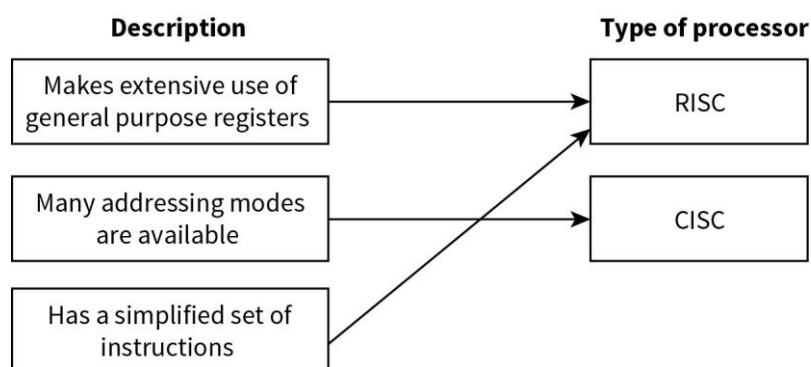# Chapter 18: Hardware and virtual machines: Answers to coursebook questions

Exam-style Questions

1 **a** **i** Reduced Instruction Set Computer (1).

      ii Any of those listed in Table 18.01 of the coursebook. 1 mark each for any of the following up to a maximum of 4.

   b **i** 1 mark each for any of the following up to a maximum of 3: Relates to the internal workings of the control unit (1), logic circuits (1) are used to handle instructions (1), no ROM inside the CU (1), no microprogramming (1).

      ii 1 mark each for any of the following up to a maximum of 2. Microprogramming (1), firmware (1), a ROM inside the CU (1). (No mark given if the same point has been made in answer to b i).

2 **a, b** A is the guest OS (1) which is software (1) that supports the execution of Application Program 1 (1).

      B is the virtual machine (1) which emulates the hardware (1) that normally would be used by the guest OS (1).

      C is the virtual machine implementation software (1) which is specific to the virtual machine (1) and for which execution is supported by the host OS (1).

      1 mark each for any of the following up to a maximum of 3: D is the host OS (1) which is a version specific to the hardware (1) that can support any software (1) and provide an interface to the hardware (1).

   c Application 2 is supported by the host OS (1) and does not need a virtual machine (1).

3 **a** **i** 1 mark each for any of the following up to a maximum of 3: Instructions (1), processors (1), memory usage (1) computer systems (1).

      ii Instructions (1).

      iii 1 mark each for any of the following up to a maximum of 5: A diagram as shown in Figure 18.01 in the coursebook (2), stages in instruction handling described (3), comment on progress through diagram (1).

   b 1 mark each for any of the following up to a maximum of 3: Interrupts normally detected and handled when an instruction has completed execution (1), if in a pipelined system one instruction has completed while others have not (1), interrupt handling routine has to be put into the pipeline (1), might erase other instructions (1), might have dedicated registers for each strand of the pipeline (1).

4 This is Question 4 in 9608 Paper 31 November 2015. At the time of writing the published mark scheme is available on the Cambridge International School Support Hub (requires registration). The Examiners Report for the November 2015 series is also available there and this may contain comments specific to this question.

    The following are what the author of this chapter in the Teacher Resource would suggest as reasonable answers with alternatives suggested where appropriate.

   a

b i

Stage	Time interval								
	1	2	3	4	5	6	7	8	9
Fetch instruction	A	B	C						
Decode instruction		A	B	C					
Execute instruction			A	B	C				
Access operand in memory				A	B	C			
Write result to register					A	B	C		

ii 8

The cycle for one instruction takes five time intervals, so 15 time intervals are needed for three instructions. With pipelining only seven time intervals are needed.

Cambridge International AS & A Level Computer Science 9608 paper 31 Q4 November 2015

5 This is Question 3 in 9608 Paper 31 June 2016. At the time of writing the published mark scheme is available on the Cambridge International School Support Hub (requires registration). The Examiners Report for the June 2016 series is also available there and this may contain comments specific to this question.

The following are what the author of this chapter in the Teacher Resource would suggest as reasonable answers with alternatives suggested where appropriate. Where a suggested answer includes bullet points, each bullet point would be worth one mark up to the maximum mark allocation for the question.

a i The two tasks need to be described within the context described in the following paragraph.

The virtual machine is application software, which is running under the control of the host operating system, which in turn is providing access to the host hardware. There are two main functions of the virtual machine. One is to create or delete an interface that emulates hardware that allows a guest operating system to be installed. The other is carrying out tasks when an application is running under the control of a guest operating system. These include the virtual machine receiving requests for action from the guest operating system. These have to be passed through to the host operating system and subsequently to the hardware. Then any result arising from the request has to be received from the host operating system and passed on to the guest operating system to pass on to the application.

ii This should be answered by providing statements that are true for one of the two types of operating system but are not true for the other. Suitable examples are:

- The host operating system is providing use of real hardware

- A guest operating system is functioning as though it were providing use of real hardware but in fact it is only providing use of a hardware emulation

- The host operating system is providing support for the running of the virtual machine software

- A guest operating system is ultimately running with support from the host operating system.

b **i** As there are two imminent new items of software, the answers provided could account for testing of either or both. It should be noted that support for the old OS is to be withdrawn. This does not stop the company from continuing to use it for a limited period before the new system is fully functional. The following statements could be made:

- A virtual machine could be used to run the replacement OS to allow users to gain familiarity

- A virtual machine could be used to run the existing web server on the replacement OS while the new web server software was being tested

- The new web server could be run on the existing OS supported by a virtual machine, which would allow testing and development of the web server software

- The new web server could be run on the replacement OS under the control of a virtual machine to allow testing of the webserver software.

ii The virtual machine will provide the same functionality. However, the performance will not be as good as that provided by actual hardware. The possible answers here are all concerned with this relatively poor performance:

- Speed of response needs to be established but the virtual machine will not emulate this precisely

- When the system is under pressure from high levels of traffic the performance of the virtual machine will not accurately predict how the hardware would perform

- Use of a virtual machine involves execution of extra code to provide the functionality of the OS, so performance is degraded.

Cambridge International AS & A Level Computer Science 9608 paper 31 Q3 June 2016