Xi'an Jiaotong-Liverpool University 西交利物浦大學

| PAPER CODE | EXAMINER | DEPARTMENT | TEL |
|---|---|---|---|
| INT102 | Jia WANG | Intelligent Science | 9047 |

**2nd SEMESTER 2023/24 EXAMINATIONS(RESIT)**

**BACHELOR DEGREE – Year 2**

# ALGORITHMIC FOUNDATIONS AND PROBLEM SOLVING

**TIME ALLOWED: 2.5 Hours**

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## INSTRUCTIONS TO CANDIDATES

**READ THE FOLLOWING CAREFULLY:**

1. The paper consists of Part I and Part II. Answer all questions in both parts.
2. Answer all questions in Part I using the Multiple-Choice Answer Sheet. Please read the instructions on the Multiple-Choice Answer Sheet carefully and use a 2B pencil to mark the Multiple-Choice Answer Sheet. If you change your mind, be sure to erase the mark you have made. You may then mark the alternative answer.
3. Answer all questions in Part II using the answer booklet.
4. Enter your name and student ID No. on BOTH the Multiple-Choice Answer Sheet and the answer booklet.
5. At the end of the examination, be absolutely sure to hand in BOTH the answer booklet AND the Multiple-Choice Answer Sheet.
6. All answers must be in English.

**THIS PAPER MUST NOT BE REMOVED FROM THE EXAMINATION ROOM**

# PART II

Question 1 (10 marks)

1. Describe what a decision problem is and what an optimisation problem is. ***3***

2. Describe what a P problem is and what a NP problem is. ***3***

3. For each problem below, state whether it is a P problem or NP-complete problem.

    1. Vertex Cover Problem. ***1***
    2. Finding minimum spanning tree (MST) in a weighted undirected graph ***1***
    3. 0/1 Knapsack problem. ***1***
    4. Finding the nth Fibonacci number. ***1***

Question 2 (20 marks)

Consider the problem of searching for genes in DNA sequences using Horspool's algorithm. A DNA sequence is represented by a text on the alphabet {A, C, G, T}, and the gene or a gene segment is a pattern.

1. Construct the shift table for the following gene segment. ***10***

    TCCTATTCTT

2. Apply Horspool' s algorithm to locate the pattern in the following DNA sequence. ***10***

    TTATAGATCTGGTATTCTTTTATAGATCTCCTATTCTT