# MACHAKOS UNIVERSITY

**University Examinations for 2020/2021 Academic Year**

**SCHOOL OF ENGINEERING AND TECHNOLOGY**

**DEPARTMENT OF COMPUTING AND INFORMATION TECHNOLOGY**

**FIRST/THIRD YEAR SPECIAL/SUPPLIMENTARY EXAMINATION FOR**

**BACHELOR OF SCIENCE (COMPUTER SCIENCE)**

**BACHELOR OF SCIENCE (INFORMATION TECHNOLOGY)**

**SCO 107/ SIT 121/SIT 304: OPERATING SYSTEMS**

**DATE: 26/3/2021** **TIME: 8.30-10.30 AM**

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**INSTRUCTION: Answer Question ONE and any other TWO Question**

**QUESTION ONE (30 MARKS) (COMPULSORY)**

a) Differentiate between: (10 marks)

i. Reference bit and dirty bit

ii. Disk partition and file system volume

iii. MMU and PCB

iv. Device controller and DMA

v. Batch and timesharing systems

b) When multiple processes need to cooperate, there is a choice between shared memory and inter-process communication (IPC). Compare and contrast these two techniques. Make sure to clarify the role of the operating system in each. (6 marks)

c) Define virtual memory and discuss any three page displacement algorithms (8 marks)

d) Explain the concept of polling as used in operating systems (6 marks)

**QUESTION TWO (20 MARKS)**

a) One of the key design decision in OS memory management is the choice between paging and segmentation. Compare and contrast these two approaches to memory management, making sure to identify the strengths and weaknesses of each. (4 marks)

b) Explain two different techniques for organizing the data blocks for each file in a file system. (4 marks)

c) Use the process scheduling table below to calculate average waiting time using the algorithms below: (12 marks)

| Process | Arrival Time | Execute Time | Priority | Service Time |
|---|---|---|---|---|
| P0 | 0 | 5 | 1 | 9 |
| P1 | 1 | 3 | 2 | 6 |
| P2 | 2 | 8 | 1 | 14 |
| P3 | 3 | 6 | 3 | 0 |

i. FCFS

ii. SJN

iii. Priority Scheduling

**QUESTION THREE (20 MARKS)**

a) Define timestamp. In Unix, Linux, and Windows file systems, there are multiple timestamps

b) In a storage system with conventional magnetic-media disks, several different delays occur when servicing a request. Identify at least three of these delays, and comment on their relative contribution to the total delay for servicing a request. (6 marks)

c) Multi-programming (or multi-tasking) enables more than a single process to apparently execute simultaneously. How is this achieved on a uniprocoessor? (4 marks)

d) In view of Operating systems, discuss any three key differences between I/O devices (6 marks)

**QUESTION FOUR (20 MARKS)**

a) Recall the various deadlock detection and prevention algorithms we've discussed in this course, and consider the following snapshot of a system with five processes (P1, P2, P3, P4, P5) and four resources (R1, R2, R3, R4).There are no current outstanding queued unsatisfied requests.

**Currently Available Resources**

| R1 | R2 | R3 | R4 |
|---|---|---|---|
| 2 | 1 | 2 | 0 |

i. Is this system currently deadlocked, or can any process become deadlocked? If not deadlocked, give an execution order. (4 marks)

ii. If a request from a process P1 arrives for (0, 4, 2, 0), can the request be immediately granted? Why or why not? If yes, show an execution order. (3 marks)

iii. If a request from a process P2 arrives for (0, 1, 2, 0), can the request be immediately granted? Why or why not? If yes, show an execution order. (3 marks)

b) Explain interrupts and traps, and provide a detailed account of the procedure that an operating system handles an interrupt. (6 marks)

c) Explain operating system security. (4 marks)

**QUESTION FIVE (20 MARKS)**

a) By use of an example, describe the four memory allocation algorithms and state how each created fragmentation (10 marks)

b) Provide a detail description of all activities of a context switch**.** (4 marks)

c) A semaphore is a blocking synchronisation primitive. Describe how they work with the aid of pseudo-code. You can assume the existance of a thread_block() and a thread_wakeup() function. (6 marks)