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**UNIVERSITI TUN HUSSEIN ONN
MALAYSIA**

**FINAL EXAMINATION
SEMESTER II
SESSION 2017/2018**

**COURSE NAME : INDUSTRIAL AUTOMATION
SYSTEM**
COURSE CODE : BEH 20302
PROGRAMME CODE : BEJ
EXAMINATION DATE : JUNE/JULY 2018
DURATION : 3 HOURS
INSTRUCTION : ANSWER ALL QUESTIONS

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THIS QUESTION PAPER CONSISTS OF NINE (9) PAGES

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- Q1** (a) Explain the role of automation and control technologies in a production system. (5 marks)
- (b) With respect to the industrial automation and control technologies,
- (i) Explain three basic elements for an industrial automated system. (4 marks)
- (ii) Imagine that you are the production engineer for bicycle production for extreme sports. The bicycle must meet all requirements and testing procedures. As a production engineering, point out your concerns during the planning of automation and control. (6 marks)
- (c) As the scale of production grows, for example Acer laptop, and the competition aggregates, the industry has looked for a better solution for the management of all resources including the automations.
- (i) Explain the concept of Computer Integrated Manufacturing (CIM) to help in the solution. (4 marks)
- (ii) Recently, Industry 4.0 is widely discussed as the current trend of automation and data exchange in manufacturing technologies. Critique Industry 4.0 if the concept benefits all industries to compete in the market. (6 marks)
- Q2** (a) A fiber board production is divided into several stages. Wood chips are steamed to soften them for defibration using a boiler system. Small amount of paraffin wax is added to the steamed chips and they are transformed into fluffy fiber. The fibers are arranged into a uniform "mat" on a conveyor belt. This mat is pre-compressed and then hot-pressed. Hot-pressing activates the adhesive and glues the fibers together. 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 fiber board 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) Refer to **Figure Q2(c)**, it is 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 down **five (5)** reasons why industrial robot plays an important role in manufacturing industry.

(5 marks)

(b) A pick-and-place automation system is commonly seen in the industry to lift up 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,

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- 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 the 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 are 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 first to answer the question.
- The buzzer will sound for 10 seconds after any one of the player 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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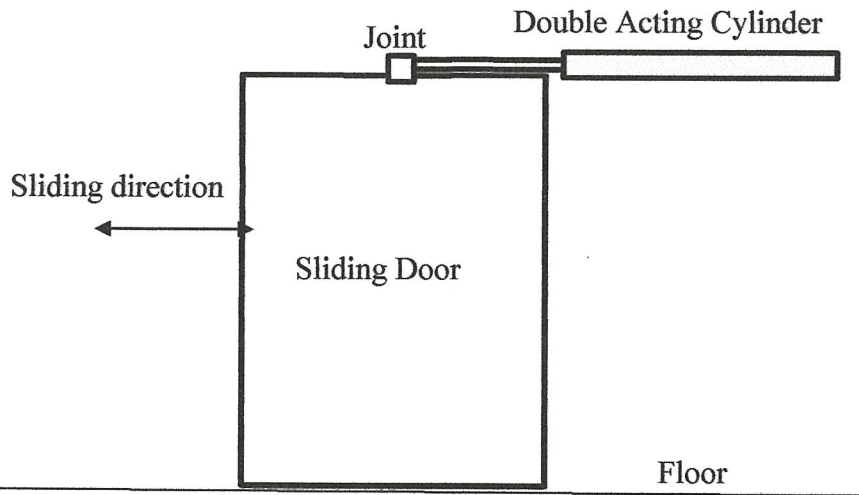


Figure Q2(b)

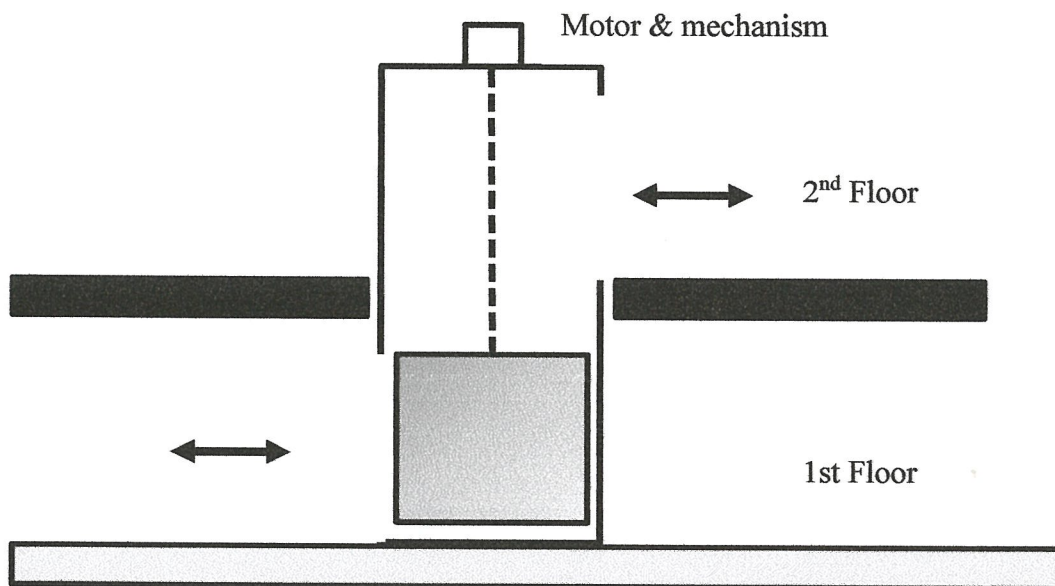


Figure Q2(c)

