

4.15 Sorting Algorithms

Name: _____ Class: _____ Date: _____ **Total: 9 marks**

KEY WORDS selection sort 选择排序 • insertion sort 插入排序 • array 数组 • 2d array 二维数组

Objective

Build the skills to answer exam questions on **sorting algorithms**.

You must be able to:

- describe how **selection sort** 选择排序 moves the smallest remaining value into place
- describe how **insertion sort** 插入排序 builds a sorted section one element at a time
- trace a collection after each pass of a sort

1 Worked examples

Study these first. Each one shows the method for a question type used later.

■ **Selection sort**

Repeatedly find the **smallest remaining** value and move it into its place at the front of the unsorted part.

■ **Insertion sort**

Build a **sorted section** at the front, one element at a time, inserting each new value into its correct spot.

■ **Tracing (selection sort on {3, 1, 2})**

- Pass 1: smallest is 1 → {1, 3, 2}
- Pass 2: smallest of the rest is 2 → {1, 2, 3}

2 Practice

2.1 Describe how selection sort works. [1]

2.2 Describe how insertion sort works. [1]

2.3 After one pass of selection sort on {5, 2, 8, 1}, state the array. [2]

3 Exam-style questions

3.1 Selection sort repeatedly moves the _____ remaining value into place. [1]

- **A** largest
- **B** smallest
- **C** middle
- **D** random

3.2 Insertion sort builds a [1]

- **A** random section
- **B** sorted section one element at a time
- **C** 2D array
- **D** linked list

3.3 Apply selection sort to {4, 1, 3, 2} (smallest moved to the front each pass).

- (a) State the array after pass 1. [1]
- (b) State the array after pass 2. [1]
- (c) State the fully sorted result. [1]

Solutions

2.1 it repeatedly finds the smallest remaining value and moves it into place at the front of the unsorted part.

2.2 it builds a sorted section one element at a time, inserting each new value in order.

2.3 {1, 2, 8, 5} — the smallest (1) is moved to the front.

3.1 B.

3.2 B.

3.3 (a) {1, 4, 3, 2}. (b) {1, 2, 3, 4}. (c) {1, 2, 3, 4}.