Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2022/2023

COURSE NAME	:	INDUSTRIAL AUTOMATION SYSTEM
COURSE CODE	:	BEJ 34103
PROGRAMME CODE	:	BEJ
EXAMINATION DATE	:	FEBRUARY 2023
DURATION	:	3 HOURS
INSTRUCTION	:	1. ANSWER ALL QUESTIONS
		2.THIS FINAL EXAMINATION IS CONDUCTED VIA **CLOSED BOOK.**
		3.STUDENTS ARE **PROHIBITED** TO CONSULT THEIR OWN MATERIAL OR ANY EXTERNAL RESOURCES DURING THE EXAMINATION CONDUCTED VIA CLOSED BOOK

THIS QUESTION PAPER CONSISTS OF **NINE (9)** PAGES

Q1 (a) Based on **Figure Q1(a)**, discover the role of automation and control technologies in a production system.

(5 marks)

(b) With respect to industrial automation and control technologies,

(i) Illustrate the basic elements of an automated system using a block diagram.

(4 marks)

(ii) Based on the three (3) types of automation, propose an example of a suitable product to be applied in each type of automation.

(6 marks)

(c) As the scale of production grows and the competition aggregates, for example a Samsung tab; the industry has looked for a better solution for the management of all resources including the automation.

(i) Explain the concept of Computer Integrated Manufacturing (CIM) to help in the solution.

(4 marks)

(ii) Recently, Industry 4.0 has become the current trend of automation and data exchange in manufacturing technologies. Discuss Industry 4.0 if the concept benefits all industries to compete in the market.

(6 marks)

Q2 (a) A fiberboard production is divided into several stages:

1. Wood chips are steamed to soften them for defibration using a boiler system.
2. A small amount of paraffin wax is added to the steamed chips and they are transformed into a fluffy fiber.
3. The fibers are arranged into a uniform "mat" on a conveyor belt.
4. This mat is pre-compressed and then hot-pressed.
5. Hot-pressing activates the adhesive and glues the fibers together.
6. Lastly, the board is then cooled, trimmed, sanded, and maybe veneered or laminated.

Investigate the criteria of the sensor selection of the automation and control for the fiberboard production at the last stages. The engineer is advised to justify the criteria based on the working environment and the potential hazards

(6 marks)

(b) Design a relay control circuitry for a sliding door using a double-acting pneumatic cylinder as illustrated in **Figure Q2(b)**. The electrical components include pushbuttons (momentary type), relays (2P2T), a 5/3 ways double coil, and a DC24V power supply.

(4 marks)

(c) **Figure Q2(c)** shows a two-level S-type cargo lift. You are required to propose and design the system.

(i) Re-draw and mark the locations of the sensors and actuators including the user panel. (Name them properly).

(6 marks)

(ii) Suggest types of sensors and actuators marked at Q2(c)(i).

(3 marks)

(iii) Justify your selection at these locations.

(6 marks)

Q3 (a) List five (5) reasons why industrial robot plays an important role in the manufacturing industry.

(5 marks)

(b) A pick-and-place automation system is commonly seen in the industry to lift a heavy object. The system is available in broad choices of arrangements, depending on the application and the load. **Figure Q3(b)** illustrates a customized pneumatic system for the purpose of pick-and-place. You are requested to develop the system. The sequence request is explained as follows:

1. Upon the press of a Start push button, the system is activated. A "Start" indicator in green colour lit up.
2. The gripper is released, and the vertical cylinder must be at its top position.
3. At position A, the vertical cylinder would travel downward to pick up an object. Then,
4. At position A, the gripper would close and grip the object. Then,
5. At position A, the vertical cylinder would travel upward to its top position. Then,
6. At position A, the horizontal cylinder would travel to position B. Then,
7. At position B, the vertical cylinder would travel downward to place the object. Then,
8. At position B, the gripper is released. Then,
9. At position B, the vertical cylinder would travel upward to its top position. Then,
10. At position B, the horizontal cylinder would travel to position A.
11. A cycle is completed. The "Start" indicator is off.
12. A new cycle would be triggered if the Start push button is pressed again.

(i) Select the types of sensors and actuators to be applied according to the diagram and description. Mark the locations of your suggestion in a system layout diagram.

