2023 Semester Test Memorandum feedback



1. Diagram – functioning of system call [5]



Any diagram containing the following:

- A program in user space initiating the system call [1 mark]
- The matching library procedure gets the call and traps to kernel [1 mark]
 - Indicate user program vs library procedure
- The call being sent to kernel space [1 mark]
 - Handled in kernel space by some steps
- The call being returned to the calling program [1 mark]

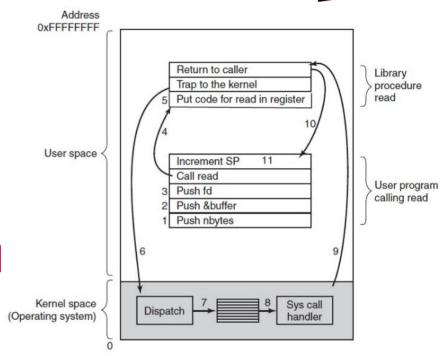
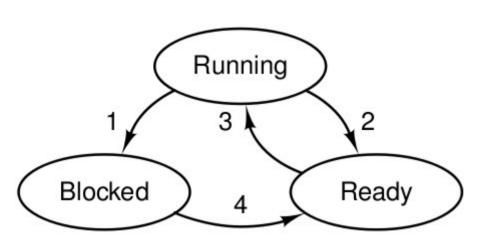


Figure 1-17. The 11 steps in making the system call read(fd, buffer, nbytes).

- From last step in kernel space to user program via library procedure
- Correct order of steps [1 mark]

2.1 Annotated diagram to show process states and process state transitions [6]





- 6 marks for
 - 3 correct states
 - 4 correct arrows (numbered)
 - 4 matching descriptions
- Minus 1 for every mistake

- 1. the running process blocks for input
- 2. process pre-empted by the scheduler
- 3. scheduler picks this process
- 4. input is now available in memory

2.2 **Discussion of transitions**: [2 marks per correct description of transition for this scenario]



- Descriptions may include how, what, why, etc., but <u>must be</u> <u>question specific</u>, e.g.:
 - The system of the process of the system of the process needs to wait for some event which is handled externally, e.g. To read data from a video file, the process is blocked while the I/O operation is in progress and under control of the OS. When the video is in RAM the process will be woken up to play it.
 - **2.** ...
 - **3.** ...

For questions 2.1, and 2.2, consider the following scenario:

A software suite that is used to edit multimedia files, such as video and audio, is run on a local machine.

2.3 **Disable interrupts?**

- It should NOT be considered when dealing with race conditions in operating systems [1 mark].
- Any valid explanation as reason [1 mark].

3.1 Briefly explain how the Clock page replacement algorithm works. [3]



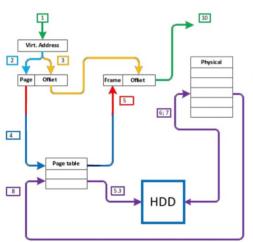
- Each page has an r-bit value (reference bit) that indicates if it has a second chance or not [1 mark].
- A pointer is used to indicate a **potential** victim page. The **pointer moves around in a circular linked-list** (in a clock-like manner) from frame to frame [1 mark].
- If a frame is the potential victim and it does **not have the r-bit, then it becomes the victim**, otherwise it just loses the r-bit and the pointer moves to the next frame [1 mark].

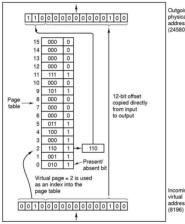
3.2 Diagram - functioning of paging systems for virtual memory. (special attention: reading from memory) [8]

Diagrams with descriptions

based on ...

or ...





- Virtual addresses split into page number and offset [1 mark]
- Lookup page number in page table [1 mark]
- Page number not found: page fault [1 mark]
- Handle page fault: Check for available page frame in physical memory [1 mark]
 - Page frame available: load page into frame [1 mark]
 - Page frame unavailable: use PRA to replace a page in chosen frame [1 mark]
 - Update page table [1 mark]
- Add offset to new page number and return physical address [1 mark]
- Use physical address to read from memory [1 mark]

4.1 Diagram to illustrate a typical layout for a file system on a hard disk. [4]



Diagram showing layout of file system [4 marks; -1 mark per obvious mistake]:

- MBR
- Partition table
- Partition
- Boot block
- Super block
- Free space management
- I-Nodes
- Root directory
- Files and directories

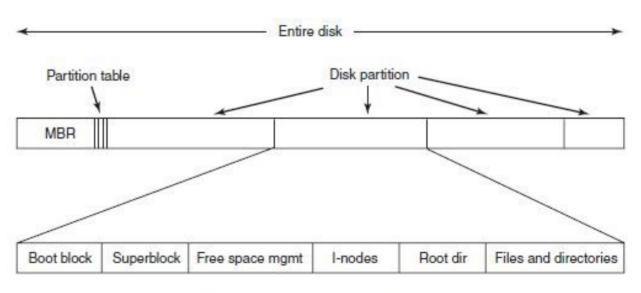


Figure 4-9. A possible file-system layout.

What would happen if any 4 of the 6 blocks become corrupted [1 x 4 = 4 marks]:



Boot Block	If there is an operating system in the partition that this boot block belongs to, then that OS will not boot. All the data in the partition is fine and if this is only a data partition the corruption will not have any effect.
Superblock	The OS will not be able to find the rest of the structures of the file system, such as the inodes and directories. All data will be inaccessible, but some of it can be recovered with tools that can rebuild the file system.
Free space mgt	The OS may not be able to allocate space for new files, or may use space already allocated to files which means that data corruption will happen. This partition should not be used until the free space management structures are repaired.
i-nodes	I-nodes contain data about files – in particular which disk blocks are located to which files. If there is corruption here it will firstly affect the files belonging to the corrupted i-nodes, but if the bad i-nodes are continued to be used it will cause further corruption in the data of other files.
Root dir	The OS will not be able to find the list of files and subdirectories and thus not have access to the rest of tha data on disk. However, the data itself is not corrupted and may be recovered by tools scanning the disk files by i-nodes and reconstructing some directory structure to give access to the files.
Files and dirs	The individual files and directories that are corrupted will be damaged and depending on the extent of the corruption may be totally unusable. However, the damage is limited to those files only and will not affect other files.

5.1 Complete the CPU scheduling table [5] 5.2 Calculate the CPU scheduling metrics [5]



	QUESTION 5: CPU SCHEDULING [10]																								
		Algori	Priority Queue FCFS with pre-emption																						
	Priority					Highest value = highest priority																			
	•																								
5,1	Process ID	Priority	Arrival	Burst Time	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
	Α	5	4	4				r*	*	*	*														[1]
	В	4	10	2										r*	*										[1]
	C	3	1	3	r *	*	*																		[1]
	D	2	3	7			r					*	*							*	*	*	*	*	[1]
	E	2	5	4					r							*	*	*	*						[1]
5,2	Responsiveness per process:						ces	s A		1 [1															
		Process B						1												[1]					
		Process C						1												[1]					
		Process D					0,39 [1]														- 1				
		Process E						0,36												[1]					
													-									•	<u> </u>		