7.2 The stored program concept

Name: _____

Class: _____

Date: _____

Time: **109 minutes**

Marks: **81 marks**

Comments:

Q1.

A school robotics club has recently purchased a robotics kit after the teacher in charge saw an advert in a magazine. The advert is reproduced below.
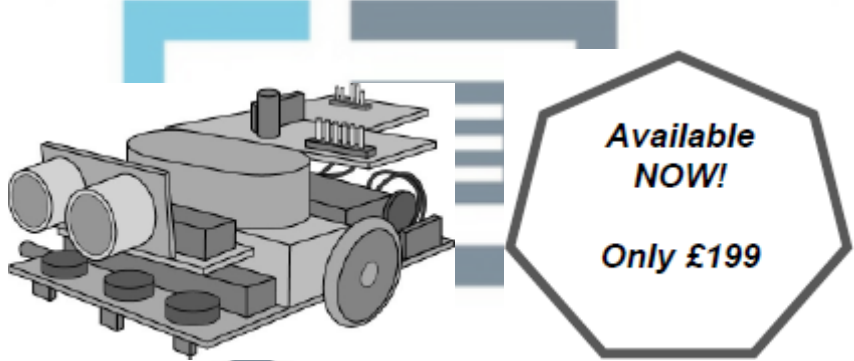
RoboEddy - a new educational robot

Specification

Hardware
500 Mhz processor
32 MB RAM
4 timers
Wi-Fi communications via WLAN 802.11g radio
Dual H-bridge motor driver

Software
Built in interpreter for the high level language RobotC
Directly run assembly code
XMODEM protocol for reliable file transfer
Support for various analogue and digital sensors

Available
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Only £199

(a)   Using the XMODEM protocol, students at the robotics club can copy a RobotC program prepared on a desktop computer to the robot.

What is meant by the term *protocol*?

_____

_____

(1)

(b)   The RobotC program that has been copied to the robot can be executed by the built-in interpreter.

How does a high level language interpreter work?

_____

_____

_____

_____

(c) The robot processor is different in some ways from a processor in a desktop computer, but it still follows the stored program concept.

What is meant by the term *stored program concept*?

_____

_____

_____

_____

(3)

(d) As well as using RobotC, it is also possible to program the robot using assembly language.

The motor driver uses memory locations to store the current speed of each motor. The left motor speed is stored in memory location `21` and the right motor speed is stored in memory location `22`.

The following set of three assembly language instructions can be used to take basic control of the motors:

`LOAD XX`   - load a value from memory location XX into the accumulator

`ADD XX`   - add the value stored in memory location XX to the accumulator

`STORE XX`   - store the value in the accumulator in memory location XX

Selecting from the set of three instructions above, write a sequence of instructions that will swap the current left motor speed with the current right motor speed. Your program may use memory location `23` for temporary storage.

_____

_____

_____

_____

_____

_____

(3)

(e) The students develop a program that can sort coloured balls into piles but it is found that the program is not very effective.

With regards to touch and vision, state **three** factors why a robot may find a task, such as sorting coloured balls, a hard task whereas for a 4-year-old child it is a relatively easy one.

Factor 1 _____

_____

Factor 2 _____

_____

Factor 3 _____

_____

(3)

(f)   The robot identifies the colour of the balls using a digital still camera component.

(i)   Describe the principles of operation of a digital still camera.

_____

_____

_____

_____

_____

_____

(3)

(ii)   The digital still camera component can take high resolution images but the students have chosen to program it to take low resolution images instead.

Give a reason why the students might have only used a low resolution.

_____

_____

_____

(1)
(Total 16 marks)

Q2.

Figure 1 and **Figure 2** show two different versions of a **small section of a program.**

<div align="center">

Figure 1   **Figure 2**

</div>

				(a)	Main memory	

Load	113,	R1
Load	114,	R2
Load	115,	R3
Add	R1,	R2
Add	R3,	R2
Store	R2,	160
End		

100	10000000	01110001
101	10000001	01110010
102	10000010	01110011
103	11110000	00000000
104	11110011	00000000
105	00010001	10100000
106	00000000	00000000

(a)   In **Figure 2** the label is missing from the column showing 100 to 106.

