# QUESTION 1.

1 The following syntax diagrams, for a particular programming language, show the

- an assignment statement
- a variable
- a number
- a letter
- a digit
- an operator

Assignment statement → [Variable] → (:=) → [Variable] → [Operator] → [Number] →

Variable → [Letter] → [Number] →

Number → [Digit] → (with loop back)

Letter → (A)
       → (B)
       → (C)

Digit → (1)
      → (2)
      → (3)
      → (4)
      → (5)

Operator → (+)
         → (–)
         → (*)
         → (/)
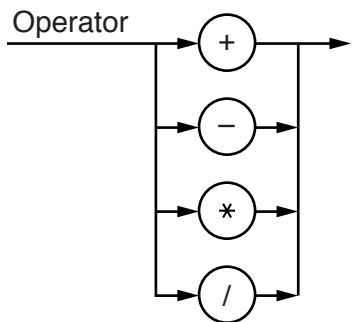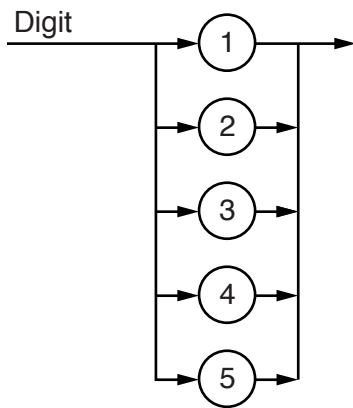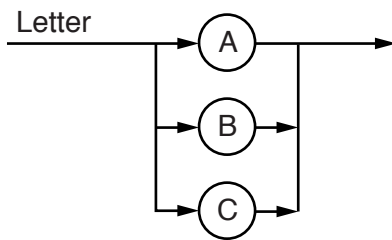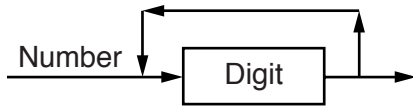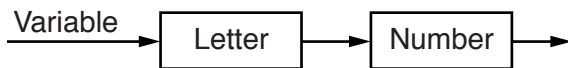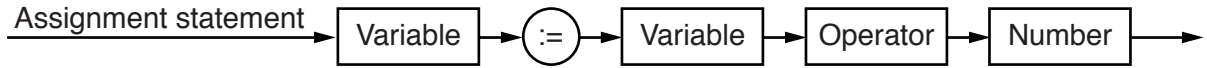
(a) The following assignment statements are invalid.

Give a reason in each case.

   (i) `A2 = B3 + 123`

   Reason ....

   ....[1]

   (ii) `B3 := B3 – 203`

   Reason ....

   ....[1]

   (iii) `A2414 := A3 * B`

   Reason ....

   ....[1]

(b) Complete the Backus-Naur Form (BNF) for the syntax diagrams shown on the opposite page.

<letter> has been done for you.

`<assignmentstatement> ::=`

....

`<variable> ::=`

....

`<number> ::=`

....

`<letter> ::= A | B | C`

`<digit> ::=`

....

`<operator> ::=`

....

[6]

4

(c) A company develops software. It provides virtual machines for its software
company has a large number of clients who use a wide range of hardware and

(i) Explain the term virtual machine. Ensure that your answer includes the terms **h**
and **software**.

....

....

....

....[2]

(ii) Give **one** benefit to the company of using virtual machines.

....

....[1]

(iii) Give **one** drawback to the company of using virtual machines.

....

....[1]

QUESTION 2.

3 **(a)** The following diagram shows how applications X, Y and Z can run on a system.

Application X	Application Y	Application Z

⇧⇩   ⇧⇩   ⇧⇩

Guest operating system 1	Guest operating system 2

⇧⇩   ⇧⇩

Virtual machine software / virtual machine monitor

⇧⇩

Host operating system

⇧   ⇩

Hardware
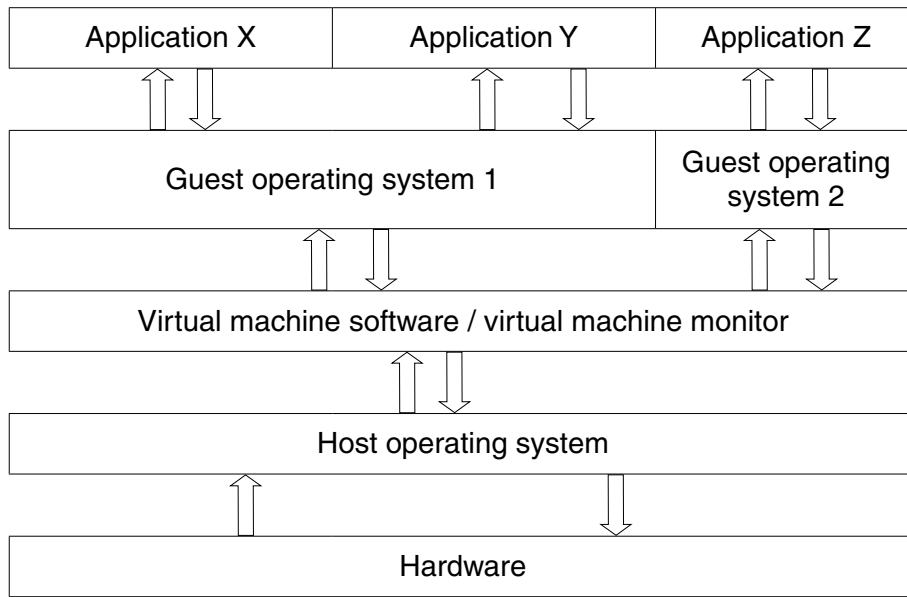
(i) The virtual machine software undertakes many tasks.

