1 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.

A input ☐

B output ☐

C process ☐

D storage ☐

[1]

(b) The owner of the shop enters a denary number to set the temperature for the room.

The denary number is converted to a binary number to be processed. The binary number is stored in a register in the air conditioning system.

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

..... [1]

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

..... [1]

(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]

(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]

Working space

.....

.....

.....

.....

.....

.....

(c) If the air-conditioning system detects an error, it displays an error code. The error code is displayed as a hexadecimal number. The binary number for each error code is stored in a register.

(i) Give the binary number that is stored in the register to display the error code 51.

..... [1]

(ii) Give the binary number that is stored in the register to display the error code E3.

..... [1]

(iii) Give the hexadecimal number that is displayed when the binary number 10000010 is stored in the register.

..... [1]

(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.

Working space .....

.....

.....

.....

Two's complement 8-bit binary integer .....

[2]

(e) The air-conditioning system uses a temperature sensor and a microprocessor to keep the temperature of the room at a constant level.

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

A input ☐

B output ☐

C process ☐

D storage ☐

[1]

(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]

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

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

.....

.....

.....

..... [2]