In today’s lecture, we learned how to Compactly Represent Bags of Integers using Bloom filters. The formal definition of the problem, and its solution, appear below, but let us first understand why this is necessary.

1 A Sample Application

Suppose we have a set of valid URLs, $U$, and that $|U| = n$. Suppose further that each URL is approximately 100 characters in length; then the each URL requires 800 bits for proper representation. It should be clear that any set requires $800n$ bits to represent the $n$-element set, $U$.

Now consider the following basic caching structure from Fan et al. where

Table 1: A simple shared caching structure (picture omitted)

- $C_1, C_2, C_3$ are caches, each with a set of documents stored; documents are indexed by URL
- edges represent the xfer of a cache’s set of URLs
- a query for URL $x$ can be made in one, some, or all of the caches.

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