What should this label be? _____

(1)

(b)   What generation of programming language is shown in **Figure 1**?

_____

(1)

(c)   The code as written by the programmer is shown in **Figure 1**. A translator program is needed to produce a version of the code the processor can execute.

(i)   What is this translator program called?

_____

(1)

(ii)   Following the translation process various outputs will be produced.
One output from this translation is the machine code executable file.

Name **one** other possible output _____

(1)

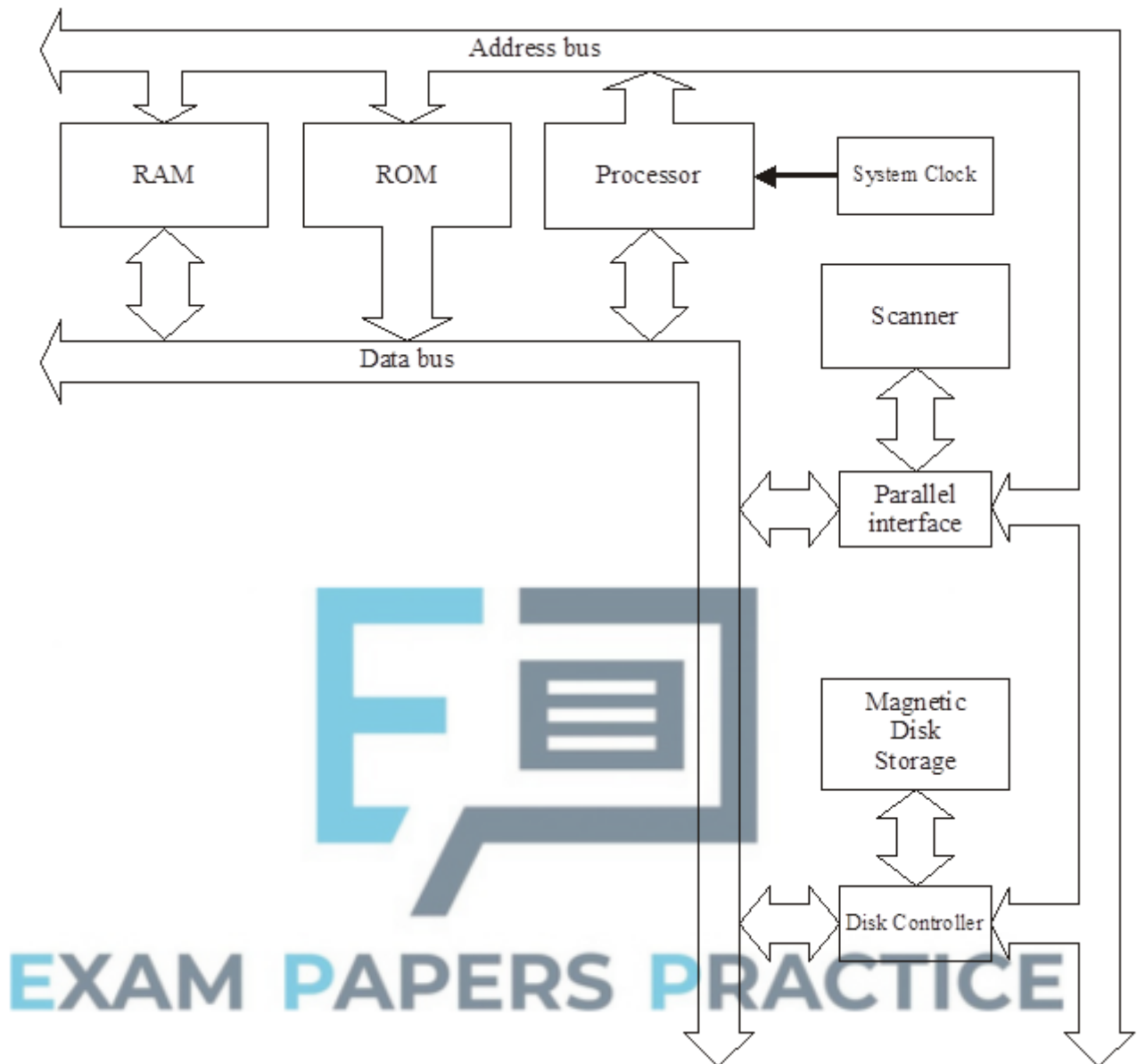(d)   Many digital computers operate on the stored program concept.