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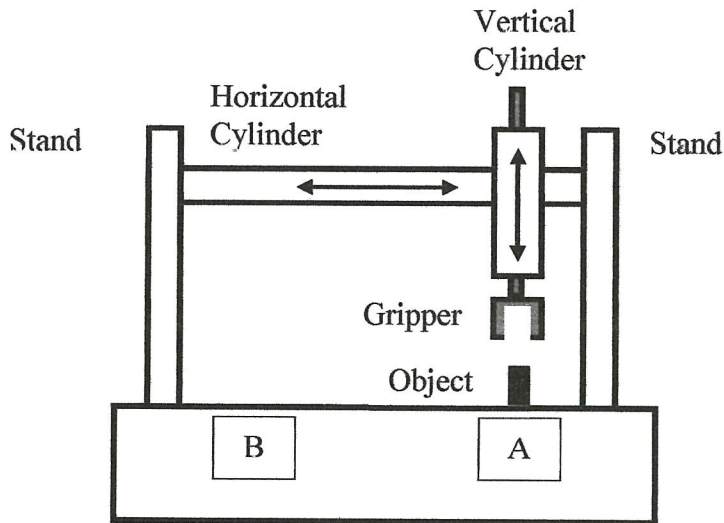


Figure Q3(b)

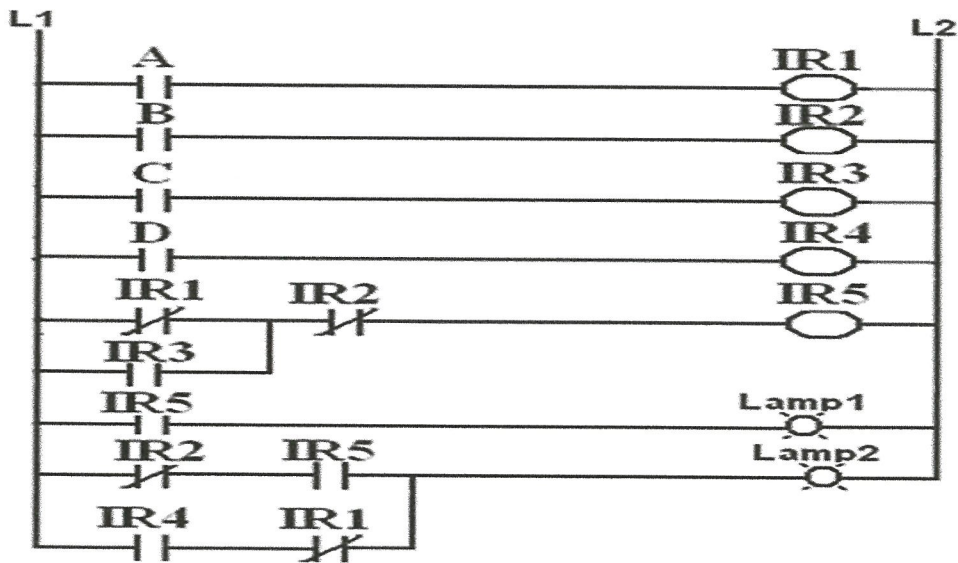


Figure Q4(b)

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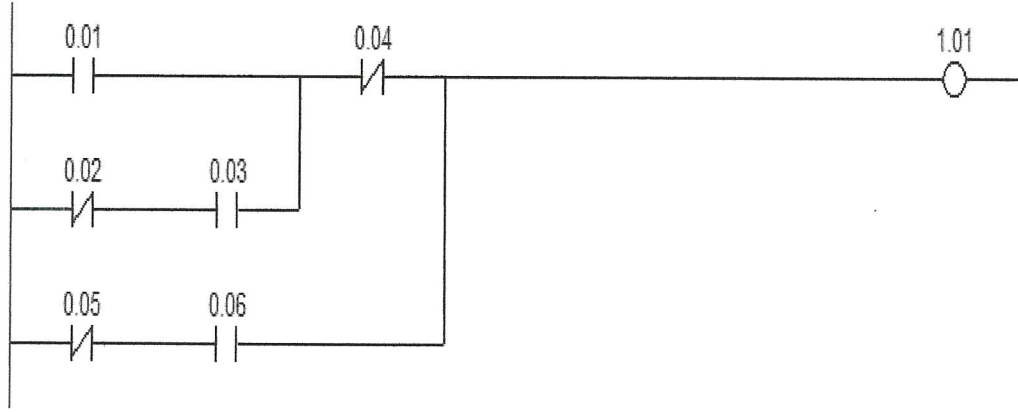


Figure Q4(c)

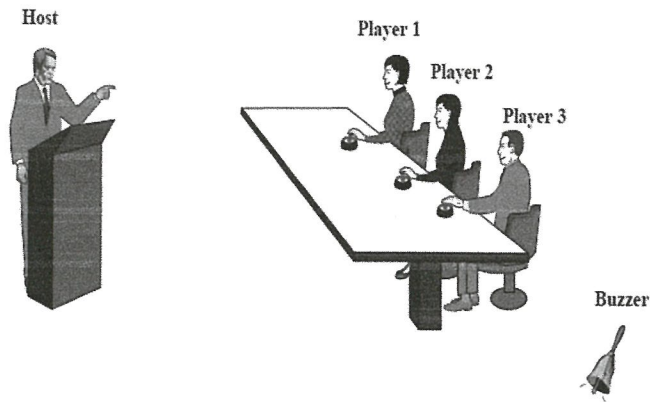


Figure Q4(d)(i)

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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