MODULE H SOFTWARE · H3

Memory management and multitasking: mark scheme

20 marks · OCR J277 spec 1.5.1 (memory management and multitasking: the transfer of data between memory, the allocation of memory to applications, how it allows for multitasking) and 1.2.1 (virtual memory: why it may be needed, how it works)

How to use. One mark per bullet up to the maximum shown. **/** separates alternatives; **//** separates alternative statements for the same mark. Words in (brackets) are not needed for the mark. NE = not enough. Credit any other valid answer that shows the same understanding. Paging and segmentation are not required at GCSE: do not expect them, but do not penalise a correct use of "pages".

QUESTION	ANSWER	MARKS	GUIDANCE
1(a) J277 1.5.1	More than one program / application / task running / open at the same time // (appearing to) run several programs at once	**1**	Do not accept "doing more than one thing" alone (NE): the answer must refer to programs / applications / tasks / processes. Accept "switching between programs so they appear to run at the same time".
1(b) J277 1.5.1	Transfers instructions and data into RAM: True Every program shares the same area: False Memory of a closed program can be allocated to another: True Processor finishes one program before the next: False	**4**	One mark per correct row. A row with both boxes ticked scores 0.
2(a) J277 1.5.1	(The program's instructions / data are) transferred / loaded / copied from secondary storage / the SSD / hard drive into RAM / main memory The OS allocates / reserves (an area / amount of free) RAM / memory for the program Checks there is enough free memory (for the program) Keeps track of which (part of) memory is used by the program // records which memory is in use / free Data / instructions are transferred between RAM and the processor / CPU (as the program runs) // the CPU fetches the program's instructions from RAM Data the program needs (e.g. a video file) is loaded into RAM // data is transferred from RAM to secondary storage when work is saved	**3**	Max 3. Accept "memory" / "main memory" for RAM. Do not accept "storage" or "ROM" for RAM. Do not accept "it opens the program" / "it manages the memory" alone (NE: repeats the question). The whole program does not have to be loaded at once: credit "the parts needed".

QUESTION	ANSWER	MARKS	GUIDANCE
2(b) J277 1.5.1	(Allocates) each program its own / a separate area of RAM / memory All the open programs (and the OS) are held in RAM at the same time Keeps the programs' areas separate // stops one program overwriting / corrupting / using another program's data / memory Keeps track of which memory is in use and which is free (so it can allocate it) Frees / deallocates memory when a program closes, so it can be reused (by another program) Uses virtual memory when RAM is full, so more programs can stay open So the processor can switch quickly between the programs // without reloading them from secondary storage	**3**	Max 3. Do not accept "the laptop has enough RAM" alone (NE). Do not credit points about sharing processor time here (they belong to Question 3), unless linked to the programs being held in memory.
2(c) J277 1.5.1	Frees / deallocates / releases it // marks it as free / available // so it can be allocated to another program (e.g. the video editing program)	**1**	Do not accept "deletes it" / "saves it" / "moves it to virtual memory". Accept "adds it to the free memory (making 1.5 GB free)".
3(a) J277 1.5.1	The processor / core can only carry out / execute (instructions from) one program at a time The OS shares (out) processor time between the programs // gives each program a (short) turn / time slice The OS switches between the programs very quickly / many times a second ... so (to the user) they appear to run at the same time / simultaneously The OS decides which program runs next / how long each gets // schedules the programs (e.g. by priority) All three programs are held in RAM // memory management allows it to switch without reloading them	**3**	Max 3. The word "scheduling" is not required. Do not accept "it runs them at the same time" or "it uses more cores" (the processor has one core). Do not accept "it is fast" alone (NE).
4(a) J277 1.2.1, 1.5.1	RAM is (nearly) full // there is not enough (free) RAM for the project // only 1 GB is free but 2 GB is needed Without it, the project could not be opened / the program could crash / freeze // the editor would have to close (other) programs It provides extra memory (on secondary storage) // lets the laptop use more memory than the RAM it has	**2**	Max 2. Accept "1 GB short / 1 GB more is needed" for the first point. Do not accept "to make the laptop faster".

QUESTION	ANSWER	MARKS	GUIDANCE
4(b) J277 1.2.1, 1.5.1	Part of secondary storage / the SSD / hard drive is used as (temporary) extra memory / RAM Data / programs (or parts of them) not currently in use (e.g. the music player / web browser) are moved / transferred from RAM to virtual memory / secondary storage This frees space in RAM for the project (data) When data in virtual memory is needed again it is transferred back into RAM // (other data is moved out to make room) The processor can only use data / instructions when they are in RAM (not directly in virtual memory)	**3**	Max 3. Do not accept ROM, cache or the cloud as the location of virtual memory. Do not accept "it moves data to secondary storage" without saying it is data from RAM / not currently in use (NE for the second point). Accept "pages" for data.

Total: 20 marks