Explain the *stored program concept*.

_____

_____

_____

_____

(4)
(Total 8 marks)

Q3.

The figure below shows an incomplete diagram of a typical computer system architecture.

(a) Two of the components shown in the figure for a typical PC, are the RAM and the Magnetic Disk Storage. Select from the list below a typical specification value for each component.

300 GB   2 MHz   1 GB   128 kbps   3.0 MHz

(i)   RAM _____

(1)

(ii)   Magnetic Disk Storage _____

(1)

(b)   A third bus has been omitted from the diagram in the figure above.

Name this bus. _____

(1)

(c)   Explain why the data bus is bi-directional, but the address bus is one-way only.

_____

_____

_____

_____

(2)

(d)   The processor performs different types of operations; for example, arithmetic operations.

Name **one** other type of operation. _____

_____

(1)

(e)   Explain the **stored program concept**. _____

_____

_____

_____

(3)
(Total 9 marks)

Q4.

Some of the components of a computer system are

Internal components
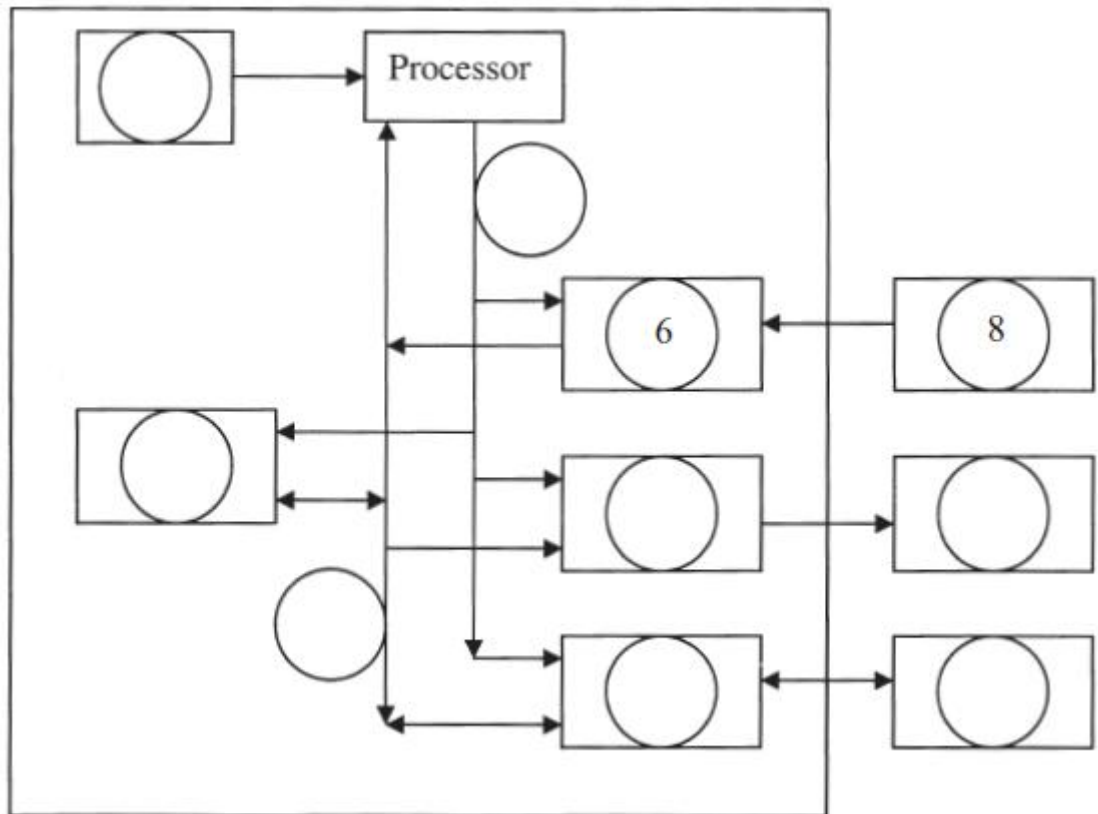Clock   1
Data Bus   2
Address Bus   3
Main Memory   4
VDU Controller   5
Keyboard Controller   6
Disk Controller   7

