1.2 SOFTWARE & SOFTWARE DEVELOPMENT · 1.2.1

Types of OS, BIOS, drivers & virtual machines — Mark scheme

34 marks · spec 1.2.1(e)(f)(g)(h)

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)	An OS built into a device for a single/dedicated purpose (1); with limited resources, usually held in ROM (1). (2)	AO1	2
1(b)	1 mark per example, max 2: washing machine / microwave / camera / car engine management / smart thermostat, etc. (2)	AO1	2

Q	ANSWER	AO	MARKS
2	1 mark for each type named + 1 for its purpose, max 6 (three types). E.g.: • Distributed (1) — shares processing/storage across networked computers (1) • Multi-tasking (1) — lets one user run several programs at once (1) • Multi-user (1) — lets many users share one computer at the same time (1) Real-time is also acceptable (guaranteed response time).	AO1	6

Q	ANSWER	AO	MARKS
3(a)	Real-time operating system. (1)	AO1	1
3(b)	It must respond within a guaranteed time limit (1); a late response could cause a crash / be unsafe (1). (2)	AO2	2
3(c)	Many users can use/access one (powerful) computer (1) at the same time, with the OS sharing processor time between them (1). (2)	AO1	2

Q	ANSWER	AO	MARKS
4(a)	Basic Input Output System. (1)	AO1	1
4(b)	1 mark per point, max 3: • runs a power-on self-test (POST) (1) • initialises and tests the hardware (e.g. RAM) (1) • loads the bootloader, which copies the OS into RAM (1)	AO1	3
4(c)	The hardware is not initialised (1); the OS cannot be loaded, so the computer will not start (1). (2)	AO2	2

Q	ANSWER	AO	MARKS
5(a)	Lets the OS communicate with / control a specific hardware device. (1)	AO1	1
5(b)	Any one: printer / graphics card / scanner / webcam / mouse, etc. (1)	AO1	1
5(c)	1 mark per point, max 3, e.g.: • can test software on a different OS/configuration without separate hardware (1) • if the software crashes the VM, the host machine is unaffected (sandboxing) (1) • can run the same intermediate code on any machine with the VM (1)	AO2	3

Q	LEVELS-OF-RESPONSE MARK SCHEME	AO	MARKS
6	Mark using the levels descriptors below. AO1 (knowledge of OS types), AO2 (application to the controller), AO3 (justified recommendation). **LEVEL** / **DESCRIPTOR** **Level 3 (7–8)**: Considers the relevant OS types accurately, clearly **applied** to the controller's constraints (single purpose, low power, must act on time), leading to a clear **justified** recommendation. Well structured. **Level 2 (4–6)**: Discusses one or more OS types with **some** application to the device; a recommendation is made with partial justification. **Level 1 (1–3)**: Basic points about OS types with little application or justification. **0**: Nothing creditworthy. **Indicative content** (credit any valid point): • Embedded: the device has a single dedicated purpose and limited resources, so an embedded OS (likely in ROM) is appropriate. • Real-time: it must switch the heating reliably and on schedule, so real-time behaviour (guaranteed response) matters; many embedded controllers use a real-time embedded OS. • Multi-tasking / multi-user are not needed and would waste resources. • Justified conclusion: an embedded (real-time) operating system is most suitable for a low-power, single-purpose, time-sensitive controller.	AO1 ×3 AO2 ×3 AO3 ×2	8

Total for paper: 34 marks