Algorithms Division **Winter 2020**
TU Braunschweig

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Question Sheet
Quiz 4 for Nov 24, 2020

Which is the correct answer?

Question 1:

Which of the following is **not** a property required for a metric?

- Triangle inequality
- Definitiveness
- Symmetry

Question 2:

What is the most accurate description for the role of the α_i in the Master Theorem when applied to compute the runtime of a recursive algorithm?

- They arise as the inverse of the number of subproblems.
- They define a convex combination of problem components.
- They correspond to the size of subproblems.

Question 3:

What is the origin of the logarithmic term in the runtime of a recursive algorithm with $\sum \alpha_i^k = 1$?

- It corresponds to the height of the recursion tree.
- It arises from binary search.
- It is the result of inverting the exponentiation with k.

Question 4:

What is the solution of the recursive equation $Q(n) = 4n^2 - 7n + 6 \cdot Q(\frac{n}{3}) + 3 \cdot Q(\frac{n}{6}) + 4 \cdot Q(\frac{n}{4})$?

- $\Theta(n)$
- $\Theta(n \log n)$
- $\Theta(n^2)$
- $\Theta(n^2 \log n)$
- $\Theta(n^3)$

Question 5:

Which of the following modifications in *median of medians* algorithm does **not** result in linear runtime?

- Partition the set of numbers into groups of 3 instead of 5.
- Partition the set of numbers into groups of 7 instead of 5.
- Partition the set of numbers into groups of 9 instead of 5.

Question 6:

For which of the following problems does the paper by Ben-Or provide a lower bound of $\Omega(n \log n)$?

- Deciding whether $n = h$ for the convex hull of a set of planar points.
- Deciding whether a given number is the median for a set of points.
- Sorting a set of n numbers.

Question 7:

What is a concise way to describe the algorithm of Bentley and Shamos?

- Split the point set into two smaller subsets, solve the subproblems recursively, solve a lower-dimensional problem.
- Compute a median, split the point set, try out all pairs along the median.
- Sort the points by x-coordinate, split the point set, try out a subset of the pairs with distance δ or less.

Question 8:

What is the most relevant role of presorting in the algorithm of Bentley and Shamos, as described for the two-dimensional case?

- It saves one $\log n$ in the overall runtime.
- It allows splitting the point sets.
- It reduces computing the closest pair by considering neighbors in the sorted order.

Question 9:

The final critical idea for achieving a runtime of $O(n \log n)$ for finding a closest pair in d dimensions is...

- ... finding a set S that is δ-sparse.
- ... finding a cut hyperplane H for which the resulting merge problem has a sublinear number of points.
- ... solving a recursion over the dimension d.