PAN AFRICA CHRISTIAN UNIVERSITY

CERTIFICATE IN INFORMATION AND COMMUNICATION TECHNOLOGY

END OF SEMESTER EXAMINATION

DEPARTMENT: COMPUTING AND INFORMATION TECHNOLOGY

COURSE CODE: CICT0111

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:

Alex, a systems engineer, is optimizing memory management for a client's computer system. He is undecided on whether to use paging or segmentation techniques.

i. Explain the main difference between paging and segmentation. (2 marks)
ii. Alex eventually decides to use paging technique since the system requires efficient memory allocation. Discuss two advantages and two disadvantages of using paging in the system. (8 marks)

SECTION B

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

Question 2:

a)You are working as a system administrator for PAC University computer lab that supports multiple students working on different projects simultaneously. One day, a student reports that their work has been modified without their consent, and another student claims they accidentally accessed someone else's private files. Identify two security issues that might be occurring in this multiprogramming and time-sharing system. (2 marks)

b)A mobile application developer notices that when switching between multiple open applications, the previous application resumes exactly where it was left off without losing progress. Explain how an operating system saves and restores the execution context of a process during a context switch. (4 marks)

c)A university's grading system runs on a multiuser platform where each professor should only access their own students' grades. Describe two different mechanisms the OS could use to prevent one user from accessing or modifying another user's data. (4 marks)

Question 3:

a)A web browser allows users to open multiple tabs simultaneously, each loading a different webpage. How does the use of threads improve the browser's performance in this scenario? (1 mark)

b)A cloud service provider notices that some users are hogging CPU resources, preventing other users' applications from running smoothly. Describe a mechanism the OS can implement to prevent one user process from monopolizing resources and blocking others from making progress. (3 marks)

c)Compare and contrast multiprogramming and multitasking in terms of their purpose, scheduling, and responsiveness to user interactions. (6 marks)

Question 4:

a)A bank's ATM software unexpectedly stops processing transactions. After investigation, you find that the system encountered a division by zero error while calculating transaction fees. Separately, the ATM software is designed to pause temporarily when a customer inserts a card, then resume operation. Explain the difference between an interrupt and a trap in this context, identifying which situation corresponds to which. (4 marks)

b)A hospital's patient record system runs multiple processes handling confidential data. However, a junior IT technician notices that one process seems to slow down whenever another intensive process runs alongside it. Additionally, the hospital wants to prevent unauthorized memory access between processes. Describe how the system's operating system can protect a user process from accidental or deliberate interference in terms of CPU, memory, and I/O access. (6 marks)

Question 5:

A large e-commerce company runs multiple backend services that handle order processing, payment transactions, and inventory management. One day, the system experiences a deadlock, causing some orders to remain stuck in processing indefinitely.

I. Explain the four necessary conditions for a deadlock to occur in this system, providing an example of how each condition could manifest in the company's backend services.
(5 marks)

ii.Discuss two possible strategies the company could use to prevent from deadlocks in their backend services. (5 marks)

Question 6:

A hospital management system runs multiple processes that schedule patient appointments, update medical records, and handle billing. These processes move between different states during execution. Discuss the five states of a process highlighting the conditions under which a process moves from one state to another in the hospital's system. (10 marks)

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