Peripherals
Keyboard   8
Monitor   9
Secondary Storage   10

(a)   The figure below is partially filled in. Complete the figure by writing a number from the list above, in **each** empty circle.
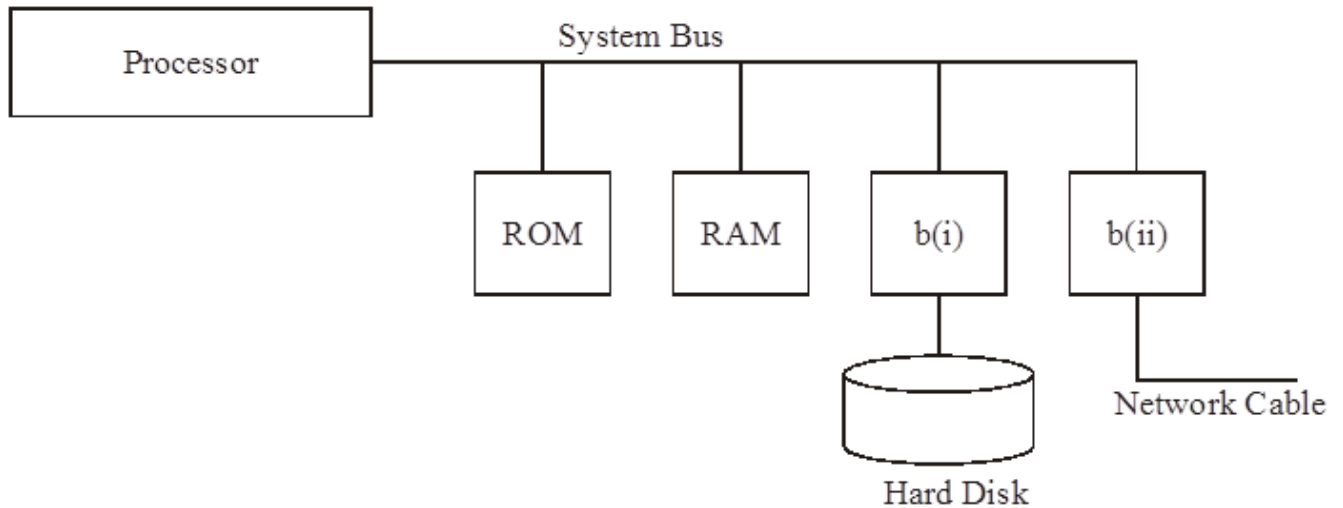
(6)

(b) The above computer system uses the *stored program concept*. Explain this term.

_____

_____

_____

(1)

(Total 7 marks)

Q5.

(a) The diagram above represents part of a computer system. Give the full name of **each** of the following:

(i) ROM _____

(1)

(ii) RAM _____

(1)

(b) In the diagram above, what are the parts labelled (b)(i) and (b)(ii)?

