

2920/105
OPERATING SYSTEMS
July 2017
Time: 3 hours



THE KENYA NATIONAL EXAMINATIONS COUNCIL
DIPLOMA IN INFORMATION COMMUNICATION TECHNOLOGY

MODULE I

OPERATING SYSTEMS

3 hours

INSTRUCTIONS TO CANDIDATES

*This paper consists of EIGHT questions.
Answer any FIVE of the EIGHT questions in the answer booklet provided.
Candidates should answer the questions in English.*

This paper consists of 5 printed pages.

Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.

1. (a) Explain each of the following file allocation methods:
- (i) contiguous; (2 marks)
 - (ii) linked. (2 marks)
- (b) Outline **two** approaches that could be used to improve computer file performance. (2 marks)
- (c) Four jobs were scheduled as follows: 7 minutes, 3 minutes, 5 minutes and 2 minutes. Compare the turnaround times using each of the following scheduling algorithms:
- (i) Shortest Job First (SJF); (3 marks)
 - (ii) First Come First Served (FCFS). (3 marks)
- (d) (i) Outline **four** computer files attributes. (4 marks)
- (ii) With the aid of a diagram in each case, describe **two** types of directory structures. (4 marks)
2. (a) (i) State **two** modes of operations of programmable clocks as used in operating systems. (1 mark)
- (ii) Explain **two** duties of an I/O control system. (4 marks)
- (b) A disk has 40 cylinders. An initial request comes in to read a block on cylinder 6. New requests come in for cylinder 1, 31, 11, 29, 4 and 7 in that order.
- (i) Calculate the arm motions required using each of the following disk scheduling algorithms:
 - I. Shortest Seek First (SSF); (1 mark)
 - II. First Come First Served (FCFS); (1 mark)
 - III. SCAN. (1 mark)
 - (ii) Represent graphically each of the disk scheduling algorithms in (i). (6 marks)
- (c) A certain organization opted for a client-server model for its operating systems. Explain **two** advantages that could have influenced the choice. (4 marks)
- (d) An IT professional designed an operating system consisting of several modules. Each module was designed on one below it.
- (i) State the name given to the resultant structure after design. (1 mark)
 - (ii) Outline **one** advantage of this structure. (1 mark)
3. (a) (i) Describe the terms *relocating loader* as used in memory management. (2 marks)
- (ii) With the aid of a diagram in each case explain the effect of *double buffering* as compared to *single buffering* data transfer. (6 marks)
- (b) Mary's printer has a device that intercepts data sent to it, stores the data in disk files and manages the printing when convenient for the system.
- (i) Name the device that Mary had installed in her printer. (1 mark)

- (ii) Outline **three** advantages she would get from the device identified in (i). (3 marks)
- (c) Explain the function of *job control language* as used in operating systems. (2 marks)
- (d) A certain organization bought a new system for its file systems. Explain **three** considerations that could be put in place with regard to their file management. (6 marks)

4. (a) (i) Define the term *virtual memory* as used in operating systems. (2 marks)
- (ii) Consider an executing process P that issues I/O request. The processes temporarily stopped. At some later point, a disk interrupt occurs and the driver detects that P's request is satisfied. At some later time, the operating system looks for a job to run and picks P. With the aid of diagrams outline these process states. (3 marks)

(b) Figure 1 shows file system architecture of a certain organization. Use it to answer the question that follows.

