

The Open University of Sri Lanka  
Faculty of Engineering Technology  
Department of Electrical & Computer Engineering



Study Programme	: Bachelor of Technology Honours/Bachelor of Science Honours in Engineering
Name of the Examination	: Final Examination
Course Code and Title	: <b>EEX5564 Computer Architecture and Operating Systems</b>
Academic Year	: 2022/2023
Date	: 20 <sup>th</sup> of February 2024
Time	: 1330 – 1630hrs
Duration	: <b>3 hours</b>

### General Instructions

1. Read all instructions carefully before answering the questions.
  2. This question paper consists of **Five (5)** questions on **Two (2)** pages.
  3. Answer **all** questions. All questions carry equal marks.
  5. Answer for each question should commence from a new page.
  6. This is a Closed Book Test (**CBT**).
  7. Answers should be in clear handwriting.
  8. Do not use red colour pens.
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### Question 1

Consider Flynn's taxonomy of computer architectures, which classifies systems into four categories: SISD, SIMD, MISD and MIMD.

- i.) Define each of the four classifications SISD, SIMD, MISD and MIMD. **[08 marks]**
- ii.) Discuss the advantages and disadvantages of using an MIMD architecture in comparison to SISD and SIMD architectures. **[04 marks]**
- iii.) Given a SISD architecture, if the execution time on a uniprocessor system ( $T_{uni}$ ) is 2000 clock cycles and the CPI is 2, calculate the total number of instructions executed ( $I_{total}$ ). **[04 marks]**
- iv.) Consider a SIMD architecture designed for the same workload as for part(iii). If the SIMD architecture has four processing units and the CPI remains the same as in the SISD architecture, calculate the minimum achievable time on the SIMD system ( $T_{simd}$ ). **[04 marks]**

### Question 2

- i.) List the considerations for deallocating memory in a dynamic partition memory allocation system and explain why each consideration is important. **[06 marks]**
- ii.) Develop an algorithm in pseudocode to deallocate memory blocks for a dynamic partition memory allocation system, taking into account the considerations outlined in the list above. **[06 marks]**
- iii.) Virtual memory allows programs to use more memory than is physically available in the system. Are there any benefits to having virtual memory on a computer with larger physical memory sizes? Justify your answer. **[08 marks]**

### Question 3

- i.) Compare and contrast Multilevel Queue Scheduling with Round-Robin Scheduling and Priority Scheduling, highlighting the advantages and disadvantages of each approach. **[10 marks]**
- ii.) Consider a system running ten I/O-bound tasks and one CPU-bound task. Assume that I/O-bound issues an I/O operation once for every millisecond of CPU computing and that each I/O operation 10 milliseconds to complete. Also assume that the context switching overhead is 0.1 millisecond and that all processes are long running tasks. What is the CPU utilization for round robin scheduler when:
  - a) the time quantum is one millisecond **[05 marks]**
  - b) the time quantum is ten milliseconds **[05 marks]**

#### Question 4

- (i) Briefly explain the role of file management in an operating system and why it is important for efficient data organization and access. **[04 marks]**
- (ii) Consider a hard disk with a total capacity of 2.5 GB, consisting of multiple platters. The disk's specifications are as follows: it has 800 cylinders, 32 heads, and 128 sectors per track. The average seek time recorded by a performance measuring utility is six milliseconds. The disk's rotational speed is measured at 5400 revolutions per minute (rpm). Calculate the total number of sectors on the disk and determine the average rotational latency. **[08 marks]**
- (iii) Design a set of file management instructions for an instruction set architecture (ISA) of a hypothetical processor. Discuss the purpose and parameters of each instruction, and explain how they can be used to perform basic file-related operations in a computer system. **[08 marks]**

#### Question 5

- i. Compare and contrast the implementation of Hardwired and Micro-programmed Control Unit. **[04 marks]**
- ii. Discuss the advantages and disadvantages of each approach in terms of flexibility, complexity, and ease of modification. **[06 marks]**
- iii. Describe the stages involved in the pipeline and discuss potential hazards that may arise during pipelining and how they are mitigated. **[10 marks]**

