

1.2 SOFTWARE & SOFTWARE DEVELOPMENT · 1.2.1

Operating systems: functions & memory management — Mark scheme

34 marks · spec 1.2.1(a)(b)

AO key: AO1 = knowledge & understanding · AO2 = application · AO3 = reasoned judgements. Accept any valid alternative; do not award the same point twice.

Q	ANSWER	AO	MARKS
1(a)	To manage the computer's resources / act as a bridge (interface) between the user and the hardware. (1)	AO1	1
1(b)	1 mark per function, max 3: memory management / scheduling / interrupt handling / I/O management / file (backing store) management / user interface / security. (3)	AO1	3

Q	ANSWER	AO	MARKS
2(a)	Allocating areas of memory to programs/processes (1); keeping them separate and freeing memory when no longer needed / making best use of limited RAM (1). (2)	AO1	2
2(b)	1 mark per point, max 3: - the user can run several programs at once (1) - without programs overwriting each other / crashing (1) - and larger programs than RAM alone can run (via virtual memory) (1)	AO2	3

Q	ANSWER	AO	MARKS
3(a)	Names + describes two methods, max 4: Paging (1): memory split into fixed-size pages; a process is held in non-contiguous pages mapped by a page table (1) Segmentation (1): memory split into variable-length logical segments that follow the program's structure (1)	AO1	4
3(b)	Paging. (1)	AO1	1
3(c)	The mapping between logical (page) addresses and physical (frame) addresses. (1)	AO1	1

Q	ANSWER	AO	MARKS
4(a)	Using secondary storage (disk) (1) as an extension of RAM / to hold pages that do not fit in physical memory (1). (2)	AO1	2
4(b)	Inactive pages are swapped out to disk to free RAM (1); needed pages are swapped back in when required (1). (2)	AO2	2
4(c)	Heavy swapping (disk thrashing) (1); the OS spends most time swapping, so performance slows because disk is much slower than RAM (1). (2)	AO2	2

Q	ANSWER	AO	MARKS
5(a)	The user cannot communicate with hardware directly (1); the OS hides the complexity behind a simple interface and handles the hardware for them (1). (2)	AO2	2
5(b)	Stored in secondary storage (hard disk/SSD) (1); a loader in ROM copies it into RAM at switch-on (1). (2)	AO1	2

Q	LEVELS-OF-RESPONSE MARK SCHEME	AO	MARKS										
6	Mark using the levels descriptors below. AO1 (knowledge of the techniques), AO2 (application to running applications), AO3 (reasoned explanation of why it is necessary). <table><tr><th>LEVEL</th><th>DESCRIPTOR</th></tr><tr><td>Level 3 (7–9)</td><td>Thorough explanation covering allocation, paging/segmentation and virtual memory, clearly linked to running several applications, with well-reasoned justification of why management is necessary. Accurate terminology; well structured.</td></tr><tr><td>Level 2 (4–6)</td><td>Explains some techniques with some reasons why management is needed; may omit virtual memory or the justification.</td></tr><tr><td>Level 1 (1–3)</td><td>Basic points about memory management with little explanation of how or why.</td></tr><tr><td>0</td><td>Nothing creditworthy.</td></tr></table> Indicative content (credit any valid point): • The OS allocates each process its own area of memory and keeps processes separated so they cannot corrupt each other. • Paging (fixed pages + page table) and segmentation (variable logical segments) let memory be used without needing one continuous block. • Virtual memory swaps inactive pages to disk so more/larger programs can run than fit in RAM; overuse causes disk thrashing. • Why necessary: RAM is limited and shared; management enables multitasking, protects processes, and makes best use of available memory.	LEVEL	DESCRIPTOR	Level 3 (7–9)	Thorough explanation covering allocation, paging/segmentation and virtual memory, clearly linked to running several applications, with well-reasoned justification of why management is necessary. Accurate terminology; well structured.	Level 2 (4–6)	Explains some techniques with some reasons why management is needed; may omit virtual memory or the justification.	Level 1 (1–3)	Basic points about memory management with little explanation of how or why.	0	Nothing creditworthy.	AO1 ×3 AO2 ×3 AO3 ×3	9
LEVEL	DESCRIPTOR												
Level 3 (7–9)	Thorough explanation covering allocation, paging/segmentation and virtual memory, clearly linked to running several applications, with well-reasoned justification of why management is necessary. Accurate terminology; well structured.												
Level 2 (4–6)	Explains some techniques with some reasons why management is needed; may omit virtual memory or the justification.												
Level 1 (1–3)	Basic points about memory management with little explanation of how or why.												
0	Nothing creditworthy.												

Total for paper: 34 marks