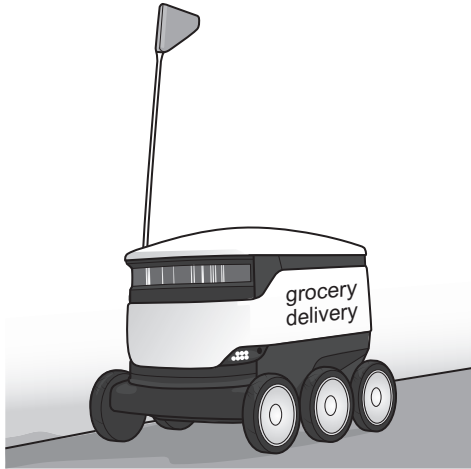


5 A supermarket wants to start delivering groceries to local elderly people, using robots.



(a) Describe the characteristics of a robot.

.....

.....

.....

.....

.....

.....

..... [3]

(b) Explain **one** benefit to the supermarket of using robots to deliver groceries to elderly customers.

.....

.....

.....

..... [2]

(c) Explain **one** drawback to the elderly customers of robots being used to deliver their groceries.

.....

.....

.....

..... (1) [2]

(d) Each robot has a media access control (MAC) address.

Tick (✓) **one** box to show the correct statement about a MAC address.

- | | | |
|----------|-------------------------------------|--------------------------|
| A | It is assigned by the manufacturer. | ☐ |
| B | It is assigned by the product. | ☐ |
| C | It is assigned by the router. | ☐ |
| D | It is assigned by the user. | ☐ |

[1]

(e) The robots have artificial intelligence (AI).

Give **three** ways the robots could make use of AI.

1

.....

2

.....

3

.....

[3]

8 A robot is used to move car parts in a factory.

(a) One characteristic of the robot is that it has a mechanical structure.

Give **one** other characteristic of a robot.

.....
 [1]

(b) The robot has firmware.

State what is meant by firmware.

.....
 [1]

(c) Interrupts are generated when the robot is operating in the factory.

Give **two** examples of interrupts that may be generated when the robot is in operation.

1
 2 [2]

(d) Give **two** advantages to the workers in the factory of using robots to move the car parts.

1

 2 [2]

(e) The robots have the ability to automatically adapt their own processes.

State the name of the ability described.

..... [1]

8 A farmer uses an automated robot to plant seeds in the field.

(a) State what is meant by the robot being automated.

.....
 [1]

(b) Give **three** characteristics of a robot.

1

 2

 3
 [3]

(c) The robot plants seeds and stops when it reaches a fence. It then turns and continues planting seeds. The robot uses sensors and a microprocessor to know when it reaches a fence.

Explain how the robot uses sensors and a microprocessor to know it has reached a fence.

.....

 [6]

(d) Give **two** advantages of the farmer using an automated robot to plant seeds.

- 1
-
-
- 2
-
-

[2]

(e) Give **two** disadvantages of the farmer using an automated robot to plant seeds.

- 1
-
-
- 2
-
-

[2]

(f) The robot is adapted to have machine learning capabilities.

Explain how this will improve the robot.

-
-
-
-
-

[2]

9 A company uses robots in its factory to manufacture large pieces of furniture.

(a) One characteristic of a robot is that it is programmable.

State **two** other characteristics of a robot.

- 1
-
- 2
-

[2]

(b) Give **two** advantages to company employees of using robots to manufacture large pieces of furniture.

- 1
-
- 2
-

[2]

(c) Give **one** disadvantage to the company's owners of using robots to manufacture large pieces of furniture.

-
-

[1]

6 A company is involved in robotics.

One of its robots is designed to make a specific movement depending on a binary value.

(a) The table gives some of the movements for the robot.

Complete the table by writing the missing binary, denary or hexadecimal value for each movement.

Movement	Binary	Denary	Hexadecimal
forward 1 step	00011111	31	
back 1 step		140	8C
turn right	01011010		5A
turn left		120	78

[4]

Working space

(b) Describe what is meant by robotics.

(c) The robot has a sensor and a microprocessor.

The robot will move forward continuously until it detects an object that is less than or equal to 10 cm in front of it.

If an object is less than or equal to 10 cm in front of it, the robot turns 90 degrees right. It then tries to move forward again.

Explain how the sensor and the microprocessor are used to automate this robot.

[7]

(d) The robot needs to find its way through different puzzles. Each puzzle has a series of paths that the robot needs to follow to find its way to the end of the puzzle. The puzzle contains dead ends and obstacles, so the robot needs to decide which way to go.

The robot's program will use artificial intelligence (AI).

(i) Describe the characteristics of AI.

.....
.....
.....
.....
.....
..... [3]

(ii) Explain how the program will use AI.

.....
.....
.....
.....
.....
.....
.....
..... [4]