



UNIVERSITY OF GHANA

FACULTY OF ENGINEERING SCIENCES

FIRST SEMESTER UNIVERSITY EXAMINATIONS (2007/2008)

LEVEL 300: BACHELOR OF SCIENCE IN ENGINEERING

(COMPUTER ENGINEERING)

CENG 313: OPERATING SYSTEMS (3 credits)

EXAMINATION DURATION: THREE HOURS

Answer ALL Questions in SECTION A and four (4) Questions in SECTION B

SECTION A (40 Marks)

Answer ALL Questions in this section.

A1. System calls use software interrupts rather than normal function calls because _____

- (a) system calls need to run in kernel mode
- (b) system calls need to run in user mode
- (c) system calls do not perform quite well with normal function calls
- (d) normal function calls require more arguments in order to be called

A2. A program runs in a _____ when it executes protected instructions.

- (a) privileged mode
- (b) user mode
- (c) private mode
- (d) executable mode.

A3. Most of the tasks in a computer are _____

- (a) I/O bound tasks
- (b) CPU bound tasks
- (c) Memory bound tasks
- (d) File bound task.

- A4. Starvation is a condition that occurs when a process _____.
(a) waits for the kernel to release delayed resource
(b) waits for resource that may never happen
(c) waits for the user mode to allocate resource
(d) waits for resource to be allocated in time
- A5. The first and last things that are executed during an interrupt service are _____.
(a) open and save
(b) open and close
(c) save and restore
(d) open and restore
- A6. The wastage of storage outside the allocated partition is referred to as _____.
(a) external fragmentation
(b) internal fragmentation
(c) compaction
(d) external segmentation
- A7. Both kernel and user mode operations are required to ensure that applications _____.
(a) can adequately take control of the operating system for quick response
(b) can easily bypass the operating system for quick action
(c) cannot have good interaction between the two modes
(d) cannot take control of the operating system
- A8. Time sharing was not widespread on the early batch systems because they _____.
(a) lack the required memory to operate such programs
(b) lack the required type of OS to run systems
(c) lack the required speed to support the programs
(d) lack the required hardware to protect the OS from malicious programs

A9. Kernel programmers need to be careful in the implementation of system calls because _____.

- (a) poor implementation can result in system crash
- (b) poor implementation can result in more use of memory
- (c) poor implementation can result in more use of process time
- (d) poor implementation can result in limited process time

A10. Kernel programmers avoid the use of large arrays of local variables because _____.

- (a) the kernel stack can release delayed resource which may turn to crash the machine
- (b) the kernel stack resource cannot be made available to the user mode which leads to crashing of the machine
- (c) the kernel stack has to wait longer for the user mode to allocate resource and that crashes the machine
- (d) the kernel stack is a limited resource and a stack overflow crashes the machine

A11. The part of the computing system that manages _____ is known as the operating system.

- (a) the critical software parts of the system
- (b) the critical hardware parts of the system
- (c) critical parts of the hardware and software
- (d) the software and hardware of the system

A12. The space in main memory that is occupied by the operating system _____ for use by other processes upon request

- (a) can be made available
- (b) can be requested
- (c) cannot be requested
- (d) cannot be made available

A13. Why do system calls use software interrupts rather than hardware interrupts?

- (a) because software interrupts need to run in user mode
- (b) because software interrupts allow switching from user to kernel mode
- (c) because in kernel mode the system cannot have access
- (d) because the interrupt vector need the software interrupts

- A14. Modern CPUs have both kernel mode and user mode because of _____
- (a) security
 - (b) reliability
 - (c) the different processes required
 - (d) security and reliability
- A15. Most of the CPU time is spent in the _____
- (a) kernel mode
 - (b) user mode
 - (c) memory
 - (d) none of the above
- A16. A small quantum time can cause a program to take more time
- (a) true
 - (b) false
- A17. The arguments of a systems call are usually checked in user space.
- (a) true
 - (b) false
- A18. A program that runs with preemptive scheduling algorithm usually runs faster than one that is run using non-preemptive scheduling
- (a) true
 - (b) false
- A19. Paging is very necessary because it is a solution to the problem of _____
- (a) internal fragmentation
 - (b) external fragmentation
 - (c) segmentation
 - (d) compaction
- A20. Trashing is caused by _____
- (a) over allocation of the number of pages required by a process
 - (b) partial allocation of number of pages required by a process
 - (c) difficulty associated with required number of pages by a process
 - (d) under allocation of minimum number of pages required by a process

