



3.4.2. Virtual Machine (Pastpapers 2015 – 2018)

-  show understanding of the concept of a virtual machine give examples of the role of virtual machines
-  show understanding of the benefits and limitations of virtual machines

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Q 1/- A company develops software. It provides virtual machines for its software developers. The company has a large number of clients who use a wide range of hardware and software.

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

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.....
.....
.....[2]

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

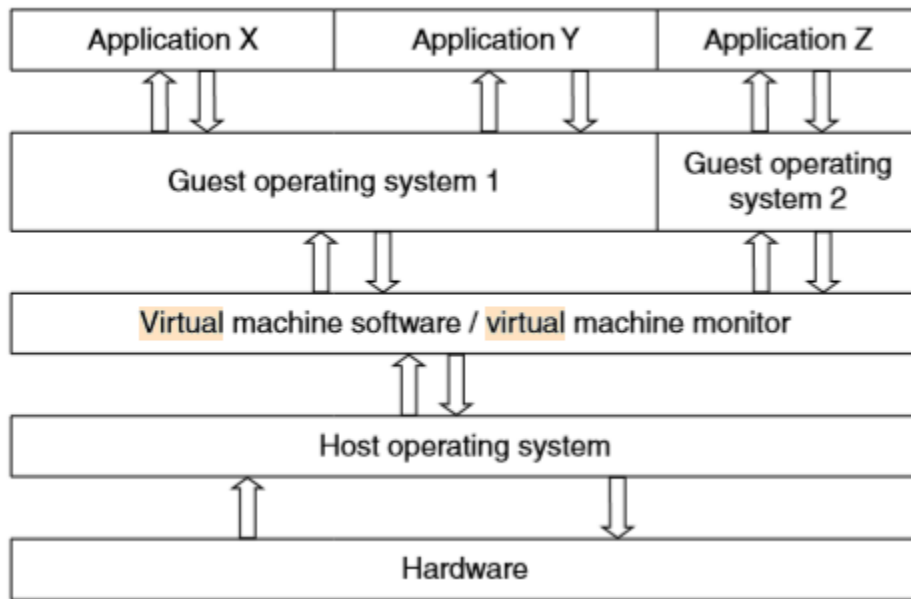
.....
.....[1]

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

.....
.....[1]

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Q2 (a) The following diagram shows how applications X, Y and Z can run on a virtual machine system.



(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 longer support the computer's operating system (OS) in six months' time. The company will then need to decide on a replacement OS.

The company is also considering changing the web server software when the OS is changed. 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.

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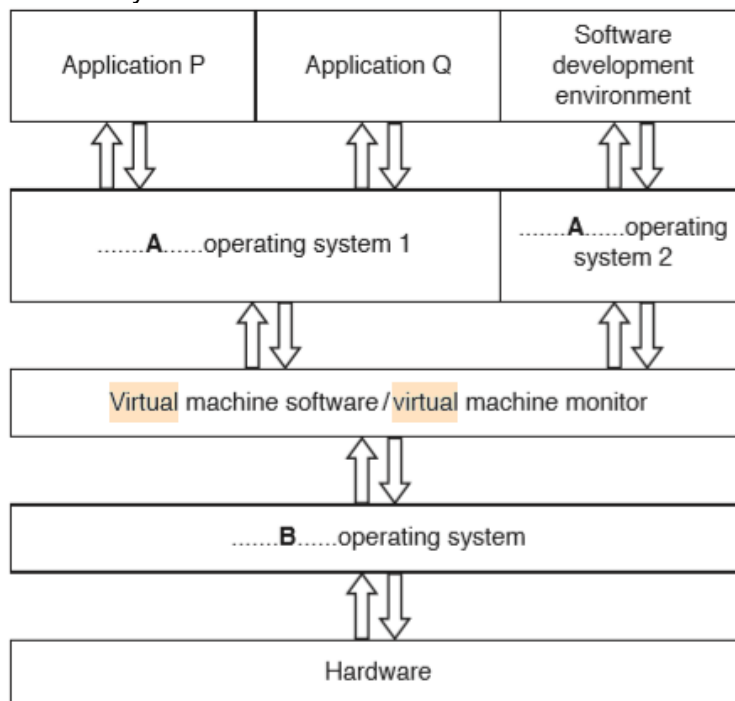
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.....[2]

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Q3 (a) This diagram shows how applications P, Q and a software development environment can be run on a virtual machine system.



(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.

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.....

.....[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]

Answers

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Q.1

(i)	Use of <u>software</u> ... (idea of using) to implement a <u>hardware</u> set-up (idea of implementing / simulating / emulating)	1 1
(ii)	e.g. no need to acquire client hardware for testing / reduces set-up time for test system / common development system for all developers	1
(iii)	e.g. software emulation runs slower than real hardware / not possible to emulate some hardware	1

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Q2.

(a) (i)	Examples: Create / delete virtual machine Existing hardware made available to guest OS // hardware emulation Ensures each virtual machine is protected from actions of another virtual machine	1 1 1 Max 2
(ii)	Guest operating system: An operating system running in a virtual machine // Controls virtual hardware // OS is being emulated Host operating system: The operating system that is actually controlling the physical hardware // the operating system for the physical machine// the OS running the VM software Guest OS is running under the Host OS software	1 1 1 Max 2
(b) (i)	Examples: Trial/use alternative replacement operating system(s) ... Test to identify possible problems Much easier to create VM with a new OS than create new computer system Trial/use alternative replacement web server software ... Test to identify possible problems Easier to try alternative new software <u>and</u> new OS combinations To provide some additional service(s) Trial/test its use - description e.g. a print server General description point – to provide a safe environment during testing (which does not disrupt the web server service)	Two marks for each use Maximum two uses Max 4

(ii)	Examples: Using virtual machine means execution of extra code // emulation of some hardware ...	1
	Non-VM installation may not perform in the same way	1
	Execution speed slower than non-VM system	1
	Problems in judging actual response times	1
	at time of maximum traffic needs fastest possible speed	1
	Particular hardware may be difficult to emulate	1
		Max 2

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3(a)(i)	A: Guest (operating system) (1) B: Host (operating system) (1)	2
3(a)(ii)	One mark for each valid point, max 3 <input type="checkbox"/> Guest OS (A) handles request as if it were running on its own physical machine // guest OS (A) is not aware it is running on a virtual platform <input type="checkbox"/> Guest OS (A) handles the request as usual <input type="checkbox"/> I/O requests are translated by the virtual machine software <input type="checkbox"/> Into instructions executed by host OS (B) <input type="checkbox"/> Host OS (B) retrieves the data from the file <input type="checkbox"/> Host OS (B) passes the data to the virtual machine software <input type="checkbox"/> The virtual machine software passes the data to the guest OS (A) <input type="checkbox"/> Guest OS passes the data to the application	3
3(b)(i)	One mark from: <input type="checkbox"/> Because software can be tried on different OS using same hardware <input type="checkbox"/> Because no need to purchase / request all sorts of different hardware <input type="checkbox"/> Easier to recover if software causes system crash <input type="checkbox"/> VM provides protection to other software / host OS from malfunctioning software	1
3(b)(ii)	Max 2 marks per limitation, max 2 limitations – max 4 marks Virtual machine may not be able to emulate some hardware ... So that hardware cannot be tested using a virtual machine ... By relevant example, e.g. developing hardware drivers Using virtual machine means execution of extra code // processing time increased ... so cannot accurately test speed of real performance A virtual machine might not be as efficient ... By relevant example, e.g. might not be able to access sufficient memory	4