

PAN AFRICA CHRISTIAN UNIVERSITY

DIPLOMA IN INFORMATION AND COMMUNICATION TECHNOLOGY

END OF SEMESTER EXAMINATION

DEPARTMENT: COMPUTING AND INFORMATION TECHNOLOGY

COURSE CODE: DICT0111

COURSE TITLE: INTRO TO COMPUTERS AND OPERATING SYSTEMS

CAMPUS: ROYSAMBU

EXAM DATE: FRIDAY 6TH APRIL, 2025

TIME: 2:00PM -5:00PM

INSTRUCTIONS

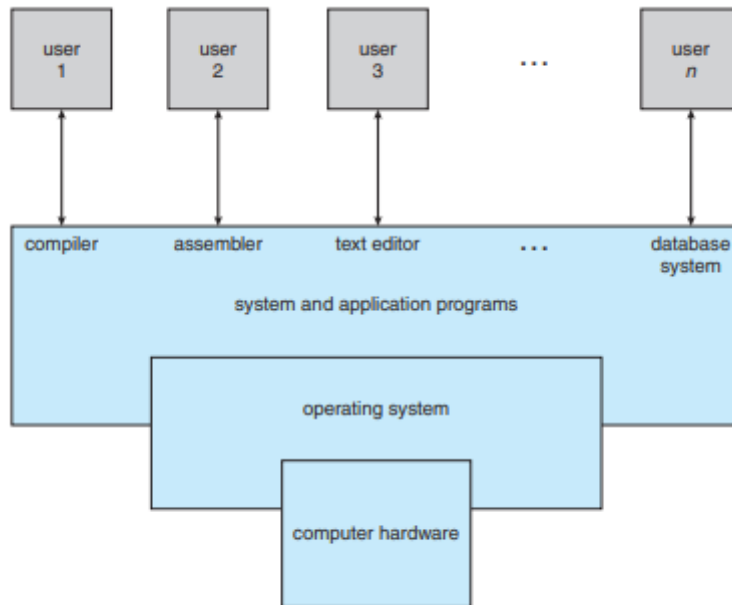
- This exam script has **TWO (2)** sections.
- Read all questions carefully before attempting.
- Answer All questions in Section **A** and any other Three questions in Section **B**.
- Write only your **student number** on the answer booklet provided.

SECTION A

(Answer ALL questions in this section)

Question 1:

The diagram below shows an abstract view of the components of a computer system.



Discuss the role of the operating system's role in the overall computer system from the following viewpoints:

- i. User view (5 marks)
- ii. System view (5 marks)

SECTION B

(Answer any THREE (3) questions in this section)

Question 2:

- a) A cybersecurity specialist is auditing the file system security of a government database. While examining file metadata stored in File Control Blocks (FCBs), he discovers that some critical metadata is missing, making it difficult to enforce security policies. List four key metadata items that should be stored in an FCB to ensure proper file management and security. **(4 marks)**
- b) A tech startup is optimizing their custom operating system for embedded devices. One of their engineers suggests that when the CPU is idle, instead of running an Idle process, the system should automatically start defragmenting the file system by rearranging files on disk into contiguous blocks. Discuss three disadvantages of this approach in a modern computing system. **(6 marks)**

Question 3:

A gaming company is developing a high-performance multiplayer game that runs multiple processes for different users. The system uses hardware-supported paging to provide virtual memory for these processes.

- i. Explain how the hardware and operating system work together to prevent one player's process from accessing another's memory. **(3 marks)**
- ii. Describe how paging introduces space and time overheads. **(4 marks)**
- iii. Explain how a Translation Lookaside Buffer (TLB) helps to reduce time overheads. **(3 marks)**

Question 4:

A financial institution is designing a secure banking system and wants to follow the Principle of Minimum Privilege to limit user access to critical resources.

- i. Define the Principle of Minimum Privilege. **(1 mark)**
- ii. Explain the importance of the principle of minimum privilege for the security of the system. **(3 marks)**
- iii. Compare Access Control Lists (ACLs) and Capabilities as methods of implementing this principle, and discuss which is better suited for enforcing

minimum privilege in the banking system.
marks)

(6

Question 5:

- a) A cloud computing provider must decide which CPU scheduling algorithm to use for its virtual machines. Three options under consideration are Shortest Job First (SJF), Shortest Remaining Time First (SRTF), and Round Robin (RR). Providing an example in each scenario, briefly describe how each scheduling algorithm works.

(6 marks)

- b) Describe how a segmentation scheme can be implemented with reasonable efficiency in a system that already supports paging.

(4

marks)

Question 6:

Jane is a software developer working on a real-time data processing application. She wants to improve the performance of her program by implementing multithreading. However, she is unsure how threads work and what benefits or challenges they may bring.

- i. Explain what threading is and how it can improve the performance of Jane's application. **(4 marks)**
- ii. Discuss three challenges Jane might face when using multithreading. **(6 marks)**

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