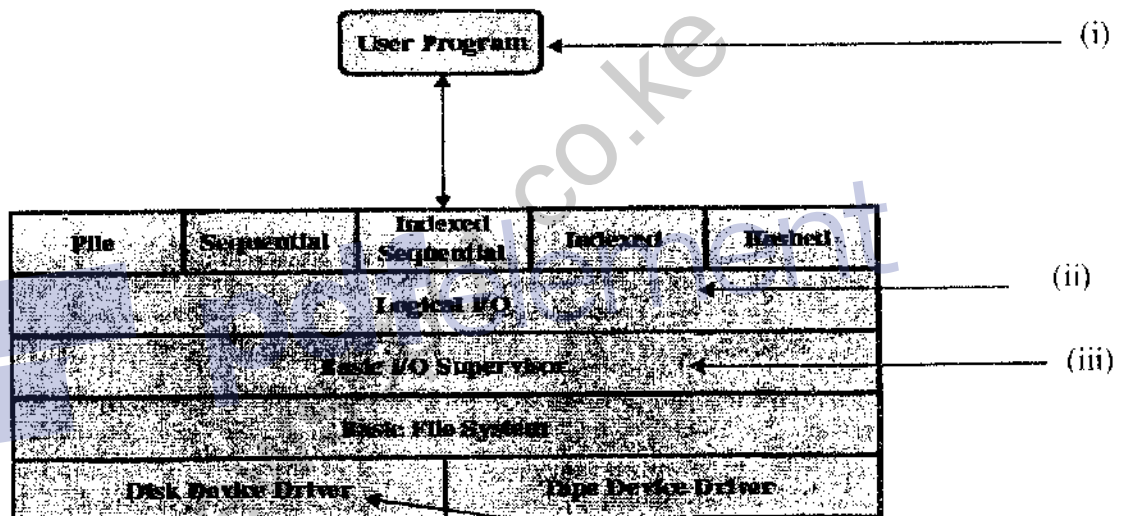


Figure 1

Outline the function of each of the parts marked (i), (ii), (iii) and (iv). (4 marks)

- (c) Differentiate between *monoprogramming* and *multiprogramming* as used in operating systems. (4 marks)
- (d) (i) Explain the term *starvation* as used in operating systems. (2 marks)
- (ii) With the aid of a diagram, describe a direct memory access operation. (5 marks)

5. (a) State **two** purposes of *device drivers* as used in a computer operating systems. (2 marks)
- (b) (i) Outline **two** operations that could be used to implement a semaphore. (2 marks)
- (ii) Describe **three** requirements for *critical section* problem as used in process management. (6 marks)

- (c) Differentiate between *first fit* and *next fit* dynamic partitioning algorithms. (4 marks)
- (d) An operating system uses detection and recovery methods to deal with possible deadlocks. Explain **three** criteria that could be used when selecting processes to abort in such an operating system. (6 marks)
6. (a) Outline **three** functions of a *memory manager* as used in computers. (3 marks)
- (b) (i) State **two** primitive system calls used in message passing. (2 marks)
- (ii) A system administrator of a certain organization is contemplating using *monitors* as inter-process communication method. Explain **two** challenges the administrator is likely to face. (4 marks)
- (c) Process **A** of capacity 15k was running in the memory, and then processes **B** of capacity 20k and **C** of capacity 35k are created. Later process **A** terminates and is swapped out of memory to disk. Then process **D** of capacity 10k is created and then process **B** is swapped out of memory to disk. Then process **E** of capacity 18k is created. The total memory capacity is 75k.
- (i) Use sketches to illustrate this memory allocation. (5 marks)
- (ii) Explain the state that the final memory would have. (2 marks)
- (d) Mary an IT expert would like to design an operating system for I/O devices. Explain **two** issues that she could put into consideration. (4 marks)
7. (a) Explain each of the following terms as used in operating systems.
- (i) compaction; (2 marks)
- (ii) overlaying. (2 marks)
- (b) (i) State **three** conditions that could cause a program running in a computer to terminate. (3 marks)
- (ii) State **one** scheduling goal that could be achieved in each of the following systems;
- I. batch systems; (1 mark)
- II. real time systems. (1 mark)
- (c) Table 1 show two concurrent processes P1 and P2 and their timed I/O requests. Use it to answer the question that follows.

| Time | P1 | P2 |
|------|------------|------------|
| 1 | Request R1 | Request R2 |
| 2 | Request R2 | Request R1 |
| 3 | Release R1 | Release R2 |

Table 1

Draw the resource allocation graph for these possible executions of the processes, indicating when deadlock occurs. (6 marks)

- (d) With the aid of a *sleeping barber classical example*, describe the inter-process communication problem as used in process management. (5 marks)
8. (a) Differentiate between *multiprocessor* and *distributed* types of operating systems. (4 marks)
- (b) Describe **two** parts of an operating system. (4 marks)
- (c) Karen was running a system using priority scheduling. She had two processes X and Y with run times of 20 minutes and 60 minutes respectively. Determine the processes to be selected:
- (i) I. If both wait for 5 minutes; (2 marks)
II. If Y waits for 35 minutes; (2 marks)
III. If X start at time 0. (1 mark)
- (ii) Outline the way this technique avoids *starvation*. (1 mark)
- (d) (i) State **four** types of access rights that could be granted in a file sharing computer. (2 marks)
- (ii) With the aid of an illustration, differentiate the *sequential* and *indexed sequential* file organization methods. (4 marks)

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