



**KENYATTA UNIVERSITY**

**EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE IN COMPUTER  
SCIENCE AND BACHELOR OF SCIENCE IN MATHEMATICS AND  
COMPUTER SCIENCE**

**SCO 231: OPERATING SYSTEMS**

**2<sup>ND</sup> SEMESTER 2023/2024**

**TIME: 2 HOURS**

**INSTRUCTIONS: Answer ALL the FOUR Questions.**

**QUESTION ONE**

- 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) Discuss how the following are used to ensure security of computer resources. Access Control Matrix, Access Control List, Capability. (6 marks)
- c) Describe the actions taken by a kernel to switch context. (4 marks)
  - i) Among threads
  - ii) Among processes.
- d) The computer Operating Systems is viewed as a virtual machine. Explain. (2 marks)
- e) What do you understand by Boot loader. (4 marks)
- f) In the evolution of computer operating systems, terms such as Multiprogramming and job Control Language (JCL) are mentioned. Discuss some five activities involved in multiprogramming. (5 marks)
- g) Assuming a 15-bit address space with 8 logical pages. How large are the pages? (5 marks)

**QUESTION TWO**

- a) What are the differences between the following? (10 marks)
  - i) Logical and physical address?
  - ii) Page table and segment table?
  - iii) First-fit placement and best-fit placement?
  - iv) Contiguous and non-contiguous storage allocation
  - v) Multiple contiguous fixed partitions (MFT) and multiple contiguous variables partitions (MVT).

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**INVOLVEMENT IN ANY EXAMINATION IRREGULARITY SHALL LEAD TO DISCONTINUATION**

- b) Explain four general strategies for dealing with deadlocks. (8 marks)
- c) What factors could influence the size of the physical address space in a modern computer system (consider various parts of the hardware). (2 marks)

### QUESTION THREE

- a) Discuss the process life cycle phases. In the discussion, explain clearly how multiprocessing takes place. Illustrate with a diagram to show how the processes interact. (9 marks)
- b) Consider the following set of processes, with the length of the CPU-burst time given in milliseconds:

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

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

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

### QUESTION FOUR

- a) What are some of the benefits of mono-programming in operating system? List ANY FOUR. (5 marks)
- b) Consider a disk pack with the following specifications – 16 surfaces, 128 tracks per surface, 256 sectors per track and 512 bytes per sector. Calculate capacity of disk. (5 marks)
- c) Consider two possible page-replacement strategies: LRU (the least recently used page is replaced) and FIFO (the page that has been in the memory longest is replaced). Assume we have FOUR page frames. Which (if either) replacement strategy will work best when the machine accesses pages in the following (stack) order: (3,4,5,6,7,6,5,4,3,4,5,6,7,6). Show your working. (10 marks)

### QUESTION FIVE

- a) A certain computer provides 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. Do not calculate. (7 marks)

b) List any four parameters to look at in computing the disk capacity. (6 marks)

c) The capacity or size of a hard drive refers to how many bytes of data the drive can store.

Capacity is determined by drive geometry. Other details of disk geometry include: Seek time, rotational latency access time among others. Assume the following details about a hard disk are provided:

- 181.6, 3.5 inch disk; 12 platters, 24 surfaces; 24,247 cylinders; 7,200 RPM; (4.2 ms avg. latency); 7.4/8.2ms 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)