(4 marks)

(ii) If OMRON programmable logic controller, CQM1H is used, construct the input/output diagram.
(Note: Input starts from channel 0; Output starts from channel 100.).
(4 marks)

(iii) Establish the sequences using a Grafset diagram.
(12 marks)

Q4 (a) Industrial production involves numerous cycles of repetitive and sequential operations. From time to time, the automation sequences could be modified or altered to meet the production need in a short notice. Give four (4) benefits of using a programmable logic controller (PLC) in industrial automation for production.
(4 marks)

(b) **Figure Q4(b)** shows the ladder diagram for two (2) lamps control. Examine the condition of Lamp 1 and Lamp 2 based on the following conditions:

(i) Condition 1: Only button A is pushed.
(2 marks)

(ii) Condition 2: Only button B is pushed.
(2 marks)

(iii) Condition 3: Only button C is pushed.
(2 marks)

(c) **Figure Q4(c)** shows the ladder diagram of a manufacturing process. Develop the mnemonic code for the ladder diagram.
(5 marks)

(d) **Figure Q4(d)(i)** shows the game buzzer control system and **Table Q4(d)** shows the IO assignment. The requirement is as follows:

- After the host had finished with the question, the 3 players will press the pushbuttons (PB1 ~ PB3) in front of them to fight to be the first to answer the question.
- The buzzer will sound for 10 seconds after any one of the players has touched the pushbutton.
- The light indicator in front of each player will light up and only reset by the host's pushbutton.

Analyze the ladder diagram in **Figure Q4(d)(ii)** and fill in the box from A to E with appropriate elements and addresses.
(10 marks)

-END OF QUESTIONS –

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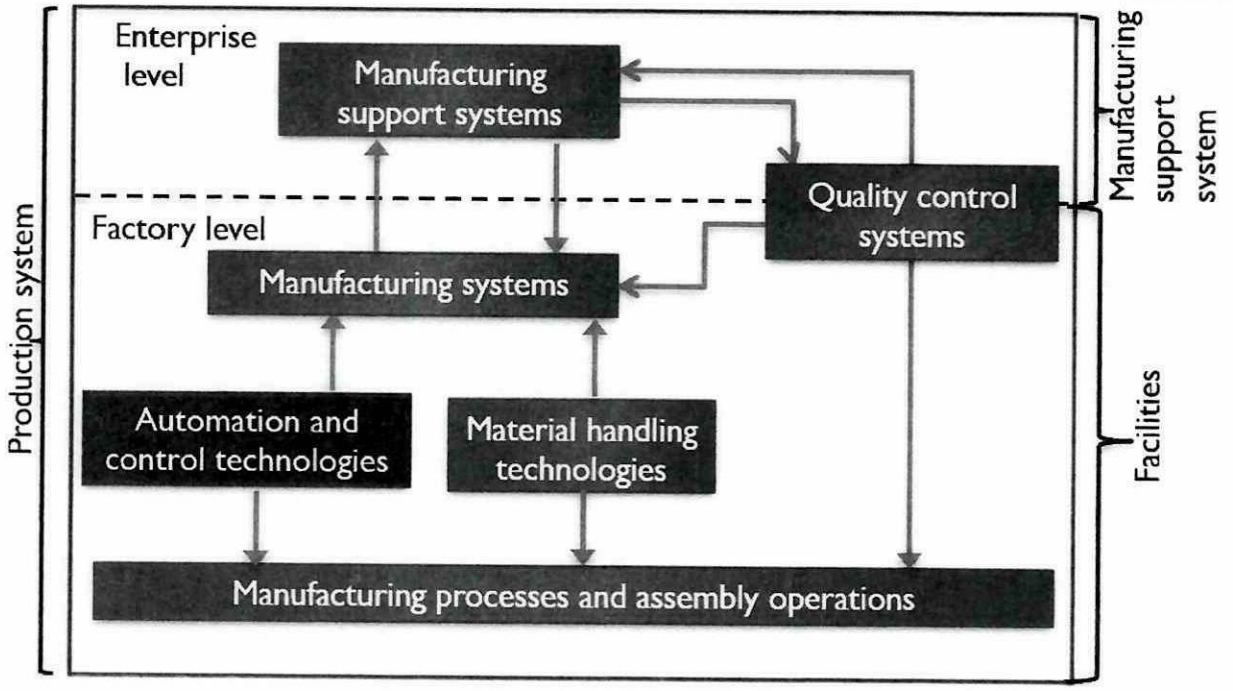

