Past-paper walk-through

Robotics ▪ 6.2

eXercise

Questions in this set

- 0478/11 N25 Q5 ▪ 11 marks
- 0478/11 J25 Q8 ▪ 7 marks
- 0478/11 J24 Q8 ▪ 16 marks
- 0478/11 J23 Q9 ▪ 5 marks
- 0478/12 M23 Q6 ▪ 20 marks

Reading the mark scheme

- **B1** a mark that stands on its own – the point is either made or not.
- **M1** a *method* mark: the right approach, even if the number is wrong.
- **A1** an *answer* mark, and it usually needs its M mark first.
- **C1** a working mark on the way to the answer.
- // separates answers the examiner accepts equally.
- **ecf** = error carried forward: a later part is marked on your own earlier answer.
- **owtte** = "or words to that effect" – the wording need not match.

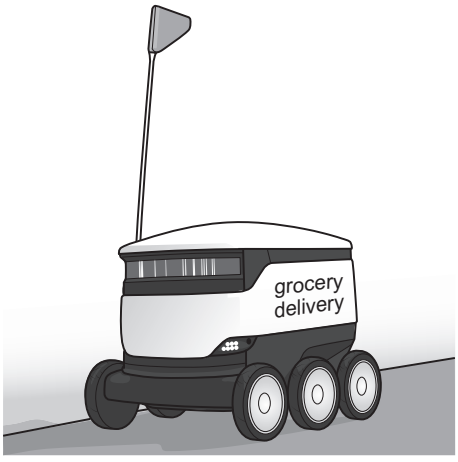
Question 5

0478/11 N25 ▪ Q5 ▪ 11 marks

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

(a) Describe the characteristics of a robot. **[3]**

Question 5



Question 5

0478/11 N25 ▪ Q5 ▪ 11 marks

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

(b) Explain **one** benefit to the supermarket of using robots to deliver groceries to elderly customers. **[2]**

Question 5

0478/11 N25 ▪ Q5 ▪ 11 marks

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

(c) Explain **one** drawback to the elderly customers of robots being used to deliver their groceries. **[2]**

Question 5

0478/11 N25 ▪ Q5 ▪ 11 marks

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

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

Tick (✓) **one** box to show the correct statement about a MAC address. **[1]**

- **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.

Question 5

0478/11 N25 ▪ Q5 ▪ 11 marks

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

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

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

1. 2. 3. **[3]**

Solution 5

(a)

Mark scheme

- Any three from:
- ▪ A mechanical structure/framework
- ▪ Electrical components
- ▪ ... such as sensors/microprocessor/actuators
- ▪ Programmable
- ▪ Has the ability to move

Solution 5

(b) Mark scheme

- Two from (one for benefit and one for matching explanation):
- For example:
- ▪ Supermarket may gain more customers
- ▪ ... as elderly people who could not previously make it to the store can now shop there
- ▪ ... which will increase their sales/profits
- ▪ Supermarket can serve customers more efficiently
- ▪ ... as multiple orders can be delivered at the same time

Solution 5

(c) Mark scheme

- Two from (one for drawback and one for matching explanation):
- For example:
- ▪ They may get less exercise
- ▪ ... as they no longer need to walk to/round the store to get their shopping
- ▪ ... that could negatively affect their health
- ▪ They may struggle to use technology // may mistrust technology // would prefer an employee/person to deliver it
- ▪ ... and this may cause additional stress/anxiety

Solution 5

- ... leading to making mistakes in receiving the delivery

Solution 5

(d)

Mark scheme

- A

Solution 5

(e) Mark scheme

- Any three from:
- For example:
- ▪ It could learn the route to a customer's house
- ▪ It could learn where there are obstacles on a route
- ▪ It could learn to deal with obstacles more effectively
- ▪ It could reason which parts of the route are paths and which are roads
- ▪ It can use machine learning
- ▪ To identify patterns in the route data

Question 8

0478/11 J25 ▪ Q8 ▪ 7 marks

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]**

Question 8

0478/11 J25 ▪ Q8 ▪ 7 marks

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

(b) The robot has firmware.

