



PAN AFRICA CHRISTIAN UNIVERSITY

(LISTING OF PROGRAMS TAKING THIS EXAM) BACHELOR OF BUSINESS INFORMATION TECHNOLOGY

END OF TERM EXAMINATION

DEPARTMENT: COMPUTING & INFORMATION TECHNOLOGY

COURSE CODE: BIT 0105

CAMPUS: ROYSAMBU

COURSE TITLE: PRINCIPLES OPERATING SYSTEMS

EXAM DATE: FRIDAY, DDTH AUG 2019

TIME: START HOUR – END 8.00 -11:00 HRS

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.
- None programmable calculator permitted
- Calculators on phones, tablets and computers are NOT permitted in Theory Papers

SECTION A

(Answer ALL questions in this section)

Question 1:

I. Identify and explain the four components of a computer system?

(4

Marks)

- *Hardware - Provides basic computing resources (CPU, memory, I/O devices).*
- *Operating System - Controls and coordinates the use of hardware among application programs.*
- *Application Programs - Solve computing problems of users (compilers, database systems, video games, business applications)*
- *Users - People, machines, other computers*

II. Define the following terms.

i. Process

(1 Marks)

Process: a program in execution

ii. Thread

(1 Marks)

Thread: a flow of control within a process

iii. Give one similarity and one difference between a process and a thread

(2 Marks)

Similar: active entities, with many attributes, that consume system resources

Different: process is heavyweight, thread is lightweight (part of a process)

III. List and explain the **two** main types of memory fragmentation

(4

Marks)

Internal fragmentation: this is when the memory allocated to a process is larger than required, thus the remaining memory is wasted.

External fragmentation: this is the inability to use available memory since the available memory holes are smaller than the required amount.

- IV. Differentiate between preemptive scheduling and non-preemptive scheduling?
(4 Marks)

Pre-emptive scheduling is based on timer interrupts, where a running thread may be interrupted by the OS and switched to the **ready** state at will (usually if something more important comes through) or when it has exceeded its timing allocation. Non-preemptive scheduling means once a thread is in the running state, it *continues until it completes*, or at least gives up the CPU voluntarily. Threads that do this are likely to monopolize the CPU.

- V. Explain the main purpose of the operating system. (4 Marks)

One is that it is designed to make sure a computer system performs well by managing its computational activities.
Another is that it provides an environment for the development and execution of programs.
Management of resources

- VI. Discuss the four conditions required for deadlock to occur. (4 Marks)

The four conditions required for deadlock to occur are:

Mutual Exclusion – the processes must be trying to access the same resource at the same time

Circular Wait – the processes exist in a circular chain, where each is waiting for the resource held by the next member of the chain.

Hold & Wait – process holds a resource, DOESN'T GIVE IT BACK, and blocks because it's waiting for more

No Preemption – resource can't be forcibly taken from the process holding it

- VII. State any **TWO** advantages of FAT32 over FAT16 filing system (2 Marks)

- *It uses space more efficiently than FAT16*
- *FAT32 volumes are less susceptible to a single point of failure than FAT16 volumes.*
- *FAT32 does not restrict the number of entries in the root folder.*

- VIII. Describe the four generations of computing and how operating systems developed as a result.
(4 Marks)

First Generation

- 1945-1955
- No Operating System
- Based on vacuum tubes

Second Generation

- 1955-1965
- Had an operating system
- Batch jobs introduced
- Based on transistors

Third Generation

- 1965-1980 (or 1971 depending on your view)
- Multi-programming and time-sharing possible
- Spooling possible
- Based on integrated circuits

Fourth Generation

- 1980 (or 1971) to present
- Start of PC revolution so MS-DOS, UNIX etc. were developed.
- Based on (V)LSI

SECTION B

(Answer any FOUR (4) questions in this section)

Question 2:

- I. Define the terms deadlock and safe state. Show that a system that is always in a safe state can never become deadlocked. (6 Marks)

Dead lock -A set of blocked processes each holding a resource and waiting to acquire a resource held by another process in the set. When a process requests an available resource, system must decide if immediate allocation leaves the system in a safe state. System is in safe state if there exists a safe sequence of all processes. Sequence $\langle P_1, P_2, P_3, \dots, P_{n-1}, P_n \rangle$ is safe if for each P_i , the resources that P_i can request, can be satisfied by currently available resources + resources held by all the $P_j, j < i$ (P_j : Processes before P_i).

- II. Discuss any FOUR reasons for process creation. (4 Marks)

New batch job

Interactive logon

Spawned by an existing process

Created by the OS to provide a service

Question 3:

I. Discuss any FOUR objectives of the process scheduling function. (4 Marks)

- Allocate time fairly among processes
- Prevent starvation of a process
- Use the processor efficiently
- Have low overhead
- Prioritize processes when necessary (e.g. real time deadlines)

II. Context switches among processes are expensive. Before a process can be switched its process control block (PCB) must be saved by the operating system. Discuss the information contained in the PCB.
(6 Marks)

- a. The process state.*
- b. The program counter, PC.*
- c. The values of the different registers.*
- d. The CPU scheduling information for the process.*
- e. Memory management information regarding the process.*
- f. Possible accounting information for this process.*
- g. I/O status information of the process.*

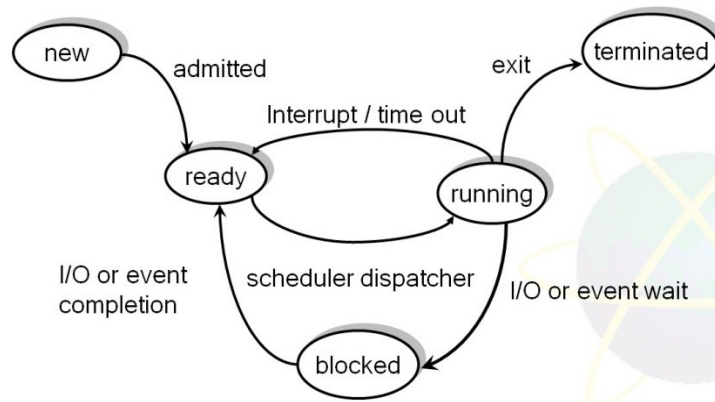
Question 4:

I. Discuss two benefits of having Virtual Machine technology in a System Administrators computer. (4 Marks)

- *Running several operating systems simultaneously on the same desktop.*
 - a. May need to run both Unix and Windows programs.*
 - b. Useful in program development for testing programs on different platforms.*
 - c. Some legacy applications may not work with the standard system libraries.*
- *Running several virtual servers on the same hardware server.*
 - a. One big server running many virtual machines is less expensive than many small servers.*

- b. *With virtual machines it is possible to hand out complete administration rights of a specific virtual machine to a customer.*

II. As a process executes, it changes state. With the aid of a diagram, describe the Five-state process model (6 Marks)



Question 5:

I. Discuss in detail any FIVE information security threats and their associated countermeasures. (10 Marks)

Viruses – prevented through use of antivirus programs

Unauthorized access – avoided through use of passwords and other authentication mechanisms

Misuse of information – use of audit trails and log files

Natural calamities - impacts avoided through backups and replication

Hardware failure – can recover data through regular scheduled backups

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