- A21. A hard real-time operating system is _____
- (a) a system that obeys rigid time requirement in operation
 - (b) a system that deal with critical tasks that should be completed on time
 - (c) a system deals with critical tasks that get the highest priority till completion
 - (d) none of the above
- A22. A system is said to be in a safe state if _____
- (a) there exist a safe sequence of all processes
 - (b) there exist a safe number of processes being scheduled
 - (c) there exist a safe number of processes in a queue
 - (d) there exist safe scheduling of all the number of processes
- A23. Deadlock can be avoided by ensuring that the system does not _____
- (a) lack resources from memory
 - (b) enter into unsafe state
 - (c) get the resources required at any time
 - (d) wait in the queue beyond the time minimum required
- A24. A thread is _____
- (a) a code that is executed within a process
 - (b) a collection of codes executed within a process
 - (c) a program in execution
 - (d) a code that is serially executed within a process
- A25. A program that uses the round-robin scheduling has a faster average response time than a program that uses SJF
- (a) true
 - (b) false
- A26. Most of the processes CPU bursts do not finish before a context switch.
- (a) true
 - (b) false
- A27. Cache memory is _____ memory and is _____ to the operating system
- (a) virtual; visible
 - (b) main; invisible

- (c) portion of; visible
 (d) portion of; invisible

A28. Windows 2000 _____ of multi-tasking in single user environment and _____ threads and SMP.

- (a) provides partial complement; does not support
(b) provides full complement; support
(c) cannot provide full complement; support
(d) provides partial compliment; support

A29. What resources are used when a thread is created _____? *fill appropriate*

- (a) virtual; visible
(b) main; invisible
(c) portion of; visible
(d) portion of; invisible

Ans.

A30. Turnaround time is the amount of time required _____.

- (a) to execute processes in a queue
(b) to put a process in a ready state
 (c) to execute a number of processes
 (d) to execute a particular process

A31. Which of the following instructions should only be allowed in a kernel mode?

- I. disable all interrupt ✓
II. read the time of day clock ✓
III. set time of day clock
IV. change the memory map ✓

- (a) I, II, III
(b) I, II, IV
(c) I, III, IV
(d) II, III, IV

A32. When a process calls a fork, the number of open file objects in the kernel is duplicated

- (a) true

(b) false

- A33. Programs that run with FCFS scheduling algorithms have a higher response time than programs that run with SJF scheduling algorithms.
- (a) true
 - (b) false

- A34. In preemptive scheduling a process takes higher priority until completion
- (a) true
 - (b) false

- A35. Threads in the same process share the same memory.
- (a) true
 - (b) false

- A36. The process table contains a set of registers and program counters for each user and kernel level thread in a process.
- (a) true
 - (b) false

- A37. The *write()* function is a system call but the *printf()* function is not.
- (a) true
 - (b) false

- A38. Translation lookaside buffer is _____ used to speed up virtual addresses to physical addresses.
- (a) a cumulative cache of page entries
 - (b) a cache of page entries
 - (c) a cache of memory entries
 - (d) an associative cache of page entries

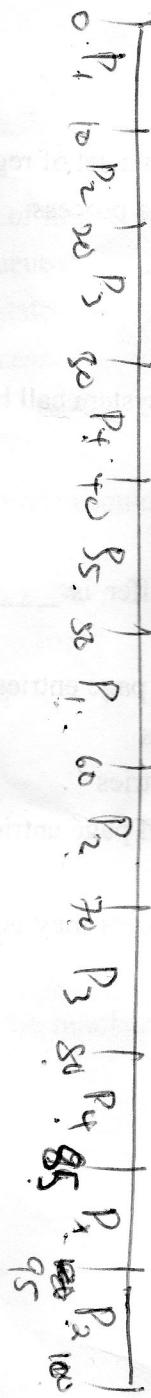
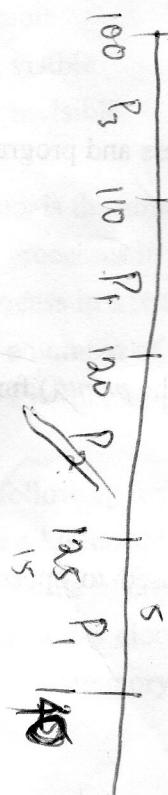
- A39. A parent and a child process may communicate using a pipe which is created by the child process.
- (a) true
 - (b) false

A39. The process scheduler is a ____.