State what is meant by firmware. **[1]**

Question 8

0478/11 J25 ▪ Q8 ▪ 7 marks

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

(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]**

Question 8

0478/11 J25 ▪ Q8 ▪ 7 marks

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

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

1. 2. **[2]**

Question 8

0478/11 J25 ▪ Q8 ▪ 7 marks

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

(e) The robots have the ability to automatically adapt their own processes.
State the name of the ability described. **[1]**

Solution 8

(a)

Mark scheme

- Any one from:
- ▪ It has electrical components. // by example
- ▪ It is programmable.
- ▪ It can move.

Solution 8

(b)

Mark scheme

- Any one from:
- ▪ Permanent instructions/software that are programmed into/stored in the ROM.
- ▪ Instructions/software that allow hardware to be controlled/managed.
- ▪ Instructions/software that provides the operating system with a platform to run on.

Solution 8

(c) Mark scheme

- Any two from:
- Examples:
- ▪ user input // by example
- ▪ encountering an obstacle
- ▪ emergency stop
- ▪ hardware error
- ▪ software error
- ▪ battery low

Solution 8

- component overheating
- two processes accessing the same location

Solution 8

(d) Mark scheme

- Any two from:
- Examples:
- ▪ Workers don't need to lift heavy machinery
- ▪ The workers are less likely to injure themselves
- ▪ The workers don't need to be in any dangerous environments in the factory
- ▪ The workers don't need to perform boring/repetitive tasks such as moving car parts
- ▪ Workers can focus on having higher expertise skills

Solution 8

- Create new jobs for workers to maintain the robots.

Solution 8

(e)

Mark scheme

- Machine learning

Question 8

0478/11 J24 ▪ Q8 ▪ 16 marks

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

(a) State what is meant by the robot being automated. **[1]**

Question 8

0478/11 J24 ▪ Q8 ▪ 16 marks

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

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

1. 2. 3. **[3]**

Question 8

0478/11 J24 ▪ Q8 ▪ 16 marks

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

(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]**

Question 8

0478/11 J24 ▪ Q8 ▪ 16 marks

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

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

1. 2. **[2]**

Question 8

0478/11 J24 ▪ Q8 ▪ 16 marks

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

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

1. 2. **[2]**

Question 8

0478/11 J24 ▪ Q8 ▪ 16 marks

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

(f) The robot is adapted to have machine learning capabilities.
Explain how this will improve the robot. **[2]**

Solution 8

(a)

Mark scheme

- The robot can perform actions without human intervention

Solution 8

(b) Mark scheme

- Any three from:
- ▪
- It has a mechanical structure/framework
- ▪
- It has electrical components
- ▪
- It is programmable
- ▪

Solution 8

- It can move

Solution 8

(c) Mark scheme

- Any six from:
- ▪
- A proximity sensor is used
- ▪
- The sensor continuously sends digitised data to the microprocessor
- ▪
- The microprocessor compares the data to a stored value/range of values
- ▪

Solution 8

- If the value is within the range/matches the robot continues planting
- ▪
- If the value is above/below/outside the range a signal is sent by the microprocessor to turn/stop the robot
- ▪
- ... using an actuator to turn/stop the robot
- ▪
- This process repeats until the robot is turned off

Solution 8

(d) Mark scheme

- Any two from:
- Example:
- ▪
- The robot is more accurate when planting seeds
- ▪
- The robot does not need to take breaks // works 24/7
- ▪
- The robot will not get bored of performing a repetitive task

Solution 8

- ▪
- The farmer can perform other tasks whilst the robot is planting the seeds
- ▪
- The robot may be faster/more efficient (at planting seeds)
- ▪
- Safer as the robot can work in a more dangerous environments (e.g. with animals in a field)
- ▪
- Doesn't need to pay labour costs/wages

Solution 8

(e) Mark scheme

- Any two from:
- Example:
- ▪
- The robot may have been expensive to purchase
- ▪
- The robot may need maintenance and this may be costly
- ▪
- The robot may take away jobs from humans that previously planted the seeds

Solution 8

- ▪
- Farmer/workers may be deskilled
- ▪
- Farmer may need training in how to use the robot
- ▪
- If it breaks the farmer will need to manually plant
- ▪
- If faulty it may cause damage to farm/seeds
- ▪
- Cannot adapt to a new/unexpected event

Solution 8

(f) Mark scheme

- Any two from:
- Example:
- ▪
- The robot can now adapt itself by changing its own rules/data/ processes
- ▪
- The robot will become more efficient
- ▪
- ... as it has a greater knowledge of its surroundings/environment

Solution 8

- ▪
- ... as it can remember where a fence is
- ▪
- ... as it can remember the route it needs to take
- ▪
- ... as it can remember where any obstacles are to avoid
- ▪
- ... as it can remember where to start and stop sowing seeds
- ▪
- ... as it may make fewer errors

Question 9

0478/11 J23 ▪ Q9 ▪ 5 marks

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.

