Karlsruhe Institute of Technology

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Exercise Sheet 14 – Cuckoo Hashing

Probability and Computing

Exercise 1 – Cuckoo Hashing & Erdős–Rényi Graphs

Note: For this exercise, n denotes a number of edges and m a number of vertices.

The "sudden emergence" result of Erdős and Rényi (slide 19, Random Graphs chapter) also holds if one replaces $G(m, \lambda/m)$ by $G^{\text{UE}}(m, \frac{\lambda m}{2})$.

(i) Describe a variant of Cuckoo Hashing which, with n keys and m table slots, is based on the graph $G^{\text{UE}}(m, n)$.

(ii) A practical disadvantage arises in the implementation of insert. What is it?

(iii) We want to insert keys up to a load of $\frac{n}{m} = \alpha < \frac{1}{2} - \varepsilon$ for some constant $\varepsilon > 0$. Deduce from the "sudden emergence" result that this is possible with high probability.

(iv) Assume now $\alpha = \frac{1}{2} + \varepsilon$ for some constant $\varepsilon > 0$. Deduce from the "sudden emergence" result that inserting up to load factor α will fail with high probability.