



# Daffodil International University

Faculty of Science & Information Technology

Department of Software Engineering

Midterm Examination, Spring 2026

Course Code: SE222; Course Title: Computer Architecture

Sections & Teachers: 44A to 44K (AS, HKN, HT, AJE)

Time: 1 Hour 30 Mins

Marks: 25

Answer ALL Questions

[The figures in the right margin indicate the full marks and corresponding course outcomes. All portions of each question must be answered sequentially.]

| 1.                       | a)        | <p>A 2 GHz processor was used to execute on a program with the following instruction mix and clock cycle counts:</p> <table><tr><th>Instruction Type</th><th>Frequency</th><th>CPI</th></tr><tr><td>Integer ALU operation</td><td>10%</td><td>1</td></tr><tr><td>Floating point Operation</td><td>40%</td><td>7</td></tr><tr><td>Loads &amp; Stores</td><td>30%</td><td>5</td></tr><tr><td>Branches</td><td>20%</td><td>3</td></tr></table> <p>Compute the effective CPI, MIPS rate and Execution Time for this program.</p> | Instruction Type | Frequency | CPI | Integer ALU operation | 10% | 1 | Floating point Operation | 40% | 7 | Loads & Stores | 30% | 5 | Branches | 20% | 3 | [Marks-5] | CLO-1<br>Level-2 |
|--------------------------|-----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|-----------|-----|-----------------------|-----|---|--------------------------|-----|---|----------------|-----|---|----------|-----|---|-----------|------------------|
| Instruction Type         | Frequency | CPI                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |           |     |                       |     |   |                          |     |   |                |     |   |          |     |   |           |                  |
| Integer ALU operation    | 10%       | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                  |           |     |                       |     |   |                          |     |   |                |     |   |          |     |   |           |                  |
| Floating point Operation | 40%       | 7                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                  |           |     |                       |     |   |                          |     |   |                |     |   |          |     |   |           |                  |
| Loads & Stores           | 30%       | 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                  |           |     |                       |     |   |                          |     |   |                |     |   |          |     |   |           |                  |
| Branches                 | 20%       | 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                  |           |     |                       |     |   |                          |     |   |                |     |   |          |     |   |           |                  |
|                          | b)        | <p>Explain Moore's Law and its significance for processor performance. Then, using the exponential growth model, calculate how many transistors a processor will have after 8 years if it initially contains 2 million transistors and the doubling time is 2 years.</p>                                                                                                                                                                                                                                                     | [Marks-4]        |           |     |                       |     |   |                          |     |   |                |     |   |          |     |   |           |                  |
|                          | c)        | <p>Clarify the fetch and execute instruction of GP processor along with diagram.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                         | [Marks-3]        |           |     |                       |     |   |                          |     |   |                |     |   |          |     |   |           |                  |
|                          | d)        | <p>Suppose that a task makes extensive use of floating-point operations, with 45% of the time is consumed by floating-point operations. With a new hardware design, the floating-point module is speedup by a factor of 12. Compute the speedup using Amdahl's Law.</p>                                                                                                                                                                                                                                                      | [Marks-3]        |           |     |                       |     |   |                          |     |   |                |     |   |          |     |   |           |                  |