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(a) middle-level scheduler
(b) high-level scheduler
 (c) low-level scheduler
(d) none of the above

A40. The job scheduler is a ____.

- (a) middle-level scheduler
 (b) high-level scheduler
(c) low-level scheduler
(d) none of the above



SECTION B (60 Marks)

Answer any Four (4) Questions from this Section.

- B1.** (a) List the layers (from top-to-bottom) in the design hierarchy of the operating system. You may illustrate your answer with a diagram.

- (b) Enumerate the fields of a process table and briefly explain the function of each field.

- (c) What are the steps involved in a context switch.

- (d) What resources are used when a thread is created? How do they differ from those when a process is created?
- Registers, Thread context, Stack*

- B2.** (a) List the elements that can be found in a processor and describe briefly their functions. You may use a diagram to illustrate your answer.

- (b) Describe briefly the four memory allocation schemes that are used to allocate contiguous memory.

- (c) The table below shows four jobs and their memory requirements. Use the best-fit and first-fit algorithms to allocate the memory blocks to the four arriving Jobs. Comment on the differences between the best-fit and the first-fit.

Job Stream	Memory Requirement	Memory blocks
Job 1	100K	Block 1
Job 2	200K	Block 2
Job 3	350K	Block 3
Job 4	150K	Block 4

- B3.** (a) What is the difference between multi-tasking and multi-threading?

- (b) State clearly the difference between preemptive scheduling algorithm and the non-preemptive scheduling? Give two advantages and disadvantages of the preemptive scheduling over the non-preemptive scheduling algorithm.

- (c) Enumerate four scheduling criteria that are used in scheduling processes.

- (d) A computer system has 150 ns access time to the main memory and 220 ns access time to the TLB. Assuming a hit ratio is 0.88 (88%), calculate:

- (i) the total access time when a page is found in the TLB

- (ii) the access time if a page is not found in the TLB

1. Save reg & PC
2. Save main wif info
3. Save selected structure info
4. Load new process' resource info
5. Load " a
6. Open my new proc wif info
7. Open my new proc wif info

Cpid 1 = 1st
Cpid 2 = sec
Cpid 3 = grandchild

(iii) the effective access time.

B4.

(a) Explain the following terms and indicate the reason why each is used:

- (i) swapping
- (ii) segmentation
- (iii) compaction

(b) As a systems designer, what factors will you consider as important when choosing the length of a quantum time?

✓(c) Describe the characteristics of the four CPU scheduling algorithms.

(d) Write a short code in C/C++ for a parent process that forks two child processes and the second child also forking a single child process. Each process should print its name to *stdout* (first child, second child, grandchild and parent).

B5.

(a) The table below provides information on five Jobs (P1, P2, P3, P4, and P5) which have been passed into the ready queue for execution.

Processes	Execution time (ms)
P1	55
P2	25
P3	30
P4	15
P5	10

- (i) Draw the resulting time line diagram if the operating system uses the FCFS, SJN (non-preemptive), and Round Robin scheduling algorithms. Calculate the average service time, average waiting time, response time, average turn around time, and throughput for each scheduling algorithm. (Assume preemptive scheduling for the Round Robin scheduling with a quantum time of 10ms).
- (ii) Determine which of the algorithms gives the best results.

B6.

(a) What is the difference between *buffering* and *blocking*?

(b) Explain the concept of programmed I/O and interrupt I/O in the context of receiving an input signal from a port. Which of the two techniques will lead to a better use of CPU? Give a sample situation where the less efficient technique could become very useful.

SJN - faster completion of input

RR - indefinite postponement of some jobs

RR - faster completion of short jobs

RR - fair utilization of CPU
defines good quantum time



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