7 Algorithms (FMS)

Let a *dab* be a set of disjoint segments on the real axis.

(*a*) Write a `Dab` class in Java that supports equality testing between two dabs in linear time. Provide only the data members without any constructors or methods, and highlight any noteworthy features and invariants.
Note: You may not use any pre-made lists, resizable arrays or other library collections of any kind; use only integers, doubles, pointers, arrays and classes. You are allowed to define additional classes if necessary. [4 marks]

(*b*) Draw a records-and-pointers diagram representation of the following dab

$$\{(-2.3, -1), (10, 24.53), (2, 6)\}$$

using your class from part (*a*). [2 marks]

(*c*) Given a set S of dabs, find an algorithm that returns a dab of maximum cardinality containing only segments from the dabs in S. The algorithm should run in $O(n^2)$ time, where n is the total number of segments of all dabs contained in S.

(*i*) Clearly describe and explain your algorithm. [4 marks]

(*ii*) Describe your algorithm in a few lines of pseudocode. [4 marks]

(*iii*) Prove that your algorithm is correct. [4 marks]

(*iv*) Derive the asymptotic running time of your algorithm. [2 marks]