(i) _____

(1)

(ii) _____

(1)

(c) The system bus normally consists of three buses. Give the names of each of these **three** buses.

1. _____

2. _____

3. _____

(3)

(d) What is meant by the stored program concept?

_____

_____

_____

_____

(2)

(e) Parity bits are used to ensure the accuracy of stored data.

(i)   What is meant by even parity?

_____

_____

(1)

(ii)   Briefly describe how parity bits are used.

_____

_____

_____

(2)
(Total 12 marks)

Q6.

Some of the components of a computer system are:

Peripherals:
    keyboard   1
    monitor   2

1/0 Ports:
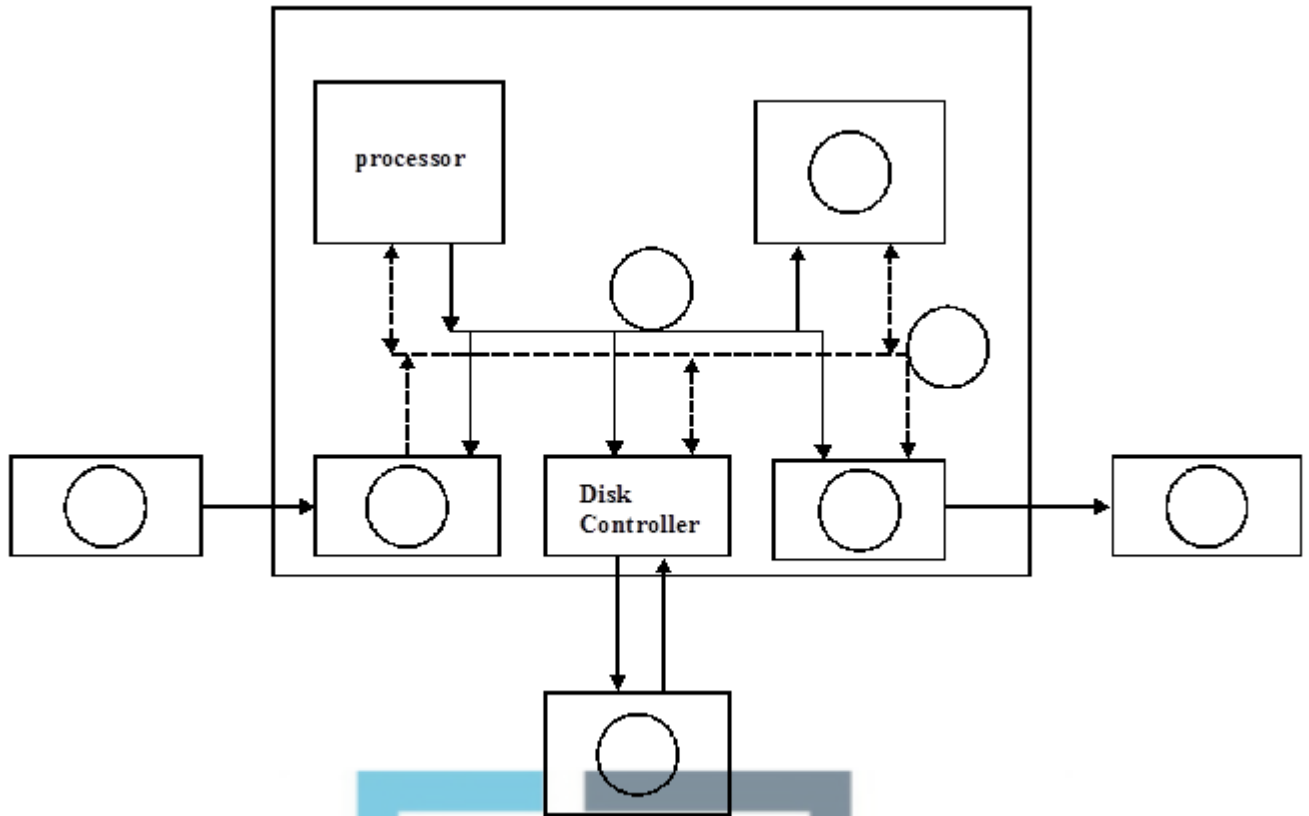   VDU controller   3
    keyboard controller 4

Memory:
    main memory   5
    secondary storage   6

System Bus:
    Data Bus   7
    Address Bus   8

(a)   In the diagram below, identify each component by writing its number, given in the list above, in the appropriate circle.

