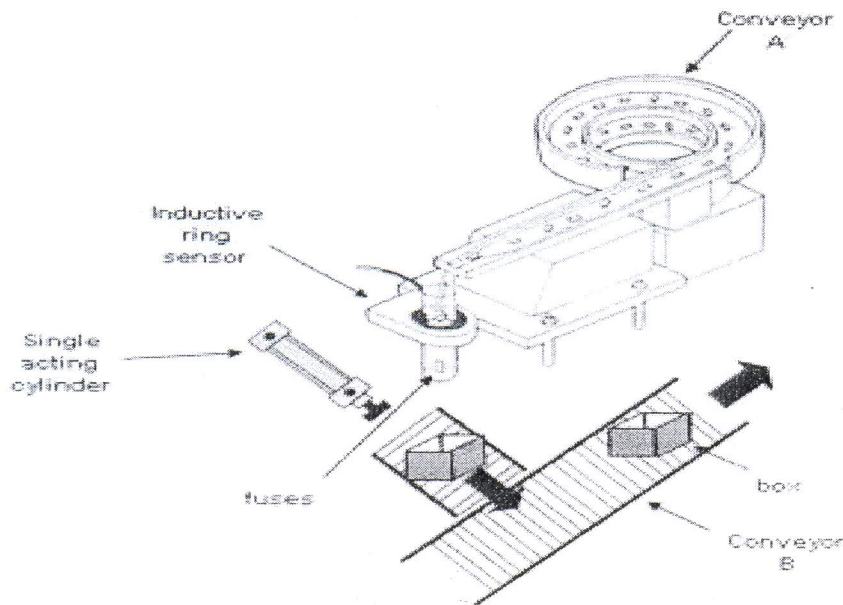


Figure 7: Overview of Counting System

#### Description of the system:

The number of fuses carried out on a conveyor A is counted by a through-hole head proximity switch. The fuses are then will be entered in the box. When the set value of 100 is reached, a cylinder will extends and evacuates the box to the conveyor B. At the same time, the conveyor A will stop. After 5 seconds the conveyor A will energize again and the process continue. There will one Start Pushbutton and one Stop Pushbutton (N/C) to run this system. A start push button and a stop push button are used in this system.

Answer all the questions below:

- (a) List the PLC Input(s) and Output(s) Devices. (3.5 marks)
- (b) Draw the PLC Input and Output schematic wiring diagram. (3.5 marks)
- (c) Design the ladder diagram of the Fuse Counting system. Your ladder diagram should consist of MCR (Master Control Relay). (8 marks)

*Operation of the system:*

- When we press the Start Pushbutton a first internal bit will be on only for 1 scan cycle / rising edge.
  - This internal bit will be used to energize the conveyor A and the conveyor B. The conveyor B should be maintained energised even if the start pushbutton is released. The conveyor A will STOP only when a second internal bit is on. When the Stop Pushbutton is pressed both conveyor A and conveyor B will be STOP.
  - Each time the fuses drop and past through the inductive ring sensor S1, this will increment the value of the counter. The counter will be reset only when it has counted 100.
  - When the counter is done (equal to 100), the second internal bit will turn on. This internal bit will turn off only if a third internal bit turns on.
  - The second internal bit will energize the single acting cylinder, and the timer will turn on for 5 seconds.
  - After 5 seconds, the timer is done and this will turn on the third internal bit.
- (d) Convert the ladder diagram in Question 7 (c) to Instruction List. (5 marks)

**END OF QUESTION**