Algorithms and Data Structures I. Theoretical Questions

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Sources:

[1] Cormen, T.H., Leiserson, C.E., Rivest, R.L., Stein, C.,
. Introduction to Algorithms (Third Edititon), *The MIT Press*, 2009.
[2] http://aszt.inf.elte.hu/ asvanyi/ds/AD.pdf
[3] http://aszt.inf.elte.hu/ asvanyi/ds/AlgDs1LectureNotes.pdf

Note: Presenting an algorithm, remember to analize its operational complexity ($MT(n) \geq AT(n) \geq mT(n)$; sometimes $T(n) = MT(n) = mT(n)$). (Many books are downloadable from <http://gen.lib.rus.ec/>.)

1. Algorithms in computing, insertion sort, operational complexity, space complexity, growth of functions $(O, o, \Omega, \omega, \Theta)$, divide and conquer, merge sort.
[1] Chapter 1-3; [3] Chapter 1, 3, 6.

2. Elementary data structures: arrays, stacks, queues, singly and doubly linked lists (acyclic and circural, sentinels), binary trees. Operations on linked lists: print, search, insertion, deletion.
[1] Chapter 10; [2] 4.1 - 4.4.2; [3] Chapter 2, 4.

3. Dynamic sets: stacks, queues, priority queues, binary search trees .
[1] Chapter 10, 6, 12; [2] 4.3, 4.4; [3] Chapter 2, 4, 5.

4. Trees, binary trees, traversals, representations, heaps, priority queues, binary search trees.
[1] Chapter 10, 6, 12; [2] 4.4; [3] Chapter 5.

5. Comparison sorts, simple and fast methods: insertion sort, merge sort, heap sort, quick sort, lower bounds for the number of comparisons, lower bounds for $mT(n)$ and $MT(n)$.

[1] Chapter 2, 6, 7; [3] Chapter 3, 4.1.5, 4.2.3, 5.9, 6, 7.

6. Sorting in Linear time. Stable sort. Counting-Sort, Radix-Sort, Bucket-Sort.

[1] Chapter 8.

7. Dictionaries. Direct-address tables. Hash tables. Hash functions. Collisions. Collision resolution by chaining, search and update operations, load factor, simple uniform hashing, average-case time of search. Good hash functions, the Division method, the Multiplication method.

[1] Chapter 11.

8. Hash tables. Hash functions, the Division method. Collisions. Open addressing, search and update operations, probe sequence, empty and deleted slots; Linear probing, primary clustering; Quadratic probing, secondary clustering; Double hashing.

[1] Chapter 11.