



KENYATTA UNIVERSITY

**EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE (COMPUTER
SCIENCE)**

SCO 217/SCO 107: OPERATING SYSTEMS

2ND SEMESTER 2023/2024

TIME: 2Hours

INSTRUCTION:

Question One

- a) Describe the action taken by a kernel to switch context. [4 marks]
 - i) Among threads
 - ii) Among processes
- b) Explain the ABSTRACTION and RESOLURCE MANAGEMENT roles of an Operating System. [4 marks]
- c) Demonstrate how an ICT admin can use DISTRECTIONARY ACCESS CONTROL in enhancing access to software. Show how the Access Path is created. [4 marks]
- d) In computer Operating systems, using a clear illustration, distinguish between internal and external fragmentation in Memory Management. [5 marks]
- e) What is the relationship between device drivers and operating systems, are they one? [4 marks]
- f) Discuss how the following are used to ensure security of computer resources. Access Control Matrix, Access Control List, Capability. [3 marks]
- g) A computer system has a 36-bit virtual address space with a page size of 8K, and 4 bytes per page table entry.
 - i) How many pages are in the virtual address space? [2 marks]
 - ii) What is the maximum size of addressable physical memory in this system? [4 marks]

Question Two

- a) Suppose that we have free segments with sizes 6, 17, 25, 14, and 19. Place a program with size 13kB in the free segment using first-fit, best-fit and worst-fit? [4 marks]
- b) What factors could influence the size of the physical address space in a modern computer system (consider various parts of the hardware). [3 marks]

- c) Why are the page size, the number of pages in the virtual address space, and the number of page frames in the physical address space all a power of 2 in binary machine?

[7 marks]

- d) A paging system has the following parameters 2^{32} bytes of physical memory: page size of 2^{10} bytes; 2^{16} pages of logical address space:

- How many bits are in a logical address [2 marks]
- How many bytes are in a frame? [2 marks]
- How many bits are in the physical address specifying the frame? [2 marks]

Question Three

- Explain the four conditions required for deadlock to occur. [9 marks]
- Consider the following set of processes, with the length of the CPU-burst time given in milli seconds

Process	Burst Time	Priority
P1	10	3
P2	1	1
P3	2	3
P4	1	4
P5	5	2

The process are assumed to have arrived in the order P1, P2, P3, P4, P5 all at time 0.

- Draw four Gantt charts illustrating the execution of these processes using FCFS, SJF and RR (quantum=1) scheduling. [6 marks]
- Compute the turnaround time for SJF scheduling algorithms? [2 marks]
- What is the waiting time of each process for SJF scheduling algorithms? [3 marks]

Question Four

- What are some of the benefits of mono-programming in operating system? List any four. [4 marks]
- Consider a (very old) disk with the following characteristics:

INVOLVEMENT IN ANY EXAMINATION IRREGULARITY SHALL LEAD TO DISCONTINUATION

- Block size B=512 bytes
- Gap size C=128 bytes
- 20 sectors per track
- 400 tracks per surface
- 15 double-sided platters

Use this information to answer the question that follows:

- What is the total capacity of a track. [3 marks]
 - What is its useful capacity of a track (excluding interblock gaps). [3 marks]
- c) Consider the page references 7, 0, 1, 2, 0, 3, 0, 4, 2, 3, 0, 3, 2, 3, with 4 page frame. Using Optimal page replacement and Least Recently used, find number of page fault. [10 marks]

Question Five

- A certain computer provided its users with a virtual-memory space of 232 bytes. The computer has 218 bytes of physical memory. The virtual memory is implemented by paging and the page size is 4096 bytes. A user process generates the virtual address 11123456. Explain how the system establishes the corresponding physical location. Distinguish between software and hardware operations. [7 marks]
- List any four parameters to look at in computing the disk capacity. [6 marks]
- The capacity or size of a hard refers to how many bytes of data the drives can store. Capacity is determined by drive geometry. Other details of disk geometry include: Seek time, rotational latency access time among other. Assume the following details about a hard disk are provided:
181.6 GB, 3.5 inch disk: 12 platters, 24 surfaces: 24.247 cylinders: 7,200 RPM: (4.2ms avg. latency; 7.4/8.2 ms avg. seek (r/w); 64 to 35 MB/s (internal); 0.1 ms controller time; 10.3 watts (idle)

Required:

Calculate time to read 64 KB (128 sectors) for hard disk using advertised performance noting that sector is on outer track. [7 marks]