2920/105
OPERATING SYSTEMS
November 2021
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 4 printed pages.

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

Turn over

1. (a) (i) Explain the role played by operating systems in the following services:

   (I) program development; (2 marks)

   (II) system access. (2 marks)

   (ii) Outline **two** typical characteristics of microkernel architecture operating systems. (2 marks)

   (b) The operating system controls the execution of processes depending on various existing conditions in the system. Explain **four** reasons that could necessitate termination of a running process. (8 marks)

   (c) Figure 1 shows cross-sectional organization of a disk system. Use it to answer the question that follows.
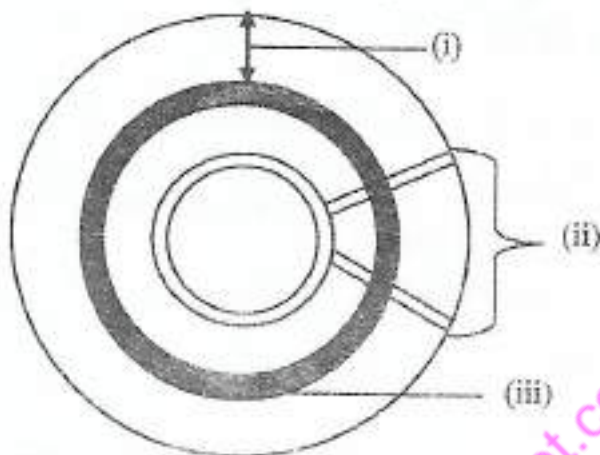

Figure 1

Explain the function of the parts labeled (i), (ii) and (iii). (6 marks)

2. (a) Outline **two** typical attributes associated with computer files. (2 marks)

   (b) Differentiate between *memory paging* and *memory segmentation*. (4 marks)

   (c) Gijo Consultants have advised Youl Technical Institute to consider installing a multiprocessor system for its server room.

   (i) Describe the system. (2 marks)

   (ii) Explain **two** advantages of the system that could have influenced the advice. (4 marks)

   (d) Table 1 shows execution information of four processes in a system using SRTN scheduling algorithm. Use it to answer the questions that follow.

Process	Arrival time	Service
W	0	1
X	1	10
Y	2	3
Z	3	7

Table 1

Evaluate:

(i)   the average waiting time for the processes;   (3 marks)

(ii)   the average turn-around time for the system.   (5 marks)

3.   (a)   Explain the following terms as used in operating systems:

          (i)   multithreading;   (2 marks)

          (ii)   process.   (2 marks)

    (b)   Outline **four** typical functions of the operating system kernel during process management.   (4 marks)

    (c)   Differentiate between *block-oriented* and *stream-oriented* I/O devices.   (4 marks)

    (d)   Memory management is a key function that should be carefully addressed when designing an operating system. Explain **four** requirements that the memory management design of an operating system should endeavor to satisfy.   (8 marks)

4.   (a)   (i)   Outline **four** criteria that should be considered when selecting a file organization method.   (4 marks)

          (ii)   Describe **three** types of operations commonly performed on file directories.   (6 marks)

    (b)   Distinguish between *demand cleaning* and *precleaning* as used in virtual memory management.   (4 marks)

    (c)   Fred is designing an input device for his mini laptop that would use the DMA I/O technique. Describe the process of reading a block of data from the device.   (6 marks)

5.   (a)   (i)   Outline **two** RAID configurations.   (2 marks)

          (ii)   Explain the following terms as used in disk systems:

               (I)   head;   (2 marks)

               (II)   density.   (2 marks)

    (b)   Deric would like to implement an index-sequential file organization system is an operating system he is designing.

          (i)   Explain **two** types of indexes he could apply in the system.   (4 marks)

          (ii)   Outline **two** application areas where the file system in most appropriate.   (2 marks)

    (c)   Figure 2 shows allocation of resources to two processes. Use it to answer the questions that follow.
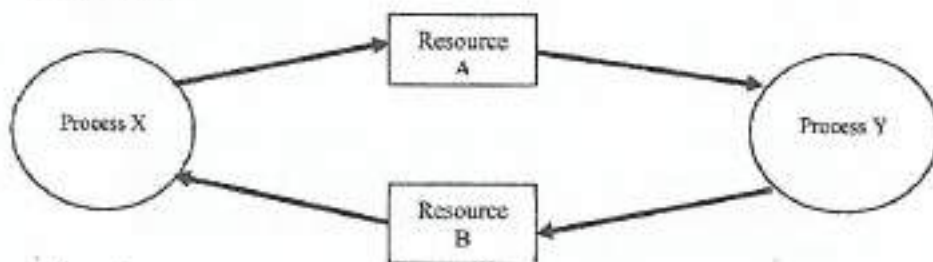

Figure 2

(i)   Identify the condition depicted in the figure justifying your answer.   (2 marks)

(ii)   Explain **three** measures that could have prevented the condition.   (6 marks)

6.   (a)   Distinguish between a *clock interrupt* and an *I/O interrupt* as used in process management.   (4 marks)

    (b)   (i)   Explain the *principle of locality* as used in memory management.   (2 marks)

              (ii)   Outline **four** typical contents of page frame data table as applied in memory management systems.   (4 marks)

    (c)   A particular hard disk has a total of 200 tracks. Six processes make requests for data from the following tracks respectively:

        60   70   50   30   98   130

    For each of the following disk scheduling algorithms, determine the *average seek length* assuming that the starting track is 100.

              (i)   FIFO;   (3 marks)

              (ii)   SSTF.   (3 marks)

    (d)   With the aid of a diagram, describe the contiguous file allocation method.   (4 marks)

7.   (a)   Explain the following terms as used in memory management:

              (i)   virtual address;   (2 marks)

              (ii)   thrashing.   (2 marks)

    (b)   (i)   Outline **three** lists that are maintained to manage the buffer cache in UNIX systems.   (3 marks)

              (ii)   With the aid of a diagram, describe a typical organization of I/O subsystem.   (7 marks)

    (c)   Free space management is important for efficient file management. Explain **three** techniques applied by operating systems to manage space on disks.   (6 marks)

8.   (a)   Differentiate between *best-fit* and *first-fit* policies as used in memory management.   (4 marks)

    (b)   (i)   Outline **two** categories of user access rights used in file management.   (2 marks)

              (ii)   The extent to which user requirements are met by a file management system depends on the application and environment. Outline **four** such requirements for an interactive and networked environment.   (4 marks)

    (c)   (i)   Prince intends to use semaphores for process control in the operating system that he is developing. Outline **four** typical elements that should constitute the semaphore module.   (4 marks)

              (ii)   A computer laboratory technician has been instructed to install a new hard disk with three logical partitions in the HOD's computer. Describe **three** activities that he/she would carry out before installing the operating system and other applications into the hard disk.   (6 marks)

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