Figure Q1(a)

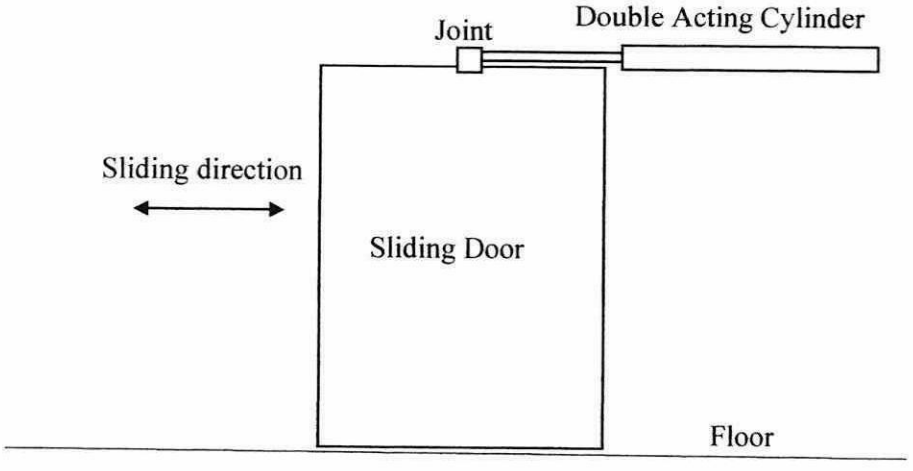

Figure Q2(b)

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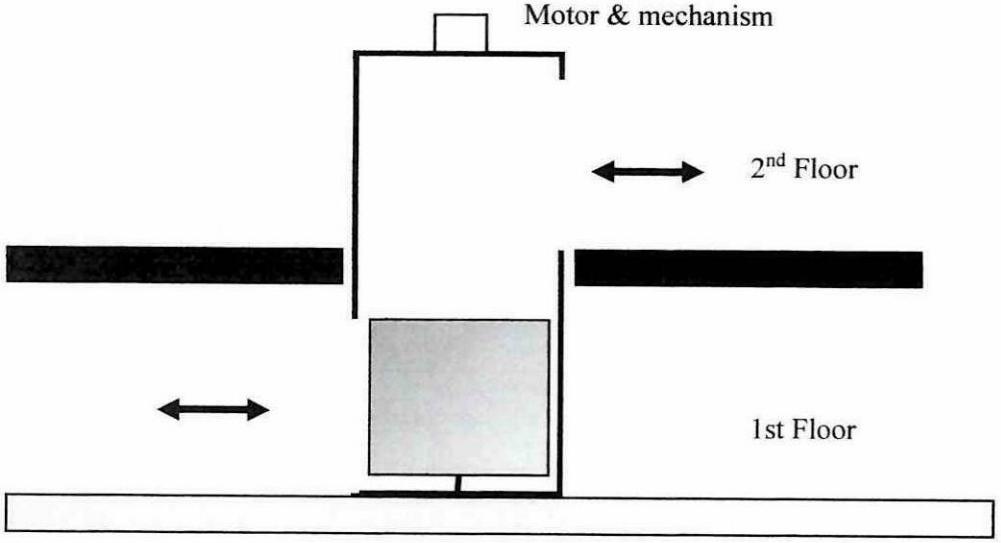

Figure Q2(c)

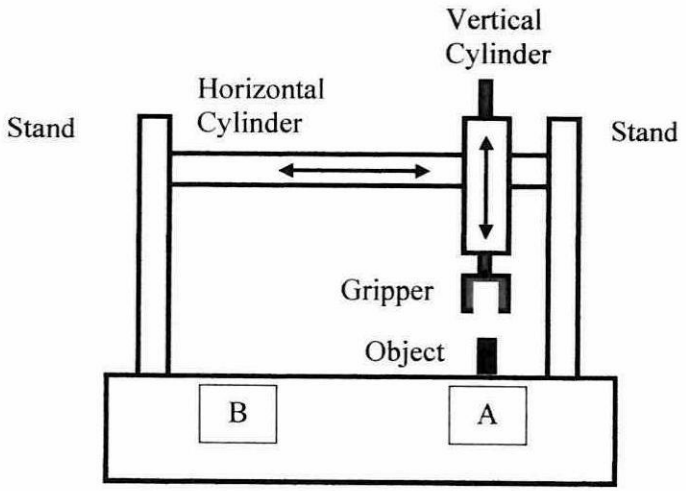

Figure Q3(b)

