JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY

SCHOOL OF INFORMATICS AND INNOVATIVE SYSTEMS

DEPARTMENT OF COMPUTER SCIENCE & SOFTWARE ENGINEERING
UNIVERSITY EXAMINATION FOR THE DEGREE OF MASTERS OF IT SECURITY & AUDIT
1ST YEAR 2ND SEMESTER 2024/2025 ACADEMIC YEAR

KISUMU

COURSE CODE: ICM 1101

COURSE TITLE: COMPUTER OPERATING SYSTEMS & VIRTUALIZATION

EXAM VENUE: -------- **STREAM: IT SECURITY & AUDIT**

DATE: 22/4/2025 **EXAM SESSION: 9.00-12.00**

TIME: 3HOURS

INSTRUCTIONS

1. Answer ANY THREE questions
2. Candidates are advised not to write on the question paper
3. Candidates must hand in their answer booklets to the invigilator while in the examination room

QUESTION ONE [20 marks]

a) Use a diagram to illustrate how virtual memory control program may crash in RAM **(3 marks)**

b) What is going to happen to the program performance when the data it needs is on the disk and not in memory? **(2 marks)**

c) How do we use holes left when programs quit the memory? **(2 marks)**

d) Discuss the difference between local users and domain users. **(2 marks)**

e) Coffman (1971) identified four conditions that must hold simultaneously for there to be a deadlock.

i). List and briefly explain these four conditions. **(4 marks)**

ii). Provide an example of a real-world scenario or a computer system situation where these conditions could lead to a deadlock. **(3 marks)**

iii). Discuss at least two strategies that can be used to prevent or resolve deadlocks in a system. **(2 marks)**

f) Consider the following set of processes with their arrival times, burst times, and priority levels (where a lower number indicates a higher priority):

Process	Arrival Time	Burst Time	Priority
P1	0	10	3
P2	1	1	1
P3	2	2	4
P4	3	1	5
P5	4	5	2

Assume that the scheduling is non-preemptive. Answer the following questions:

i). Draw the Gantt chart that shows the execution order of the processes using Priority Scheduling. **(1 marks)**

ii). Calculate the average waiting time for all processes. **(1 marks)**

QUESTION TWO [20 marks]

a) Hypervisors come in several different flavors. They can be categorized, for example, by type—that is, whether they run directly on the physical hardware (Type 1) or within (hosted by) an operating system environment (Type 2) .

   i) Using a diagram discuss the differences between Type 1 and Type 2 hypervisors. Give one example of each.

   ii) Briefly explain why there a difference in performance between the two? **(10 marks)**

b) A recent study involving Chief Information Officers (CIOs) revealed that over one-third of respondents considered server, storage, and cloud virtualization as key factors influencing their spending decisions. Additionally, nearly one-quarter of respondents identified desktop virtualization as a similar driver. The study also highlighted that virtualization would have a greater impact on spending decisions compared to other factors like labor optimization, wireless computing, Green computing, or security concerns. Based on this, briefly discuss five common applications of virtualization in use today **(10 marks)**

QUSETION THREE [20 marks]

a) In one of your lab activities you installed Windows 2012 server, added various server roles and implemented some security policies. This activity was done in a virtualized environment using VMware. VMware Workstation runs on x86/x64, provides VMM for guests.

   i) Briefly discuss this type of virtualization.

   ii) Would this be considered a Type 1 or Type 2 hypervisor? Justify your answer **(10 marks)**

b) One of the most common tasks for an administrator is to create an Active Directory user objects. Windows Server 2012 includes several tools you can use to create objects. Briefly

describe how you would add a computer to a domain. **(10 marks)**

QUSETION FOUR [20 marks]

With a 32-bit virtual address space, 4KB page, and 4 bytes per page table entry in virtual memory, answer the following questions.

i). Compute the number of page table entries. **(5 marks)**

ii). Compute the total size of the page table. **(5 marks)**

iii). In the above virtual memory system, a running program accesses the 4MB physical memory with the following virtual addresses in order: 0x283802, 0x2848C2, 0x283142, 0x285478, 0x38580A, 0x2839E0, 0x2848C2. We assume that the physical memory is initially empty and pages in virtual memory do not share same frame in physical memory. Pages are replaced with LRU scheme. What is the number of page faults? **(5 marks)**

iv). Describe how the OS handles the page fault exception. Include architectural support (if any) in your answer. **(5 marks)**

QUESTION FIVE [20 marks]

a) Using a diagram briefly discuss type of virtualization used by Xen **(5 marks)**

b) When installing Windows Server 2012 you have several editions to choose from based on multiple factors including: (1) the server roles (2) virtualization strategy (3) licensing strategy. Using examples discuss the *three categories* of server roles mentioned above. **(9 marks)**

c) A computer running Windows can have one or more local policy objects associated with it. Local Group Policy is managed through the local Group Policy object (GPO). Windows uses 3 layers of local GPOs. Discuss these layers and explain the order in which they are processed. **(6 marks)**.