(6)

(b)   The above computer system uses the *stored program concept*. Explain this term.

_____
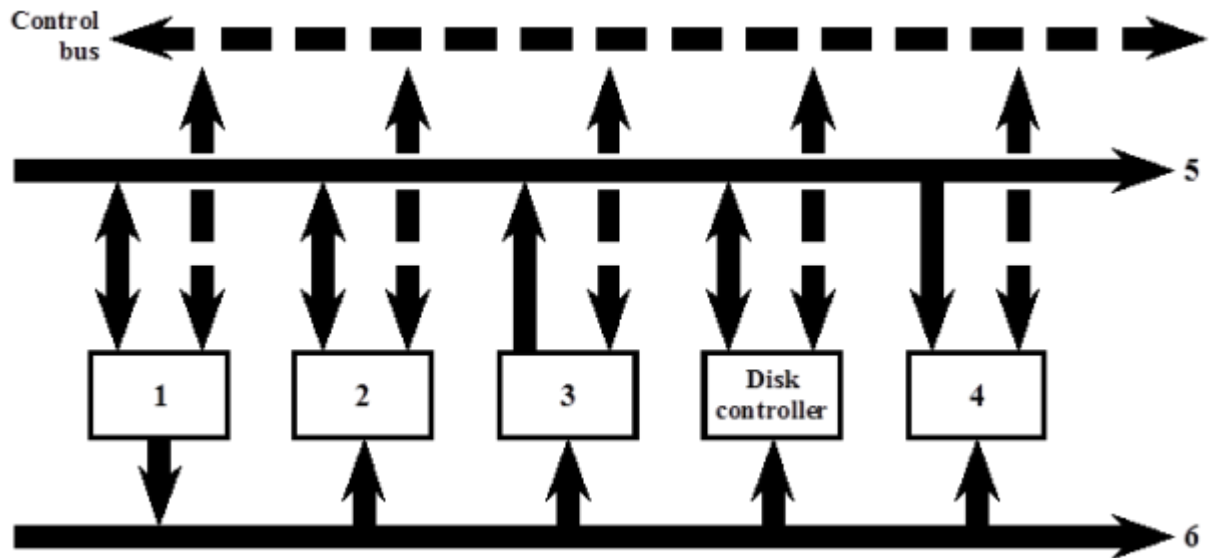
_____

_____

_____

(2)
(Total 8 marks)

Q7.

Some of the internal components of a computer system are processor, main memory, control bus, address bus, data bus, keyboard controller, VDU controller, disk controller.

The diagram below shows how these are connected.

(a) Give the correct name for each of the following as labelled in the diagram above:

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

(6)

(b) If the data bus consists of 8 lines what is the largest denary value which could be transferred in one go?

_____

(1)

(c) Computer systems built using the von Neumann architecture use the stored program concept.

(i) Where is a program stored while it is being executed?

_____

(1)

(ii) Where is the data stored? _____

(1)

(Total 9 marks)

Q8.

