Simulation of written exam

Adjusted from the 9 September 2024 exam

B Data Mining

Question B.1.

a) **(4 pt)** Define what properties must a binary tree satisfy to be considered a red-black tree.

b) **(1 pt)** What is the (exact) upper-bound on the height of a red-black tree with n inner nodes?

c) **(1 pt)** What is the asymptotic (worst-case) time complexity for inserting an item in a red-black tree?

d) **(2 pt)** Is insertion in a red-black tree more or less expensive than in a binary search tree of the same height? Justify your answer.

Question B.2.

a) **(2 pt)** Describe the insertion procedure into a Bloom filter of size m equipped with k hash functions.

b) **(3 pt)** Given two sets S_1 and S_2 and corresponding Bloom filters B_1 and B_2, can the Bloom filter B_U, produced by the insertion of the elements of $S_1 \cup S_2$ into an empty filter, be obtained directly from B_1 and B_2? If so, how? Justify your answers.

c) **(3 pt)** Can the Bloom filter B_I, produced by the insertion of the elements of $S_1 \cap S_2$ into an empty filter, be obtained directly from B_1 and B_2? If so, how? Justify your answers.