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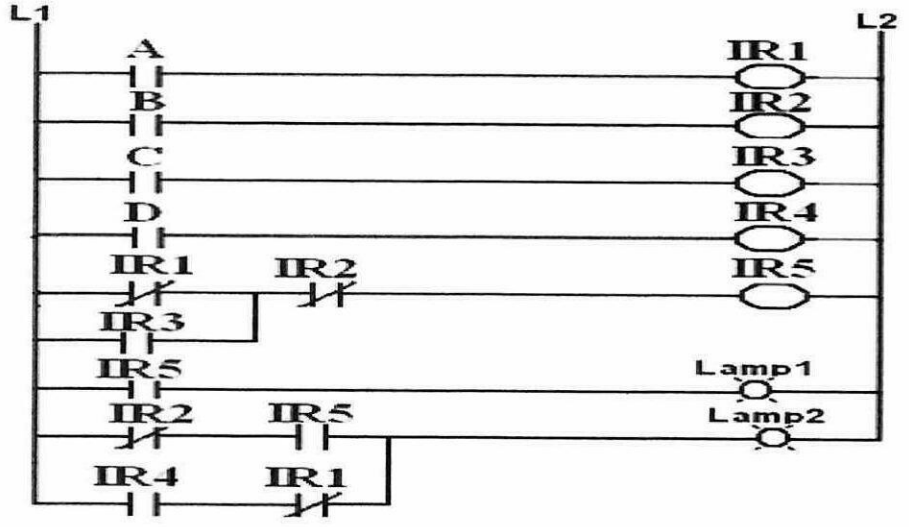

Figure Q4(b)

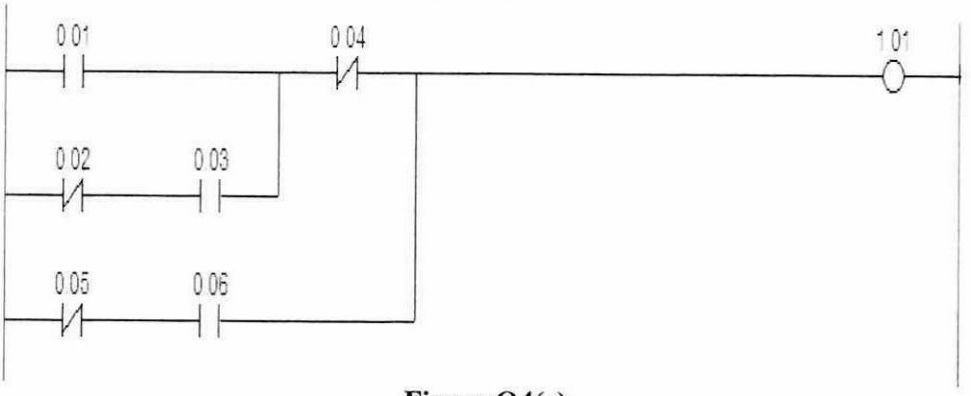

Figure Q4(c)

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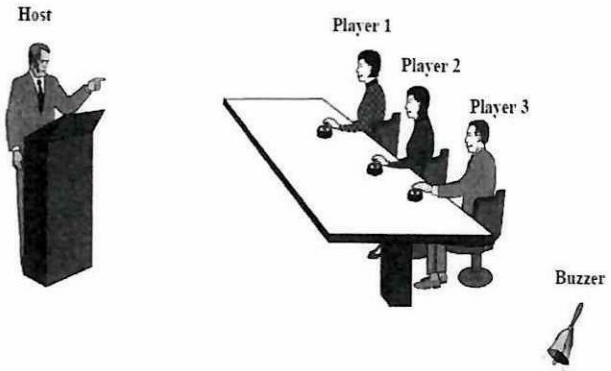

