

Past-paper walk-through

Automated systems ■ 6.1

eXercise

Questions in this set

- 0478/13 N25 Q1 ■ 16 marks
- 0478/13 J25 Q6 ■ 15 marks
- 0478/13 N24 Q5 ■ 10 marks
- 0478/12 M24 Q6 ■ 20 marks
- 0478/12 N23 Q11 ■ 5 marks
- 0478/11 J23 Q5 ■ 7 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 1

0478/13 N25 ■ Q1 ■ 16 marks

A flower shop has a room that has an air-conditioning system. It is used to keep the room at a constant temperature for storing flowers.

The owner uses a keypad to set the temperature for the room.

(a) Tick (✓) **one** box to show whether a keypad is an example of an input, output, process or storage device. **[1]**

A input

B output

C process

D storage

Question 1

0478/13 N25 ■ Q1 ■ 16 marks

A flower shop has a room that has an air-conditioning system. It is used to keep the room at a constant temperature for storing flowers.

The owner uses a keypad to set the temperature for the room.

(b)(i) Give the binary number that would be stored when the denary number 24 is entered. [1]

(b)(ii) Give the binary number that would be stored when the denary number 101 is entered. [1]

(b)(iii) The binary number 00010011 is stored in the register.

Give the denary number that has been entered for this binary number to be stored. [1]

(b)(iv) The binary number 00100010 is stored in the register.

Give the denary number that has been entered for this binary number to be stored. [1]

Question 1

0478/13 N25 ■ Q1 ■ 16 marks

A flower shop has a room that has an air-conditioning system. It is used to keep the room at a constant temperature for storing flowers.

The owner uses a keypad to set the temperature for the room.

(c)(i) Give the binary number that is stored in the register to display the error code 51. **[1]**

(c)(ii) Give the binary number that is stored in the register to display the error code E3. **[1]**

(c)(iii) Give the hexadecimal number that is displayed when the binary number 10000010 is stored in the register. **[1]**

Question 1

0478/13 N25 ■ Q1 ■ 16 marks

A flower shop has a room that has an air-conditioning system. It is used to keep the room at a constant temperature for storing flowers.

The owner uses a keypad to set the temperature for the room.

(d) If the owner of the shop wants to make the room very cold, she may need to enter a negative denary number.

The negative denary number could be represented using two's complement.

Give the two's complement 8-bit binary integer that would be stored for the temperature -5 .

Show all your working.

Two's complement 8-bit binary integer

[2]

Question 1

0478/13 N25 ■ Q1 ■ 16 marks

A flower shop has a room that has an air-conditioning system. It is used to keep the room at a constant temperature for storing flowers.

The owner uses a keypad to set the temperature for the room.

(e)(i) Tick (✓) one box to show whether the sensor is an example of an input, output, process or storage device. **[1]**

A input

B output

C process

D storage

Question 1

(e)(ii) The temperature sensor continuously sends analogue data to the microprocessor. This data is then converted to digital.

Explain how the microprocessor keeps the temperature of the room at a constant level.

[3]

Question 1

0478/13 N25 ■ Q1 ■ 16 marks

A flower shop has a room that has an air-conditioning system. It is used to keep the room at a constant temperature for storing flowers.

The owner uses a keypad to set the temperature for the room.

(f) The air-conditioning system is an example of an embedded system.

Explain why the air-conditioning system is an embedded system.

[2]

Solution 1

A input



B output

C process

D storage

Answer: **A**

Question 6

0478/13 J25 ■ Q6 ■ 15 marks

A weather station uses automated systems to collect and analyse data about the weather.

The automated system uses sensors.

(a) Give **one** other component that would be part of the automated system.

[1]

Question 6

0478/13 J25 ■ Q6 ■ 15 marks

A weather station uses automated systems to collect and analyse data about the weather.

The automated system uses sensors.

(b) One sensor that is part of the automated system is a temperature sensor.

Give **one** other sensor that could be part of the automated system.

[1]

Question 6

0478/13 J25 ■ Q6 ■ 15 marks

A weather station uses automated systems to collect and analyse data about the weather.

The automated system uses sensors.

(c)(i) Explain how a temperature above 40°C is detected for the alert. **[3]**

(c)(ii) The data for the alert is sent using serial simplex data transmission. **[3]**
Explain how the data is sent using serial simplex data transmission.

Question 6

0478/13 J25 ■ Q6 ■ 15 marks

A weather station uses automated systems to collect and analyse data about the weather.
The automated system uses sensors.

(d) Give **two** advantages to the weather station employees of using an automated weather system.

1. 2.

[2]

Question 6

0478/13 J25 ■ Q6 ■ 15 marks

A weather station uses automated systems to collect and analyse data about the weather.

The automated system uses sensors.

(e) Give **one** disadvantage to the weather station employees of using an automated weather system.

[1]

Question 6

0478/13 J25 ■ Q6 ■ 15 marks

A weather station uses automated systems to collect and analyse data about the weather.
The automated system uses sensors.

(f)(i) Machine learning is part of a branch of computer science.

Identify the name of this branch of computer science.

[1]

(f)(ii) Explain how the machine learning capabilities can be used to predict future weather.