Question 9

[2]

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

Question 9

[2]

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

Solution 9

(a)

Mark scheme

- Any two from:
- ▪
- It has a mechanical structure/framework
- ▪
- It has electrical components // by example
- 2

Solution 9

(b) Mark scheme

- Any two from:
- e.g.
- ▪
- Employees don't need to lift heavy furniture
- ▪
- Employees can be protected from dangerous tasks
- ▪
- Employees can utilise their skills in other tasks

Solution 9

- ▪
- Employees don't need to perform repetitive/mundane tasks
- 2
- 0478/11
- May/June 2023

Solution 9

(c) Mark scheme

- Any one from:
- e.g.
- ▪
- Expensive to install/purchase/setup
- ▪
- High ongoing costs/maintenance costs
- ▪
- May deskill the workforce

Solution 9

- ▪
- If they malfunction, production may stop
- 1

Question 6

0478/12 M23 ▪ Q6 ▪ 20 marks

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

Question 6

turn right	01011010		5A
turn left		120	78

[4]

Working space

Question 6

(b) Describe what is meant by robotics.

Question 6

(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.

Question 6

(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.

Question 6

(ii) Explain how the program will use AI.

Solution 6

(a) Mark scheme

- One mark each
- Movement
- Binary
- Denary
- Hexadecimal
- forward 1 step
- 00011111
- 31

Solution 6

- 1F
- back 1 step
- 10001100
- 140
- 8C
- turn right
- 01011010
- 90
- 5A
- turn left

Solution 6

- (0)1111000
- 120
- 78
- 4

Solution 6

(b) Mark scheme

- Any two from:
- ▪
- The design of robots (to perform tasks/operations/functions)
- ▪
- The construction of robots (to perform tasks/operations/functions)
- ▪
- The operation of robots (to perform tasks/operations/functions)
- 2

Solution 6

- 0478/12
- February/March 2023

Solution 6

(c) Mark scheme

- Seven from:
- ▪
- Uses an infra-red/proximity sensor
- ▪
- Sensor continuously sends the digitised value/reading/distance to the
- microprocessor
- ▪
- Microprocessor compares the data/signal to the stored value of 10(cm)

Solution 6

- ▪
- If the data/signal is greater than the stored value/10 ...
- ▪
- ...a signal is sent to make the robot move forward
- ▪
- If the data/signal is less than or equal to the stored value/10 ...
- ▪
- ...a signal is sent to make robot turn
- ▪
- An actuator is used to make the robot turn/move forward

Solution 6

- ▪
- The whole process repeats continuously until turned off/stopped
- 7

Solution 6

(d)(i) Mark scheme

- Any three from:
- e.g.
- ▪
- Collects data
- ▪
- Stores rules for using the data
- ▪
- The ability to reason

Solution 6

- ▪
- The ability to learn // uses machine learning
- ▪
- ... by adapting what it does
- ▪
- ... for example, from mistakes to not make them again // result from
- previous decisions impacts future
- ▪
- ... by changing its own rules
- ▪

Solution 6

- ...by changing its own data
- ▪
- ...by being trained
- ▪
- Makes one or more predictions (to make a decision)
- ▪
- Find/analyse patterns
- 3

Solution 6

(d)(ii) Mark scheme

- Four from:
- e.g.
- ▪
- Use machine learning algorithms
- ▪
- Collects data about where it has been
- ▪
- Collect data about obstacles/problems

Solution 6

- ▪
- Store successful actions
- ▪
- Stores unsuccessful actions
- ▪
- Identify/store patterns
- ▪
- ... to make sure it does not repeat the same incorrect route
- ▪
- ... so, it knows how to react to obstacles next time

Solution 6

- ▪
- ...so, it knows what is most likely to work next time
- 4