

THEME B: COMPUTATIONAL THINKING · B4.1 · HL ONLY

Fundamentals of ADTs

Original practice questions · 34 marks · about 55 minutes · covers B4.1.1–B4.1.6

Instructions. Answer all questions. The maximum mark for this paper is [34 marks]. The marks available are shown in brackets. Parts badged **HL** assess higher level only content; standard level students may leave these out. **B4.1 is a higher level only topic**, so every question in this paper is HL. Questions that ask you to construct code may be answered in **either Java or Python**. State which language you are using. Marks are for the logic, not for perfect syntax.

1**Total: 5 marks**

An abstract data type describes what a structure does rather than how it is built.

- (a) **HL** A stack can be built from an array or from a linked list, yet both are described as the same abstract data type. Explain why. **[3]**

- (b) **HL** State **one** benefit of defining a structure by its operations rather than by its implementation. **[2]**

A program stores a collection of readings that grows and shrinks constantly as readings arrive and expire.

- (a) **HL** Sketch a singly linked list holding the three values 7, 3 and 9. Show the head, the pointers, and how the end of the list is marked. **[3]**

- (b) **HL** **Evaluate** the use of a linked list rather than an array for this collection. **[4]**

3

Total: 6 marks

Linked lists come in several forms.

- (a) **HL** Distinguish between a singly linked list, a doubly linked list and a circular linked list. **[3]**

- (b) **HL** Describe the steps needed to insert a new node at the front of a singly linked list. **[3]**

The values 50, 30, 70, 20, 40 and 60 are inserted, in that order, into an empty binary search tree.

- (a) **HL** Sketch the resulting binary search tree. [3]

- (b) **HL** State the order in which the values are visited by an in-order traversal. [2]

- (c) **HL** State the number of comparisons needed to find the value 40 in this tree, and explain how you reached that number. [2]

Two sets are defined as $A = \{2, 4, 6, 8\}$ and $B = \{4, 8, 12\}$.

- (a) **HL** State **two** characteristics of a set. [2]

- (b) **HL** State the result of $A \cup B$, $A \cap B$, and $A - B$. [3]

A set is often implemented internally using a hash table.

- (a) **HL** Outline the purpose of a hash function in a hash table. [2]

- (b) **HL** State what is meant by a collision, and outline **one** way of resolving it. [2]

END OF QUESTIONS