[3]

Solution 6

(a)

Mark scheme

- Any one from:
- Examples:
 - ■ Microprocessor
 - ■ Actuator
 - ■ Storage/memory

Solution 6

(b)

Mark scheme

- Any one from:
- Examples:
 - ■ Humidity
 - ■ Light
 - ■ Level
 - ■ Infrared

Solution 6

(c)(i)

Mark scheme

- Any three from:
 - A microprocessor is used.
 - Microprocessor received data from the sensor.
 - Microprocessor compares data against preset data of 40.
 - If the data is greater than 40 the microprocessor sends a signal to trigger the alert.

Solution 6

(c)(ii)

Mark scheme

- Any three from:
 - ■ Data is sent one bit at a time.
 - ■ ... down a single wire.
 - ■ Data can only be sent in one direction.

Solution 6

(d)

Mark scheme

- Any two from:
- Examples:
 - ■ Employees don't need to carry out a mundane/repetitive task.
 - ■ Employees don't need to work overnight.
 - ■ Employees don't need to work outside in adverse weather conditions.
 - ■ Creates maintenance jobs for system

Solution 6

(e)

Mark scheme

- Any one from:
- Examples:
 - ▪ May de-skill the employees
 - ▪ May replace employees and take their job

Solution 6

(f)(i)

Mark scheme

- Artificial intelligence // AI

Solution 6

(f)(ii) Mark scheme

- Any three from:
- Examples:
 - ■ It can adapt its own processes/data.
 - ■ It could analyse the data for trends/patterns.
 - ■ ... and predict future weather patterns based on the patterns.
 - ■ Feedback is given on weather predictions.
 - ■ ... changes future predictions based on this feedback.
 - ■ It could learn what weather occurs at certain times of year.

Solution 6

- ■ ... and use this to predict what the weather would be like at the same time of year.
- ■ ... and adapt its rules/processes for weather predictions.

Question 5

0478/13 N24 ■ Q5 ■ 10 marks

A farmer has a plough that is an automated system. The plough is used to dig the ground in a field to prepare it for planting seeds.

The plough uses sensors and a microprocessor to maintain a straight line when digging the ground.

(a) State what is meant by an automated system. [1]

(b) Describe the role of the microprocessor in this process. [3]

(c) Give **two** benefits to the farmer of using an automated system for this purpose.

1. 2. [2]

(d) The plough uses artificial intelligence (AI) to navigate its way around the field.

Explain how the plough makes use of AI for this purpose. [4]

Solution 5

(a)

Mark scheme

- (A system) that can perform actions **without human intervention**

Solution 5

(b)

Mark scheme

- It receives data from the sensor
- It **analyses** the data // It checks if the data is within/out of a range //
- It sends **signals** to trigger actions based on the data

Solution 5

(c) Mark scheme

Any two from:

For example:

- It stops the farmer having to handle heavy equipment
- It frees the farmer up to do other jobs
- It doesn't need to take breaks // Can work 24/7
- It can perform boring repetitive tasks
- Can save money on **labour costs**
- May be more accurate at ploughing/planting
- May be more efficient than the farmer at ploughing

Solution 5

(d) Mark scheme

Any four from:

For example:

- It could make use of machine learning
- It could **gather data** from **ploughing**
- ...and use this data to **adapt its own process**
- ...so that it will make fewer mistakes
- ...such as the dimensions of the field
- ...such as the landscape of the field
- ...such as where obstacles are in the field

Solution 5

- ...to create a map of the field
- ...to develop the most efficient route to take
- ...so, it knows what to **avoid** in future

Question 6

0478/12 M24 ■ Q6 ■ 20 marks

A self-driving tractor sows seeds and harvests crops for a farmer. The self-driving tractor moves automatically through the field, turning at each end and stopping when it has finished.

(a) One reason the self-driving tractor is a robot is because it has a mechanical structure that includes wheels, an engine, and a framework.

Give **one** other reason why the self-driving tractor is an example of a robot.

[1]

Question 6

	parity bit	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1
byte 1	1	1	0	0	1	1	1	0
byte 2	1	0	0	0	0	1	1	0
byte 3	0	1	0	0	0	0	0	0
byte 4	0	1	0	0	1	1	1	1
byte 5	1	0	0	0	0	0	0	0
byte 6	0	1	1	1	1	1	1	1
byte 7	1	1	0	0	1	1	0	1
parity byte								

Question 6



Question 6

0478/12 M24 ■ Q6 ■ 20 marks

A self-driving tractor sows seeds and harvests crops for a farmer. The self-driving tractor moves automatically through the field, turning at each end and stopping when it has finished.

(b)(i) Explain how an infra-red sensor, microprocessor and actuator can be used to stop the self-driving tractor if a person is detected within 3 metres. **[5]**

(b)(ii) Identify **one** other sensor that the self-driving tractor might use and how it will use the sensor. **[2]**

Question 6

0478/12 M24 ■ Q6 ■ 20 marks

A self-driving tractor sows seeds and harvests crops for a farmer. The self-driving tractor moves automatically through the field, turning at each end and stopping when it has finished.

(c) Explain the drawbacks of a farmer using a self-driving tractor to sow seeds and harvest crops. **[3]**

Question 6

0478/12 M24 ■ Q6 ■ 20 marks

A self-driving tractor sows seeds and harvests crops for a farmer. The self-driving tractor moves automatically through the field, turning at each end and stopping when it has finished.

(d) The self-driving tractor has an in-built expert system that the farmer can use to solve any errors with the tractor.

Identify **three** components of an expert system.

1. 2. 3.

[3]