Describe **two** of these tasks.

Task 1 ....

....

Task 2 ....

....[2]

(ii) Explain the difference between a **guest operating system** and a **host operating system**.

....

....

....

....[2]

(b) A company uses a computer as a web server. The manufacturer will no lo~~~~
computer's operating system (OS) in six months' time. The company will then m~~~~
on a replacement OS.

The company is also considering changing the web server software when the OS is cha~~~~

Whenever any changes are made, it is important that the web server service is not disrupted.

In developing these changes, the company could use virtual machines.

(i) Describe **two** possible uses of virtual machines by the company.

Use 1 ....

....

....

....

Use 2 ....

....

....

....[4]

The web server often has to handle many simultaneous requests.

(ii) The company uses a virtual machine to test possible solutions to the changes that they will need to make.

Explain **one** limitation of this approach.

....

....

....

....[2]

QUESTION 3.

3 (a) This diagram shows how applications P, Q and a software development env
run on a virtual machine system.

```
┌──────────────────┬──────────────────┬──────────────────┐
│                  │                  │     Software     │
│   Application P  │   Application Q  │   development    │
│                  │                  │   environment    │
└──────────────────┴──────────────────┴──────────────────┘
     ⇑⇓               ⇑⇓                    ⇑⇓
┌─────────────────────────────────────┬──────────────────┐
│                                      │  .......A......operating │
│   .......A......operating system 1   │     system 2     │
└─────────────────────────────────────┴──────────────────┘
          ⇑⇓                                 ⇑⇓
┌─────────────────────────────────────────────────────────┐
│   Virtual machine software / virtual machine monitor     │
└─────────────────────────────────────────────────────────┘
                        ⇑⇓
┌─────────────────────────────────────────────────────────┐
│             .......B......operating system               │
└─────────────────────────────────────────────────────────┘
                        ⇑⇓
┌─────────────────────────────────────────────────────────┐
│                      Hardware                            │
└─────────────────────────────────────────────────────────┘
```
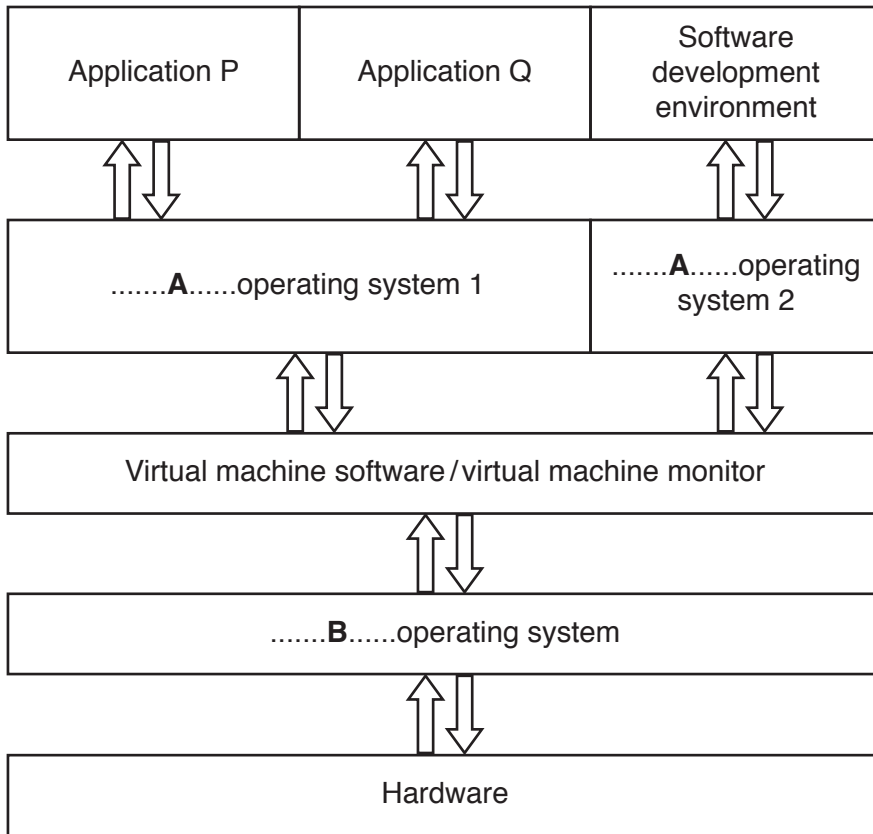
(i) State the operating systems labelled **A** and **B** in the diagram.

A ....

B ....

[2]

(ii) Application P is executing and requests data from a file.

Describe what happens after ....**A**......operating system 1 has received the data request from the application.

....

....

....

....

....

....[3]

(b) A software development company uses virtual machines to produce software

  (i) State **one** benefit to the company.

  ....

  ....[1]

  (ii) Explain **two** limitations of this approach.

  Limitation 1 ....

  ....

  ....

  ....

  Limitation 2 ....

  ....

  ....

  ....

[4]