

National College of Ireland

**HDWD\_SEP23OL**

**HDCSDEV\_INT**

**HDSDEV\_JANBLY1\_O**

**HDSDEV\_SEP23\_HDAIML\_SEP23OL\_HDBC\_SEP23OL**

**CIC\_JAN24**

**Release Date: Friday, 10 May 2024 @9.00am**

**Submission Date: Tuesday, 14 May 2024 @11.55pm**

**This TABA accounts for 50% of the overall grade**

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**Computer Architecture Operating Systems and Networks**

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Examiners: Hamilton Niculescu, Sean Bonner, Jitendra Kumar Sharma, Enda Stafford

**Learning Outcomes (LOs) for the Module:**

LO1 Identify and describe the relationship between each component of the computer system and how each individual component works

LO2 Develop a conceptual understanding of different operating systems architectures

LO3 Demonstrate competent use of the system utilities, tools and user interface to exercise, demonstrate and investigate the Operating System

LO4 Have an understanding of the theory, concepts, principles, issues and limitations of network technologies and internet technologies and how these technologies are used for inter-computers communication.

**Answer all 5 questions.**

Please do not forget to add proper reference(s) for any materials, texts, ideas, etc. that are not your own.

1. **IT Security [20 marks]**

1. “A simple but widely applicable security model is the CIA (Confidentiality, Integrity, Availability) triad”. These are three key principles that should be guaranteed in any kind of secure system. **Discuss and describe** these three principles, giving examples of how they could be achieved in an enterprise. **[10 marks]**
2. In terms of security, **define** what is meant by a threat. **[2 marks]**
3. Give examples of **two threats and discuss** ways in which the effects of each of those threats could be minimized. **[2 \* 4 marks]**
4. **Networking and Linux Fundamentals [20 marks]**
5. *Network topology* is the arrangement of the various elements (links, nodes, etc.) of a computer network and can be used in conjunction with network configurations. The following list shows four such network configurations.
   1. Personal Area Network (PAN)
   2. Local Area Network (LAN)
   3. Metropolitan Area Network (MAN)
   4. Wide Area Network (WAN)

**Compare and contrast two** of these network configurations of your own choice, in terms of when or where they might be used, cost of implementation, cost of maintenance, etc. **[2 \* 5 marks]**

1. With reference to Linux fundamentals, it is said that commands can run several programs at a time, either in sequence (one program after another) or in a “pipeline”. **Compare and contrast** (why, when, where, who) these two approaches, and give a practical example of using a pipeline to perform a series of tasks. **[2 \* 5 marks]**
2. **Cloud Computing [20 Marks]**

The way we consume computing services has been revolutionised by the use of cloud and virtualisation, providing almost endless capabilities that would otherwise be cost prohibitive.

1. “Virtualisation, in computing, is the creation of a virtual version of something”. **Discuss** virtualisation in relation to the four main elements that it encompasses.   
   **[4 \* 2 marks]**
2. Type 1 & Type 2 are two prominent hypervisor types. Provide an explanation as to how Type 1 & Type 2 hypervisors are differentiated, giving an example of each.   
   **[2 \* 3 Marks]**
3. Making the decision to invest directly in hardware or employ a Cloud Service Provider (CSP) to deploy a virtual/cloud-based solution, can be considered under the following three headings.
4. Total Cost of Ownership (TCO)
5. Capital Expenditure (CAPEX)
6. Operational Expenditure (OPEX)

**Compare and contrast** the above terms in relation to on-premises and cloud provided IT solutions [3 \* 2 Marks]

1. **CAOSN in Industry [20 Marks]**

Technology is ever evolving and synergising. From the following list of technologies **select two** of your choice:

* Blockchain
* Artificial Intelligence / Machine Learning
* Augmented Reality / Virtual Reality
* Internet of Things/Internet of Everything
* 5G Telecommunications
* Wearables/TeleHealth

Give a **brief description** of each of the two chosen technology, its current state of the art and impact of pre-existing industries. Conclude your discussion with several major points of interest with regard to the future potential of your selected technologies. The use of external resources is suggested to assist with your discussion, ensuring to reference any citations made. General recommendation for length of discussion is 600 - 800 words. Please also use diagrams to exemplify your answer, where applicable. **[2 \* 10 Marks]**

1. **Memory Management and Scheduling [20 Marks]**
2. Memory management can be considered as enabling several processes to share the main memory in a computer system. Compare and contrast the concepts of Physical and Logical memory used in the memory management of a computer.   
   **[2 \* 5 Marks]**
3. The following diagrams show four processes, with their respective Arrival Times and Burst Times.

A crossword puzzle with a number and a number

Description automatically generated with medium confidence

If the algorithm used was non pre-emptive, which of the following is it most likely to be:

1. First Come First Served Scheduling Algorithm (FCFS)
2. Shortest Process First (SPF)
3. Shortest Remaining Time First
4. Round-Robin

**[3 marks]**

1. Calculate the average waiting time of the system for the processes depicted above. **[7 marks]**