(a) Some of the components of a computer system are:

Memory:

main memory   1
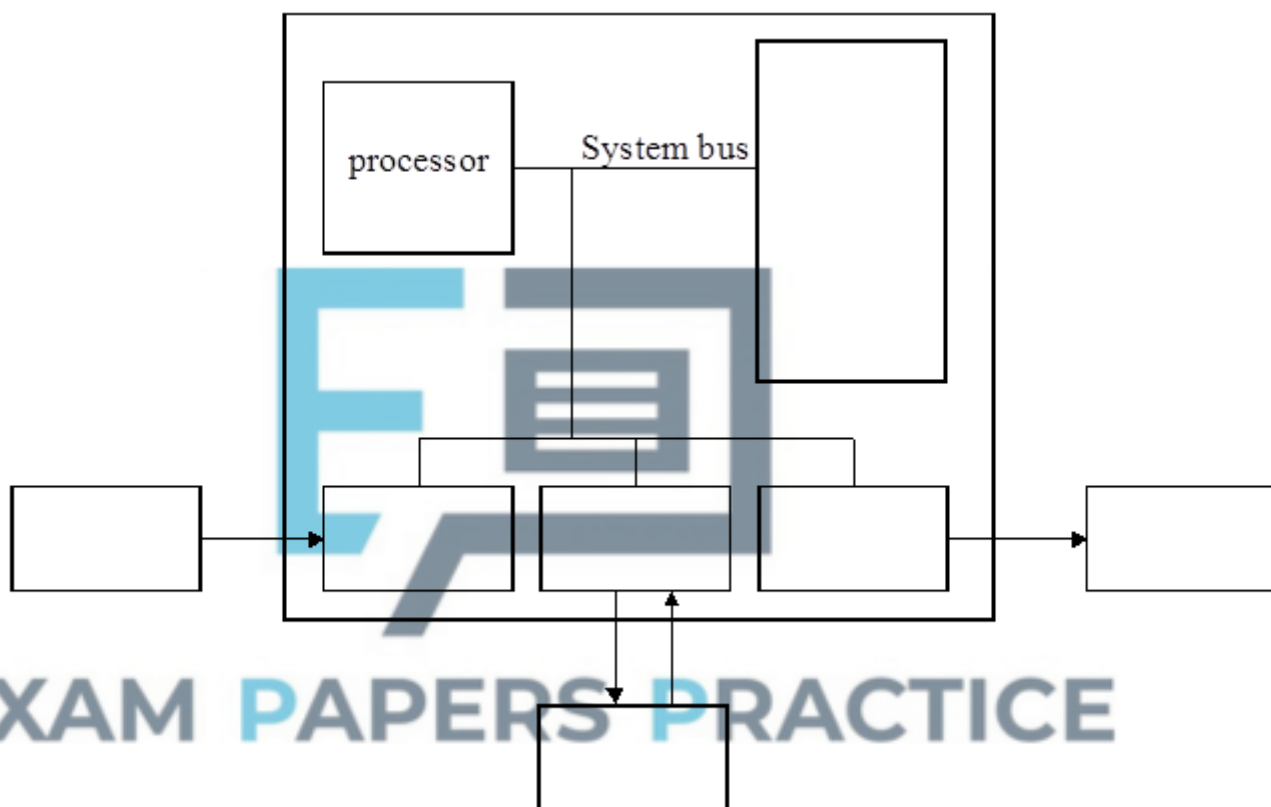
Peripherals:
     keyboard   2
     monitor   3
     hard disk drive   4

I/O Ports:
     keyboard controller   5
     disk controller   6
     VDU controller   7

In the diagram, name the components by writing the number into the appropriate box.

(4)

(b)   The above computer system uses the *stored program concept.* Explain this term.

_____

_____

_____

_____

(2)

(c)   Many computer systems and printers have both serial and parallel ports. Data can be sent to a printer from either port. What is meant by:

(i)   serial transmission of data; _____

_____

(1)

    (ii)   parallel transmission of data. _____

_____

(1)

(d)   (i)   When could parallel data transmission be used?

_____

(1)

    (ii)   Justify the answer you have given in (d) (i). _____

_____

(1)

(e)   Asynchronous data transmission is a method of data transmission in which a character is sent as soon as it becomes available, for example when a key is pressed on the keyboard. In this situation, what is the reason in having the start and stop bits?

_____

_____

_____

_____

(2)

(Total 12 marks)