Figure Q4(d)(i)

Table Q4(d): IO Assignments

Input	Device
00000	PB1
00001	PB2
00002	PB3
00003	RST (reset)

Output	Device
01000	Buzzer
01001	Player 1 light
01002	Player 2 light
01003	Player 3 light

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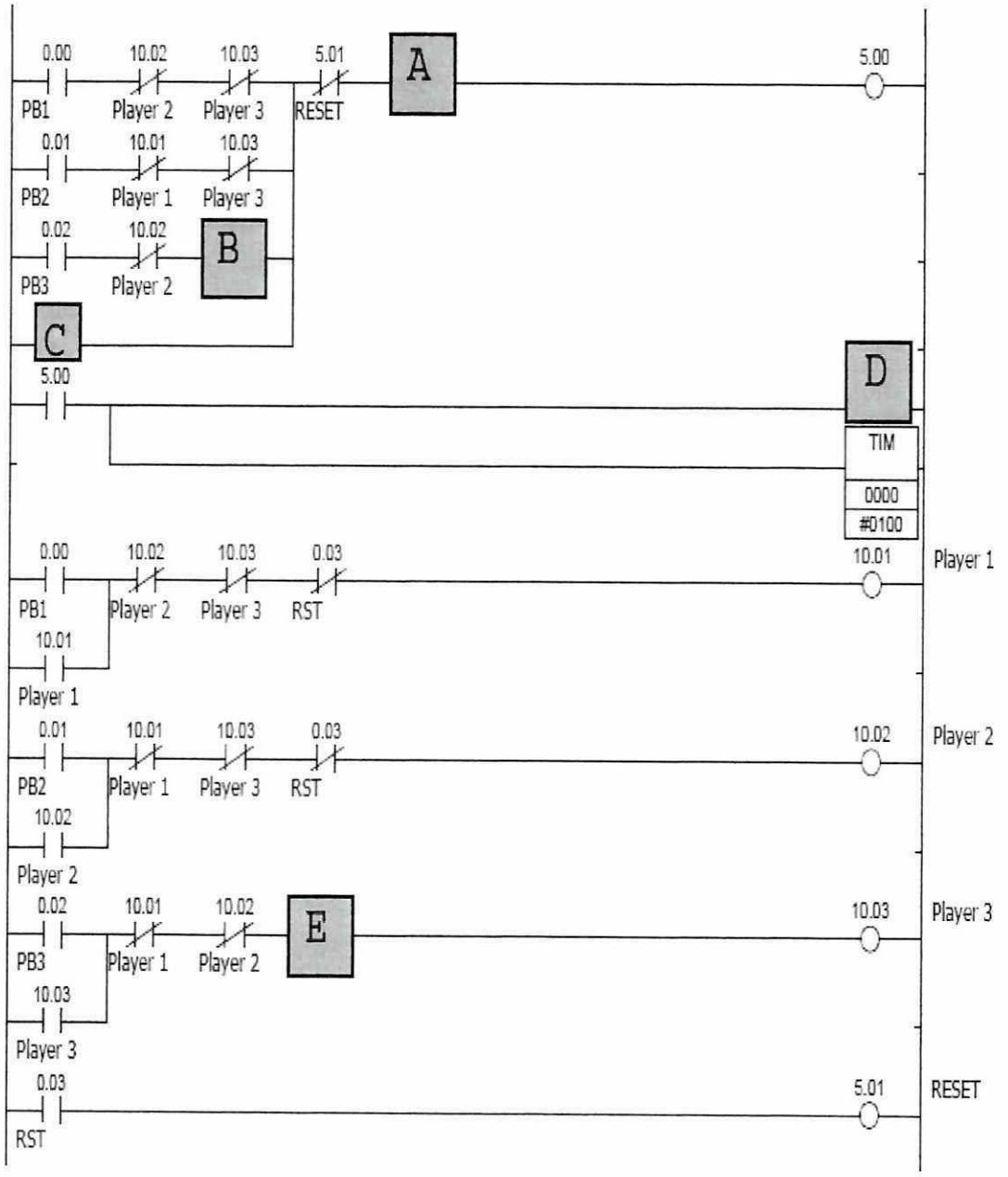

Figure Q4(d)(ii)