| 2.           | a)   | <p>Explain the execution steps of Hypothetical Processor for the given scenario.</p> <table><tr><th colspan="2">Memory</th></tr><tr><td>101</td><td>3606</td></tr><tr><td>102</td><td>6607</td></tr><tr><td>103</td><td>7608</td></tr><tr><td>104</td><td>4609</td></tr><tr><td> </td><td> </td></tr><tr><td>606</td><td>000A</td></tr><tr><td>607</td><td>0005</td></tr><tr><td>608</td><td>000C</td></tr><tr><td>609</td><td>0000</td></tr></table> <table><tr><th colspan="2">CPU Register</th></tr><tr><td>101</td><td>PC</td></tr><tr><td> </td><td>AC</td></tr><tr><td> </td><td>IR</td></tr></table> <p>Here memory contents are represented in hexadecimal<br/>0011---Load AC from Memory 3<br/>0110---Subtract AC from Memory 6<br/>0100---Store AC to Memory Location 4<br/>0111---Multiply AC to memory 3</p> | Memory    |  | 101 | 3606 | 102 | 6607 | 103 | 7608 | 104 | 4609 |  |  | 606 | 000A | 607 | 0005 | 608 | 000C | 609 | 0000 | CPU Register |  | 101 | PC |  | AC |  | IR | [Marks-4] | CLO-2<br>Level-4 |
|--------------|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|--|-----|------|-----|------|-----|------|-----|------|--|--|-----|------|-----|------|-----|------|-----|------|--------------|--|-----|----|--|----|--|----|-----------|------------------|
| Memory       |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |           |  |     |      |     |      |     |      |     |      |  |  |     |      |     |      |     |      |     |      |              |  |     |    |  |    |  |    |           |                  |
| 101          | 3606 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |           |  |     |      |     |      |     |      |     |      |  |  |     |      |     |      |     |      |     |      |              |  |     |    |  |    |  |    |           |                  |
| 102          | 6607 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |           |  |     |      |     |      |     |      |     |      |  |  |     |      |     |      |     |      |     |      |              |  |     |    |  |    |  |    |           |                  |
| 103          | 7608 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |           |  |     |      |     |      |     |      |     |      |  |  |     |      |     |      |     |      |     |      |              |  |     |    |  |    |  |    |           |                  |
| 104          | 4609 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |           |  |     |      |     |      |     |      |     |      |  |  |     |      |     |      |     |      |     |      |              |  |     |    |  |    |  |    |           |                  |
|              |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |           |  |     |      |     |      |     |      |     |      |  |  |     |      |     |      |     |      |     |      |              |  |     |    |  |    |  |    |           |                  |
| 606          | 000A |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |           |  |     |      |     |      |     |      |     |      |  |  |     |      |     |      |     |      |     |      |              |  |     |    |  |    |  |    |           |                  |
| 607          | 0005 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |           |  |     |      |     |      |     |      |     |      |  |  |     |      |     |      |     |      |     |      |              |  |     |    |  |    |  |    |           |                  |
| 608          | 000C |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |           |  |     |      |     |      |     |      |     |      |  |  |     |      |     |      |     |      |     |      |              |  |     |    |  |    |  |    |           |                  |
| 609          | 0000 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |           |  |     |      |     |      |     |      |     |      |  |  |     |      |     |      |     |      |     |      |              |  |     |    |  |    |  |    |           |                  |
| CPU Register |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |           |  |     |      |     |      |     |      |     |      |  |  |     |      |     |      |     |      |     |      |              |  |     |    |  |    |  |    |           |                  |
| 101          | PC   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |           |  |     |      |     |      |     |      |     |      |  |  |     |      |     |      |     |      |     |      |              |  |     |    |  |    |  |    |           |                  |
|              | AC   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |           |  |     |      |     |      |     |      |     |      |  |  |     |      |     |      |     |      |     |      |              |  |     |    |  |    |  |    |           |                  |
|              | IR   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |           |  |     |      |     |      |     |      |     |      |  |  |     |      |     |      |     |      |     |      |              |  |     |    |  |    |  |    |           |                  |
|              | b)   | <p>Explain the concept of an interrupt handler in a computer system. Describe the steps that occur from the moment an interrupt is generated until the CPU resumes the interrupted program.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | [Marks-3] |  |     |      |     |      |     |      |     |      |  |  |     |      |     |      |     |      |     |      |              |  |     |    |  |    |  |    |           |                  |
|              | c)   | <p>Demonstrate the cache read operational diagram of computer system.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | [Marks-3] |  |     |      |     |      |     |      |     |      |  |  |     |      |     |      |     |      |     |      |              |  |     |    |  |    |  |    |           |                  |