

QUESTION 1.



1	(a) (i)	Wrong assignment operator (should be ':= ' not '=')	
	(ii)	0 is not a digit	
	(iii)	'B' is not a number	1
	(b)	$\langle \text{assignmentstatement} \rangle ::=$ $\underline{\langle \text{variable} \rangle := \langle \text{variable} \rangle \langle \text{operator} \rangle \langle \text{number} \rangle}$ $\langle \text{variable} \rangle ::= \langle \text{letter} \rangle \langle \text{number} \rangle$ $\langle \text{number} \rangle ::= \underline{\langle \text{digit} \rangle} \underline{\langle \text{digit} \rangle \langle \text{number} \rangle}$ $\langle \text{letter} \rangle ::= A B C$ $\langle \text{digit} \rangle ::= 1 2 3 4 5$ $\langle \text{operator} \rangle ::= + - * /$	$1 + 1$ 1 $1 + 1$ 1
	(c) (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
			Total: 13

QUESTION 2.



3 (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

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(ii)	Examples: Using virtual machine means execution of extra code // emulation of some hardware ... Non-VM installation may not perform in the same way Execution speed slower than non-VM system Problems in judging actual response times at time of maximum traffic needs fastest possible speed	1 1 1 1
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QUESTION 3.



Question	Answer	
3(a)(i)	A: Guest (operating system) (1) B: Host (operating system) (1)	
3(a)(ii)	One mark for each valid point, max 3 • 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 • Guest OS (A) handles the request as usual • I/O requests are translated by the virtual machine software • Into instructions executed by host OS (B) • Host OS (B) retrieves the data from the file • Host OS (B) passes the data to the virtual machine software • The virtual machine software passes the data to the guest OS (A) • Guest OS passes the data to the application	
3(b)(i)	One mark from: • Because software can be tried on different OS using same hardware • Because no need to purchase / request all sorts of different hardware • Easier to recover if software causes system crash • 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