MODULE H SOFTWARE · H6

Interrupts and the interrupt service routine: mark scheme

20 marks · Cambridge 0478 syllabus 4.1.4 (the role and operation of interrupts: how an interrupt is generated, how it is handled using an interrupt service routine, what happens as a result; software and hardware interrupt examples)

How to use. One mark per creditworthy point up to the maximum shown. **/** separates alternative words; **//** separates alternative answers. Words in (brackets) are not needed for the mark. Credit any other valid answer that shows the same understanding.

QUESTION	ANSWER	MARKS	GUIDANCE
1(a) 0478 4.1.4	A signal (from hardware or software) sent to the processor / CPU ... to show that something / an event needs its attention // to request processor time	**1**	Both ideas needed: a signal to the processor, and needing attention. "A signal" alone is too vague. Do not credit "a message to the user that there is a problem" or "something that stops the current program".
1(b) 0478 4.1.4 (notes)	Divide by zero: Software Mouse moved: Hardware Two processes, same memory location: Software Key pressed: Hardware	**4**	One mark per correct row. A row with both boxes ticked scores 0.
2(a) 0478 4.1.4	The letter / character M appears / is displayed on the screen (in the booking program)	**1**	Accept "M is shown in the guest details". Do not credit "an error message" or "the program stops".
2(b) 0478 4.1.4	Any one from: An error message is displayed // the user is told the calculation cannot be done The (second) program / calculation is stopped / halted	**1**	Accept "the program crashes / closes". Do not credit "the computer turns off" or "the answer is zero".
2(c) 0478 4.1.4	Interrupt service routine // ISR // interrupt handler	**1**	Do not accept "operating system" alone or "interrupt queue".
3(a) 0478 4.1.4	Checks after each FDE cycle: True Every interrupt handled straight away: False Register values saved: True Paused task starts again from its first instruction: False	**4**	One mark per correct row. A row with both boxes ticked scores 0.

QUESTION	ANSWER	MARKS	GUIDANCE
4(a) 0478 4.1.4	Any two from: **Task:** the processor carries on with the task // the task is not paused // the next FDE cycle of the task is run **Interrupt:** the interrupt waits (in the interrupt queue) // is not handled yet ... it is handled later, when it has the highest priority // when no higher-priority task or interrupt is waiting // when the task has finished	**2**	max 2. Max 1 if only the task or only the interrupt is described. Do not credit "the interrupt is deleted / ignored for good" or "the task is paused".
5(a) 0478 4.1.4	Any six from: Moving the mouse generates a (hardware) interrupt // the mouse sends a signal to the processor The interrupt is given a priority ... and is placed in the interrupt queue The processor finishes its current FDE cycle (of the 3D image task) ... then checks for interrupts // checks the interrupt queue The interrupt has a higher priority than the 3D image task, so the task is paused The state of the task // the values in the registers are saved (on a stack) The source / type of the interrupt is identified ... ... and the matching interrupt service routine // ISR // interrupt handler is run The ISR handles the interrupt, e.g. the pointer moves on the screen The processor checks for any other higher-priority interrupts (and handles them first) The saved values are restored (to the registers) ... and the 3D image task carries on from where it was paused	**6**	max 6. Points need not be in this order. Do not credit "the 3D image task is cancelled / starts again from the beginning" or "the mouse converts analogue data to digital". "The task stops" is credited only with the idea that it is paused / its state is saved.

Total: 20 marks